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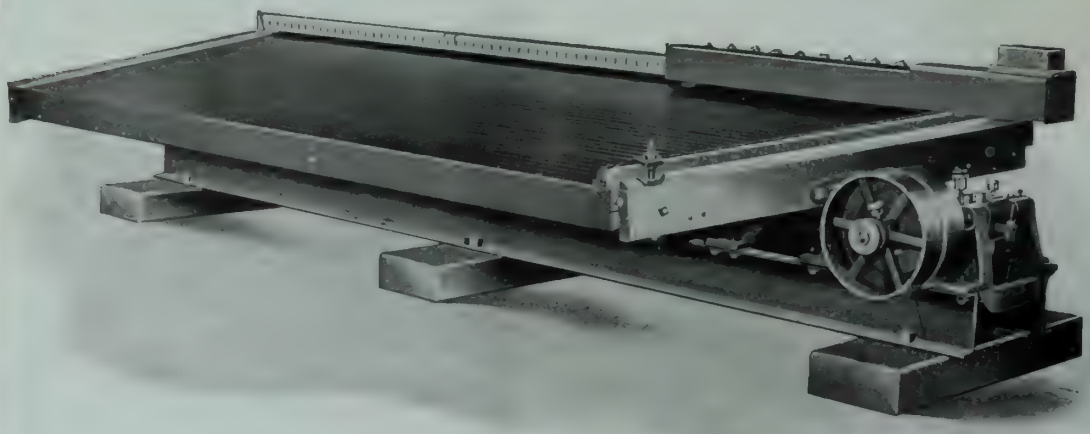

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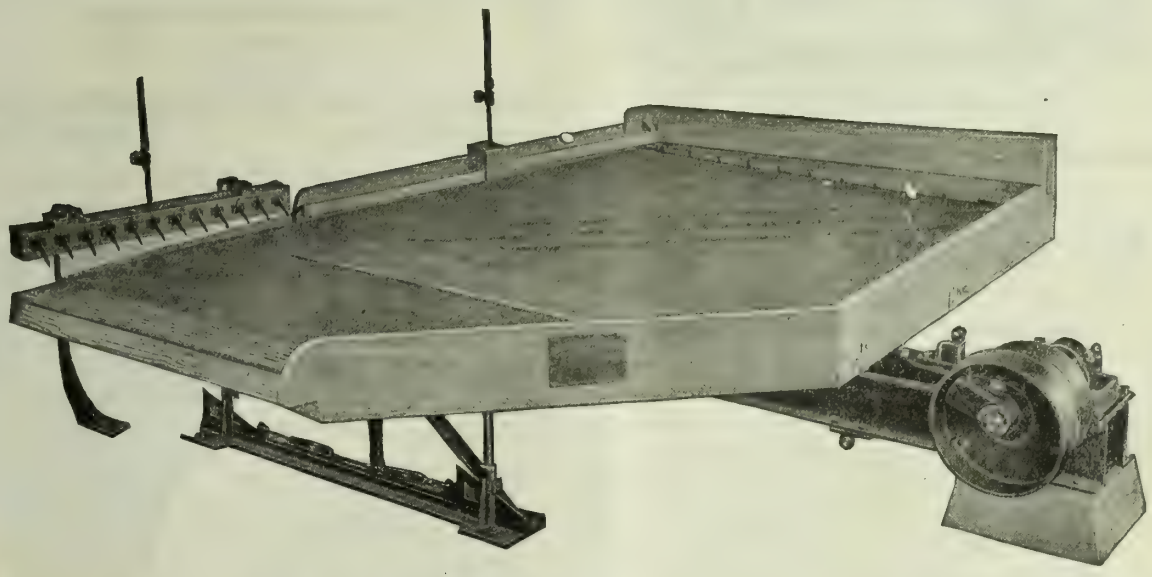

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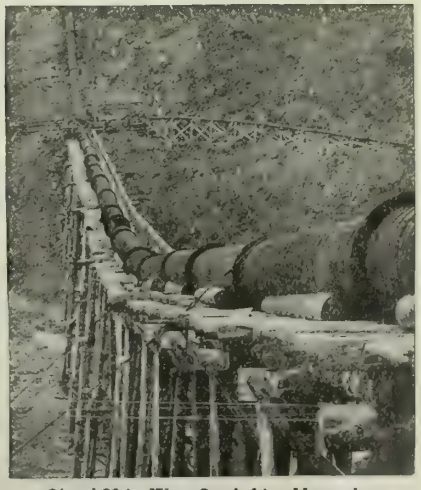

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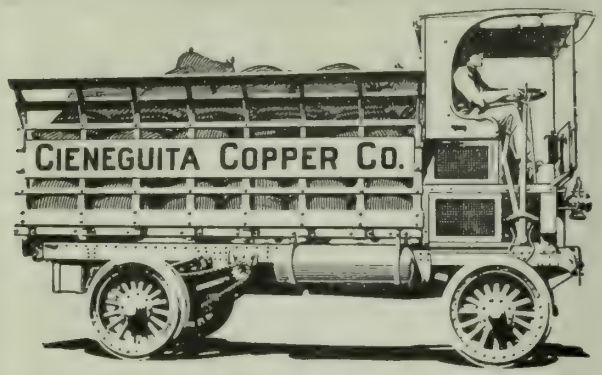

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EDITORIAL

CHINA has refused to accept the $300,000,000 offered her by the international banking syndicate. Loans are often refused, but not usually by the one who needs them.

DISCOVERY of a new Rand near Denver has been enthusiastically announced. As a matter of fact, the fossil placers in Douglas county have been known for some time, but their extent and value remain to be determined accurately. The gold is fine, and how much can be saved is not certain.

ILLINOIS petroleum fields have since 1905 yielded 158,000,000 barrels of oil worth $103,000,000, according to Mr. R. S. Blatchley, of the State Geological Survey. Mr. Blatchley estimates that over $20,000,000 has been paid in royalties and perhaps an equal amount in bonuses, labor, and other local expenditures. Of the 20,000 wells drilled in the state 85 per cent have been productive. Such figures give a realizing sense of what it means to 'strike oil' in a corn-growing country.

IT is now announced that the report of the special committee that has been investigating the affairs of the American Institute of Mining Engineers has been completed and is in the hands of the printer. Copies will be distributed among members within a few weeks and will not be held back until the special meeting of the Institute which has been postponed till October 7. In stating the latter we misinterpreted a note from New York. We are glad the report is to be made public in advance of the meeting, since what is most needed is that each member shall have an adequate knowledge of the affairs of the Institute. More members are now taking an active interest in its affairs than at any previous period in its recent past. If the whole membership could be roused to a full realization of their privileges and duties, it would be worth almost any sort of an explosion.

NOTABLE papers upon metallurgy will be features of the program of the Eighth International Congress of Applied Chemistry, to be held in Washington and New York early in September. Curiously enough, no papers upon cyanidation are listed in the preliminary announcement, though a half dozen upon the metallurgy of copper are promised. A paper upon the roasting of copper ores preparatory to leaching, by Mr. Utley Wedge, and another upon the extraction of copper by leaching, by Mr. J. O. Handy, are of timely interest, while Mr. E. P. Mathewson's account of the development of the reverberatory furnace for smelting copper ores, and Mr. Frederick Laist's discussion of the chemistry of the reduction processes in use at Anaconda will be as instructive as interesting. A study of the use of the electric furnace for the smelting of zinc ore, by Mr. F. T. Snyder, should throw light on another present-day problem. Discussions outside the metallurgical field are likely to be helpful in their collateral bearing, and engineers should plan, as far as possible, to be in New York during the first week of September.

LIBRARIES that are of value are those which have grown slowly; this is especially true of technical libraries, in which sets of journals and transactions are of first importance. The University of Minnesota has just become the fortunate recipient of what is probably one of the best geological libraries in the United States. It was built up by Mr. N. H. Winchell during the course of his long and active professional career. As editor for many years of the *American Geologist,* he received practically everything of importance published on geology. He supplemented the gifts by liberal purchases of older books, and as a result has brought together a priceless working collection. It is particularly appropriate that these should go to the university in which he was so long an active factor. The collection will be known as the 'Winchell Library of Geology,' and donations and exchanges should hereafter be so addressed. It is hoped that engineers will remember to send copies of papers that they may publish. If one man can afford to give to his profession in this form practically the savings of a life time, certainly the others can afford a little thoughtfulness in return.

CONSTRUCTION of a great mill at the mouth of the 'Newhouse tunnel' at Idaho Springs, Colorado, was part of the original plan of Mr. Samuel Newhouse and his associates. It is gratifying to note that matters have progressed to the point where the Argo Reduction & Ore Purchasing Company, organized by Mr. F. A. Schirmer and others now owning the tunnel, is prepared to build the first unit. Originally the tunnel was planned to drain the mines of Seaton mountain, Quartz, and other famous hills in Gilpin county, and to bring the ores to the south fork of Clear creek for milling. The work has been a success in draining the deep veins and measurably successful in the discovery of ore. It has afforded economical transportation and easy access to the ore; the treatment of the latter has remained to be solved. The ores mined are complex sulphides and have hitherto been treated by stamp-milling and concentration. Tailing losses have been heavy; much heavier than was generally realized or admitted. It is announced that in the new mill, to be erected under supervision of Mr. Arthur H. Roller, cyanidation will be combined with amalgamation. Selection of Mr. Roller to guide the work assures the full benefit of local experience in ore-treatment. The task will be no easy one, but the size of the orebodies warrants large expenditure and careful work, and his professional associates will hope that Mr. Roller's success may be as prompt as his good record deserves.

SOUTH AFRICAN mining conditions have been under severe criticism of late. Our Johannesburg correspondent has shown how the great consolidations of companies have not produced the favorable results that were anticipated. In London, Mr. T. A. Rickard has been vigorously denouncing 'phantom profits' and drawing numerous examples from the Rand, and in Johannesburg itself the voice of the critic has been heard. In discussing the matter before the South African Institution of Engineers, Mr. W. L. Honnold took the ground that conditions are not so bad as has been urged. Admitting an average tenor of 27s. 11d. for the past year, as against 28s. 6d. for the year before, he considers this to be due to a scramble for tonnage without regard to grade. While the working cost has apparently increased 5d. per ton, this is thought to be explainable by differences in keeping books. Certain expenses formerly debited to capital account now are charged to operating expenses because additional capital cannot be raised upon satisfactory terms. These views are worthy of especial attention, coming, as they do, from an engineer so familiar with Rand conditions. At the same time it is not likely that criticism will be stilled. With idle stamps a scramble for tonnage is but natural, and if capital is timid it indicates a profound conviction that conditions on the Rand either are not so favorable as in the past, or that the favorable elements have been persistently overestimated. Mr. Honnold is exactly right in insisting that increased efficiency is the only available means of solving the problems that Rand engineers are now meeting.

Colleges and Research

Colloids are objects of mystery to most engineers and many geologists, nor, indeed, are they well understood even by those who have devoted much effort to their study. That they must exert considerable influence in ore deposition, hydro-metallurgy, and ore-dressing is generally recognized; the exact nature and scope of their influence is still in doubt. In a recent paper, Messrs. E. Hatchek and A. L. Simon have pointed out that silicic acid gels will reduce gold from its solutions, while Messrs. W. Reinders and C. J. Van Niewenburg have discovered that the presence of gelatin and other colloids markedly reduces the rate of reduction of silver chloride by iron citrate. Evidently the problem is not a simple one. Colloids must be important in the dressing of ores, and especially in treatment of slime, but are little understood, since investigators in metallurgical plants are usually under pressure to secure results of immediate value and have neither time nor opportunity to carry out studies which do not appear to be instantly useful. The early studies of electricity exhibited no indications of proving useful, however, and a large amount of investigation in the field of pure science must be carried on so that the data may be obtained from which to perceive possible applications. In this regard it cannot be denied that many of our mining schools are not living up to their ideals of service and are being led away by a false conception of the work they are properly called upon to perform. The occupying of the valuable time of students at the universities in such matters as the loading of drill-holes and the sharpening of steel, matters which any intelligent and mentally alert man can acquire from a few days' experience when necessary, and which may never be required in the whole of a long and useful life, is certainly not the most efficient use of time, equipment, and opportunity. Much of the most advanced and most useful work is now being done outside the laboratories of the larger schools. Mining schools, as a whole, need galvanizing into renewed activity.

Colorado Fuel & Iron Company

Dividends, it is announced, will be resumed this month on the preferred stock of the Colorado Fuel & Iron Company. The eight per cent cumulative dividend on this stock has not been paid for nine years, but there is now a surplus such as warrants hope that the arrears may be wiped out. The Colorado Fuel & Iron Company is one of the large institutions of Colorado and the history of the company and the state are woven together. The properties which formed the nucleus of its holdings were originally acquired by Mr. J. C. Osgood, in the interest of the Chicago, Burlington & Quincy railroad, which, it will be remembered, once started ambitiously to build from Denver to the Pacific. Track was laid as far as Lyons, grading went some miles beyond, and rights of way and surveys extended well on to Utah. As part of the plan it was necessary to assure a fuel supply, and Mr. Osgood, a friend and associate of Mr. Perkins, then president of the road, was transferred to Colorado from Iowa, where he had made a success of the Whitebreast Fuel Company and

had opened important mines along the line of the railroad. In Colorado he optioned a number of good coal properties. Then came the famous and bitterly contested strike of the Brotherhood of Locomotive Engineers. The company won the strike, but was so crippled that the plans for Western expansion were abandoned.

Mr. Osgood saw the opportunity and promptly organized a company which took over the options on coal lands and entered actively the business of mining and selling coal. Profits were put into the business, and first coke-making, then iron-making was taken up, and finally, to make a market for the iron, steel mills were built. All this required capital, and, in the end, more than the business itself could supply. A market, too, for the steel was hard to secure. The railroads showed a strange and steady preference for Eastern rails. The inevitable smash came, and with it the long to be remembered and theatrical contest of John W. Gates for control of the company. After the battle of ballots and court proceedings, the company passed into the hands of Mr. George Gould and Edwin Hawley; whereupon the rails were promptly in demand on the Denver & Rio Grande and the Colorado & Southern railroads. Markets have been found, the plants improved, and finally the business has caught up with the company.

The story of this enterprise in all these features is typical of the West. A far-seeing man with eyes on the future overlooks the stones before his feet and stumbles, but in the end the enterprise that he founds makes good and benefits the state. In this instance it is a pleasure to add that Mr. Osgood found profit in the coal business, to which he returned after losing control of the big concern that he founded.

The Geographic Basis of Industry

The time value and place value of mineral deposits do not always receive the amount of attention they deserve. It is evident that ice, for example, is of no value at the north pole, but is immensely so in the tropics. California's oil deposits were of no value at the time J. D. Whitney examined them, now they are valued at many millions of dollars. The geographic basis of industry is somewhat obscured by the transportability of most products, natural gas being the most conspicuous exception. Wherever it occurs it has stimulated industry by affording cheap fuel, but in many cases even this is not able to counteract the disadvantages imposed by other conditions. Here again the time factor enters. The gas is often allowed to escape, and when conditions change later, and with an increase of population or the opening of means of communication the development of industry is made possible, the gas has in large part disappeared and the fuel supply has been lost. This evanescent characteristic of natural gas was exhibited in the zinc-smelting industry which sprung up in Kansas a few years ago, but as rapidly declined upon the failure of the gas supply. Gold and silver are so valuable and so easily transported that men will seek and win them wherever they may be found, but the less valuable metals have a marked place value. This is well illustrated in the case of iron ores of China, in which country ores of good quality are widely distributed, while coal for smelting is equally available. The native iron industry did not attain any considerable development, however, except in Shansi, where the ores are of poor quality and irregular in occurrence, but are associated with coal which contains a considerable percentage of phosphorus. By its use the natives are able to produce a high-phosphorus pig iron which can be used to make castings of remarkable thinness and perfection of outline, which find their way through the channels of trade even to districts where ores of better quality are found, but where the coal does not contain phosphorus.

The place factor is not the only one, however, as is illustrated by the brass fabricating industry of the Connecticut valley. This centre of supply for the United States is situated on one edge of the area supplied, if a Hibernianism may be permitted. It is at some distance from its supply of coal, a large item in brass manufacture, and not at the centre of its markets, yet efforts to develop the brass industry in Detroit and other Middle Western cities have not been markedly successful. An important reason for the Connecticut monopoly is the supply of skilled labor; the adjacent population has grown up with complete familiarity with the brass industry and resists efforts to transplant it. In time the labor supply at any point can be trained to the required degree of efficiency, but few companies are prepared to endure the intervening years of no profits. Elsewhere the Colorado Fuel & Iron Company is referred to at some length, and requires no more comment other than to call attention to the apparent paradox, that the easiest place to develop industry is not where none exists, but the reverse. The reason for this is evident, upon deeper reflection. The best place to open a shop is not in the suburbs where none exist, but in the heart of the city where there are many, because everyone desiring to purchase goods, so far as possible, naturally goes to the largest centre of supply because there the largest stock is available. There is always a small local demand in remote districts, but it never increases beyond narrow limits. Unless there is a clearly proved advantage in doing otherwise, the buyer always tends to purchase known brands from large houses which can be relied upon to always have them in stock, make good an occasional defect, and supply the same goods at the same price whenever needed. The business advantage of this to the buyer is so marked that he can afford to pay higher prices than are required to obtain the material without these assurances. Centralization results, and the tendency is to build up industry at the points where it is already established, rather than distribute mineral production and manufacturing enterprises throughout the commonwealth. Thus, though zinc is in brisk demand, the zinc resources of California, which are considerable, are not developed, nor seem likely to be, for the present, at least. Sulphur exists in considerable quantities in many parts of the United States, but the large deposits of Louisiana totally dominate the market. The textile industry of the United States skirts the eastern seaboard, where the streams descend from the piedmont plateau into the coastal plain, thus making water-power available, though most of the wool is grown in the Rocky Mountain states, where water-power is abundant and cheap. No miner can afford to neglect this place factor in the development of mines. The copper deposits of Alaska, Peru, and Chile are large, but their remote situation imposes a handicap which is difficult to overcome. The prospector who wishes to be sure of financial success should discover a 'porphyry copper' near Baltimore or Perth Amboy.

The labor cost of industry is in most instances the controlling factor. Even in the manufacture of so expensive a raw material as gold it more than doubles the cost. The cost of 14-karat gold is 61 to 64 cents per pennyweight, depending upon the market; the cost of working it in San Francisco is 68 cents per pennyweight. Where the raw material is of little value its cost of production frequently sinks into insignificance compared with the cost of utilization. It is often said that the worth of a book is its use, and the epigram is no less true of a metal. The development of the mineral industry is profoundly affected by geographical, chronological, and sociological conditions, and the prospector, to an important degree, needs to take these into account.

Veta Colorada Mill and Cyanidation Plant—I

By Bernard MacDonald

Construction and Plan of Plant

Design of Plant.—The plant of the Veta Colorada M. & S. Co. at Parral, Chihuahua, Mexico, was designed in 1906, and, in accordance with the general scheme of cyanidation plants of that date, provision was made for separate treatment of the pulp as sand and slime. Orders for the machinery were placed with different manufacturers, and the work of grading the site and construction commenced in 1907. The erection of the mill was then placed under the charge of a superintendent, who made certain changes in the design of the machinery and the arrangement of the cyanidation department, having in view its conversion to an all-sliming plant. Toward the end of 1907, on account of the panic then prevailing, the company suspended all work. Some of the machinery had then reached the ground, some was partly erected, some was *en route*, and a large part was still in the shops in the process of manufacture.

The suspension continued until February 1910, when I was employed to complete the erection of the plant and put it in operation. My instructions implied authority to purchase such new machinery and make such rearrangements and modifications of the previous designs in erection as would be necessary to complete the plant and make it suitable for the then recognized improved system of operation, but to retain and use, as far as possible, the machinery previously ordered. After numerous delays, the machinery reached the ground, was erected, and the plant went into operation in February 1911.

Source and Character of the Ore.—The ore supply in sight consisted of the old dumps at the company's mine, amounting to about 50,000 tons, an indefinite quantity in the mine workings which were caved, and an indefinite quantity of custom ore promised from neighboring mines. The average analysis obtained from the dumps and the old workings was:

	Per cent.		Per cent.
SiO_2	69.00	Pb	0.03
Fe_2O_3	3.60	Mn	Trace
Al_2O_3	9.00	Cu	None
Zn	0.01	Ag (ounces)	12.5
Au	Trace		

The silver occurred mainly as sulphide in the ore, but subordinately in the form of chloride and bromide.

Yard and Operating Facilities.—At the head of the mill a large patio or yard was excavated where the custom, dump, and mine ores are received. Tram tracks from the mine, dump, and railroad terminal converge on this yard, and from it a cross-track was laid down along the entire length of the mill with platforms at the various floor-levels of the mill and cyanidation plant for receiving supplies. The company's business and assay offices, warehouse, carpenter shop, and track scales are built on this yard. The coal-bins are situated immediately below the yard-level, and from them the coal is lowered by gravity tram to the power-house.

Power.—Electric power generated by steam in a plant on the ground is used for lighting and operating the machinery throughout the mill, with sufficient power to spare for the mining operations. Steam is generated in Heine safety and Fairbanks water-tube boilers, and the electric generators are operated by Harris-Corliss engines, with the generators mounted on the fly-wheel shafts.

Mill Machinery and Equipment.—Below the level of the patio is the receiving bin for all classes of ore, from which it is fed over grizzlies (60-lb. rails inclined 42° and spaced 4 in. apart) to the primary Blake rock-crusher, of Australian type with jaw dimensions 12 by 24 in. set to crush to 4-in. size. The product of this crusher joins the ore that passed through the preceding grizzly and gravitates over another leading to the secondary crusher, which has its bars spaced 1½ in. apart and set on an incline of 42°. The secondary crusher is of the same kind and type as the first, with jaw openings 9 by 15 in. set to crush 1½-in. size. The product from this crusher joins that which passed through the preceding grizzly, all falling into a small steel-hopper collecting bin and automatically feeding upon an upwardly inclined belt-conveyor 16 in. wide and 30 ft. long, which, with a travel speed of 150 ft. per minute, delivers the ore into an open-bottom hopper from which it is spouted to a vertical elevator which carries it up to a hopper-bin set above the cross-conveyor built over the battery-bin. The vertical elevator is of the belt and bucket type, 18 in. wide by 40 ft. between centres with buckets 16 by 7 in. set 18 in. apart. The cross conveyor-belt over the battery-bin is 18 in. wide by 120 ft. long and is provided with an automatic traveling tripper which discharges the ore into any of the compartments of the battery-bin. This bin is flat bottomed, 12 ft. wide, 20 ft. high, and 120 ft. long, partitioned off for each 10 stamps, and has a total holding capacity of 1300 tons with a run-off capacity of 1000 tons. Parallel with the cross conveying-belt a tram track runs over the bin. On this the lime required in the treatment is brought and it is mixed with the ore as the latter is delivered into the battery-bin.

Sampling Mill Equipment.—From the stream of ore falling from the collecting hopper at the delivery end of the inclined conveyor-belt two buckets suspended at equal distances apart between two endless chains cut out the sample by taking all the stream for the moment they are passing under the collecting hopper. In operation these buckets are carried over and discharge automatically into a 5-ton bin with 45° bottom, sheeted throughout with steel plate. This is the first cut-out sample. When desired the door of this bin is opened and the contents drawn off and fed to a 7 by 10-in. Dodge crusher set underneath. The crushed product falls on steel plates, where it is shoveled and quartered, the reject sent to the vertical elevator and by it delivered to the battery-bin, while the retained sample goes to a pair of 12 by 12-in. fine rolls, the product from which falls on the floor and is shovel-sampled, the reject being handled as before. The retained sample is then sent through two laboratory grinders in sequence, being shovel-quartered after each grinder and the final sample put through an Iler pulverizer, the entire product of which is quartered on oil-cloth and sent to the assay office. The cutting-down floor underneath the sampling machinery has an area of 12 by 20 ft. and is sheeted with ¼-in. steel plate throughout.

Stamps and Dewaterers.—From the battery-bin the ore is fed to the stamp-mortars by suspended Challenge feeders; the mortars weigh 10,500 lb. and are bolted to concrete foundations with a ¼-in. rubber sheet intervening. The stamps, of which there are 80, weigh 1050 lb. each and are set to drop 7½ in. 104 times per minute. The depth of the discharge is 4 in. above the dies, about 1 in. above the ore-bed. The ore is crushed in the precipitated solution returned from the zinc-boxes and fed to the mortars with the ore in the ratio of 8 tons to 1 ton of the dry ore. Rectangular screens of the equivalent of 14 to 16 mesh were used, and 35% of the pulp issuing from the mortars would pass 200 mesh. The crushing capacity is about 5 tons per stamp.

On issuing from the mortars, the pulp from each 20 stamps is piped to a 4 by 4-ft. dewatering cone which overflows 20% of the battery water with a varying quantity of 200-mesh pulp in suspension, this overflow being piped direct to the Dorr thickeners. The underflow pulp from these dewatering cones, containing between 6 and 7 tons of solution to 1 of solids, is carried in floor (cement) launders to a collecting tank from which it spouts to two belt-bucket elevators which lift and deliver it to a dis-

tributing box set 20 ft. above the floor. From this box it is equally distributed and carried in three distributing pipes to three duplex Dorr classifiers each 5 by 15 ft. The slime portion of the pulp classified by these, of which about 80% goes through 200 mesh, goes direct to the Dorr thickening tanks, while the sand classification is distributed in pipes to the scoop-boxes of the tube-mill.

classifiers, where it is received for re-classification along with the battery pulp underflowing from the dewatering cones mentioned above. Thus, the classification of the pulp, with the exception of that overflowing from the dewatering cones, is effected in a closed circuit and results in a slime classification going to the thickening tanks, 80% of which is of −200 mesh.

VETA COLORADA, GENERAL VIEW.

AGITATING TANKS AND FILTERS.

Fine Grinders.—There are five tube-mills set together, each 5 by 14 ft., operated at from 27 to 30 revolutions per minute. The discharge from all these mills is received in a cross-launder set on 10% grade, which in turn discharges into the boots of three belt-bucket elevators, two of which are kept in operation and one held in reserve. These elevators raise the tube-mill product to a distributing box from which it is led back through pipes to the Dorr

Pulp Thickeners.—The three Dorr thickening tanks which receive the classified slime are 36 ft. diam. by 12 ft. high, and in them the collecting rabbles are geared to make one revolution every seven minutes. The clear solution overflowing from these tanks goes to a 12 by 36-ft. sump-tank, from which it is pumped back to the two head-supply tanks (set 30 ft. above the batteries), each of which is 12 ft. high by 36 ft. diam. When this sep-

arated solution from the thickening tanks becomes sufficiently charged with silver to warrant precipitation, provision is made to pipe it to a filter-press through which it flows by gravity and is clarified and then goes to the zinc-boxes for precipitation.

Dilution and Elevation of the Thickened Pulp to the Treatment Tanks.—The thickened pulp underflow from the thickeners, containing about 1½ of solution to 1 of solids, is piped to the boots of two elevators by which it is raised to the agitation tanks. As this pulp is delivered to the elevators it is diluted by precipitated solution returned from the zinc-boxes mixed with the wash-water from the filter-presses to the consistence of 2:1, which was found to give the best results in treatment.

The two elevators lifting to the agitation tanks are of the belt-bucket type, 55 ft. between centres, the belts being 24 in. wide. One of these elevators is in constant use and the other held in reserve. The elevated pulp is received in a box, at the head of the elevators, fitted with a cover and false bottom of wire screen, into which the cyanide and lead acetate required to bring the solution in the pulp up to treatment strength are placed every hour, and are gradually dissolved by the splash of the discharging pulp. Provision is made for piping the pulp from the receiving box to any of the agitation tanks for treatment by the individual-tank process, or for delivery into the first of the series of agitation tanks for treatment by the continuous process as desired. In the latter case, which was permanently adopted after extended trial, provision is made for the pulp to flow from tank to tank and be drawn from the last of the series to the filter-presses.

Agitation Tanks.—The treatment or agitation tanks consist of a battery of six tanks which contains one standard Pachuca tank, 15 ft. diam. by 45 ft. high, and five Parral tanks 25 ft. diam. by 42 ft. high, having holding capacities of 83 and 250 metric tons, respectively, of 2:1 pulp. The agitation is effected by compressed air in both tank systems; in the Pachuca tank in the usual way through a central lift-pipe of 16-in. diam., and in each of the Parral tanks by four lift-pipes each of 12-in. diam. set equidistant from each other and 2½ ft. from the interior side of the tank. The discharge ends of the lift-pipes in the Parral tanks are set horizontal and so directed that the discharging pulp flows in the same direction as segmental cords with respect to the interior side of the tank. The force of the discharge pulp sets up and maintains a rotary flow in the entire pulp charge from top to bottom of the tank. This rotary flow preserves the solution and solid constituents of the pulp charge in proper proportional mixture and prevents the settlement of the pulp on the bottom of the tank into dead accumulations.

Filter-Presses.—When the treatment cycle in the agitation tanks is completed, the pulp is drawn off to a battery of Kelly filter-presses, of which there were 8 operated hydraulically from a central platform in two units of 4 each. Each of the presses is 5 by 15 ft. and contains 13 leaves having a total filtering area of 1500 sq. ft. The Kelly filter-presses, and the excess-pulp, precipitated-solution, and wash-water tanks are shown in the foreground in the illustrations.

The operating cycle and results are as follows: Density of pulp received, 1.26; percentage of −200 pulp, 80; time charging and building cake, 13 to 28 minutes; expelling surplus pulp, 2; washing with precipitated solution, 10; washing with water, 3; drying with air, 3; discharging cake, 10; total cycle, 40 to 50 minutes; thickness of cake, ⅝ to 1 in.; moisture in discharged cake, 15 to 18%; assay difference between washed and unwashed cake, 3 grams silver.

Disposal of the Cake.—The cake discharged from the filter-presses falls into a V-shaped box sheeted with steel plates which extended transversely underneath all the presses. In the bottom of this box is a right and left-hand screw-conveyor which works the discharged cake, mixed with water, to a central box where it is cut up with a chopper made of spikes inserted in a hub to the shaft of the screw-conveyor. As the cake is being chopped it is struck by a 1-in. stream of water under pressure-head of 200 ft. and thus mixed and diluted, it passes through the tailing launder, set on grade of 12%, to the tailing dump.

Manipulation of the Filtered Solution.—The filtered rich solution from the presses is collected in a launder underneath, from which it flows in a pipe to two collecting tanks each 10 ft. high by 20 ft. diam., from which it flows to five clarifying boxes, each having five compartments. These boxes are of the zinc-box type with baffle partitions between the compartments and 3 by 15 ft. over all by 5 ft. deep. Leaves of cocoa matting are placed in the compartments and spaced 2 in. apart. The outflow from these boxes is piped to two storage tanks, each 36 ft. diam. by 10 ft. high, from which the flow to the zinc-boxes was so regulated as to be continuous and uniform.

Measuring the Solution.—These tanks were designed to be used alternately in feeding the zinc-boxes; when one is feeding the zinc-boxes the other is receiving the solution flowing from the clarifying boxes. With floats connected by ropes run over sheaves to weights which rise and fall along vertical recording boards in the zinc-room like those of railroad tanks, the zinc-room man is enabled to record the cubic feet or tons of solution that passes each shift of 12 hours through the zinc-boxes.

Sampling the Solution.—The solution coming to the zinc-boxes is sampled by a drip-cock tapped into the main delivery pipe, and thus the tonnage of solution going through the zinc-boxes, and its assay value, is recorded. In like manner the main pipe carrying the precipitated solution from the zinc-boxes to the precipitated solution sump-tank is provided with a drip sampler, the assay of which subtracted from the head sample shows the amount precipitated in the boxes.

Return of the Solution.—The sump-tank is 10 by 36 ft. and the precipitated solution received in it is pumped back to an intermediate sump-tank from which the amount required for diluting the pulp going to the elevator lifting to the agitation tanks is supplied, the amount not needed for this purpose being pumped back to the supply-tanks at the head of the mill.

The Precipitation Room.—The precipitation of the rich solution is effected by zinc shavings in 11 zinc-boxes, each box having five compartments, 3 by 3 by 3 ft., for the zinc shavings and having a total holding capacity of 1331 cu. ft. of shavings. As a rule only four compartments of each box were charged with shavings, since the precipitation is complete in four of the compartments. From the bottom of these compartments, which are pyramidal in shape, a pipe with stop-cock is provided for the discharge of precipitate during the clean-ups, which are made weekly. The precipitate, with the associated zinc shorts, as discharged from the zinc-boxes, is flushed and brushed through half-round steel launders to a collecting sump-tank provided with screen trays at its top, through which the precipitate passes. The zinc shorts, + 60 mesh, in the precipitate are caught in the screening trays, where they are scrubbed and washed and removed from time to time, and returned to the head compartments of the zinc-boxes, where they are gradually consumed by the flow of the rich solution entering for precipitation.

Filter Pressing the Precipitate.—From the sump-tank the precipitate is pumped through a Dehne press, 8 by 2½ ft., with 30 leaves having a total filtering area of 650 sq. ft. The effluent solution from the precipitate press goes to the zinc-boxes, where any escaping precipitate is caught in the zinc shavings.

Fluxing and Drying the Precipitate.—When the cake of precipitate is built in the press it is discharged into a shallow box run on flat wheels underneath the press. In this box the precipitate when sampled for moisture is weighed, mixed with the required fluxes, and filled into iron trays 30 by 10 by 4 in. and placed on the shelves of a steam-drying cabinet. This is a closed cupboard-shaped box made of $^{3}/_{16}$-in. steel plate, measuring 8 by 6 by 3 ft.,

with shelves made of 1¼-in. pipe extending from 3-in. headers at the sides, through which low-pressure steam generated in an upright 5-hp. boiler circulates. The cabinet can be securely locked and serves as a safe for the precipitate until needed for melting.

Melting and Sampling.—For melting the precipitate there are three Steele-Harvey tilting oil-fired furnaces, containing No. 275 Monarch crucibles, into which the dried and fluxed precipitate is charged and the melt effected. The bars weigh from 70 to 75 lb. avoirdupois each, and are sampled by boring at opposite corners of both sides $^{3}/_{16}$-in. holes to the depth of 1 in. The silver in the bars ranges from 850 to 900 fine.

Air-Compressors.—An Ingersoll-Rand, type 10, air-compressor generates the compressed air used for agitation, filter-pressing, and air lifts. This compressor has a sea-level displacement of 1000 cu. ft. of free air per minute, and at the plant, 6000 ft. elevation, about 80% efficiency is obtained. The pressure carried for this plant is 30 lb. per square inch.

Motors.—Westinghouse motors are used throughout the plant, the type being 3-phase, 25 cycle, 440-volt, alternating current. Their number, where used, rated horse-power, hours run per day, and power consumed is as follows:

No.	Used to run	Rated hp.	Consumed hp.	Running hr. per day.
1	Two Blake crushers and belt bucket-elevator	50.0	49.7	10
1	Cross conveyor-belt	5.0	2.7	10
1	Sampling mill machinery	15.0	5.0	8
4	Stamp batteries, one to each 20 stamps	200.0	198.8	24
3	Three Dorr classifiers	5.0	3.0	24
1	Five pulp elevators	20.0	12.7	24
5	Five tube-mills, 40 hp	200.0	155.0	24
3	Three Dorr thickeners	3.0	1.0	24
1	One belt bucket-elevator to treatment tanks	10.0	4.2	24
1	Ribbon pulp conveyor	10.0	5.3	20
1	Triplex pump returning solution	20.0	16.8	20
1	Triplex pump returning solution	15.0	7.6	20
1	Triplex pump returning solution	7.5	2.0	20
1	Pump and lathe in zinc room	5.0	5.7	10
1	Ingersoll-Rand compressor	100.0	83.3	24
1	Motor generator	40.0	32.0	24
	Lighting (417 hp-hr), from plant	17.4	17.4	12
28	Totals	722.9	602.4	

From the table it will be seen that the 28 motors connected with and driving the milling machinery, have a total rated capacity of 722.9 hp. and that these motors when carrying the full load of all machinery running together, including the pro-rated lighting, consumed 602.4 hp., 83% of the nominal power of the motors, or say, 1.5 hp. per ton of milling capacity.

(To Be Continued.)

COMPLETE returns of the coal production in the states of the Rocky Mountain region in 1911 have been received by E. W. Parker, of the U. S. Geological Survey. The eight states included, namely, Colorado, Idaho, Montana, Nevada, New Mexico, North Dakota, Utah, and Wyoming, produced in 1911 a total of 26,044,387 short tons, valued at $40,098,747. Although no coal was produced in Nevada in 1910, the output of the seven other states was 28,857,413 short tons, valued at $43,776,715, indicating a decrease in 1911 of 2,813,026 short tons, or 9.7% in quantity, and of $3,677,968, or 8.4% in value. This decrease was due to the resumption of mining in the Mississippi Valley states, the idleness in which, caused by the strike in 1910, resulted in extraordinary demand on the mines of most of the Rocky Mountain states. The total number of men employed in the coal mines of the Rocky Mountain states was 33,783, who worked an average of 219 days, against 34,652 men for an average of 245 days in 1910.

The La Fortuna Mine

By F. J. MARTIN

During the early nineties a large number of men were on the desert of southern California, Nevada, and Arizona, prospecting for placer gold. A dry-washing machine had been invented that seemed to answer the purpose of a rocker or long-tom. And although nothing particularly good in the way of placers was found, the excitement proved to be the means of a number of good lode mines being discovered; among them the Yellow Aster in Kern county, California, and the La Fortuna in Yuma county, Arizona.

As is well known, few live springs of water exist on the desert, especially in Arizona, but nearly every mountain range contains natural depressions which are filled by summer and winter showers. These 'tanks' vary in size and retaining capacity. Those filled with coarse sand and gravel are less liable to be drained by wild animals and evaporation. It was at one of these tanks that three prospectors, Halbert, Albert, and Thomas, had their camp in the winter of 1894, on the western slope of the Gila City range of mountains, about twenty-three miles southeast of the town of Yuma. They had been there but a few days when Thomas found some good-looking 'float' in one of the main washes, and it did not take him long to trace it to the croppings, which were quite prominent, and rich. Pieces broken at random from any part of the vein, when ground and panned, showed a long string of colors, some of which were as large as wheat grains.

It is remarkable that no one had ever taken the trouble to investigate those croppings before, since a well-beaten smugglers' trail led by not a hundred feet away. While the smugglers were intent on beating the Mexican or United States government out of a few dollars, there was an unsuspected fortune staring them in the face.

It is wonderful how news of a discovery spreads. One may be on the desert prospecting weeks at a time without meeting a soul, but let a rich prospect be discovered, and before he is aware of it, the place is swarming with men. I have seen notice of location of valuable claims written on cigarette papers, about one and a half by three inches in size, the locators having rushed pell-mell to the new district with nothing but some tobacco and cigarette papers, the inevitable article always in evidence on the southern desert. As soon as the news of the find reached Yuma, the recorder, a man named Pool, sent word to his friend, R. M. Straus, who was at the Haraqua-Hala mine during its palmy days and who had requested Pool to keep him informed of anything new. Straus lost no time in getting on the ground, and, being well and favorably known, had no trouble in securing a bond on the property at a price of $150,000. He took the matter to C. D. Lane, of Utica mine fame, and persuaded him to go and examine the property. It proved to be a case of love at first sight with Lane. The locators had sunk a hole about 30 ft. deep by this time, and had shipped a carload of selected ore to a smelter and received over $70 per ton.

Mr. Lane decided to develop the property immediately, and a force of men was put to work. The 'tank' water by this time having all been used, water had to be hauled from Blaisdell station, on the Southern Pacific railroad, a distance of 14 miles. The railroad company charged 10c. per gallon for this, having brought it from Sentinel, 80 miles distant, in tank-cars, and stored it in a cistern built of concrete on the ground. The railroad company maintains these cisterns at all their dry stations and section-houses, and prospectors are welcome to all they can make use of, for themselves and burros, free of charge. Several months after Lane became interested, I visited the camp. Much sport was being made over the scarcity and expensiveness of the water, it being sold in camp at 25c. per gallon. The supply ran low several times, and the men claimed that they had to wash in left-over soup, after which the soup was used for drilling. They said

the soup didn't always have the first use—but all agreed that the last use was for drilling.

When the shaft, which was sunk in the centre of the main lens, had reached a depth of about 200 ft., Mr. Lane decided to buy and equip the property. A 20-stamp mill was erected, each stamp weighing 1450 lb.; a compressor and hoist were set up with four 80-hp. boilers; shops, store, boarding-house, and buildings were built, and a good well was sunk at the Gila river, a pumping station built, and a 4-in. screw pipe-line laid to camp. This furnished an ample supply of fairly good water.

The vein occurs in the middle of a large belt of amphibolite schist, which extends across the mountain range a distance of fully ten miles, dipping under the desert on both sides, and it is about three miles wide, gradually merging into a mica schist at either side, and from that into granite. The beds of this schist lie at an angle of about 60°, the strike being east and dip south. The quartz differs from any I have ever seen. It was mostly rose colored, and the best of it was glassy and transparent, slightly tinged with green in places, although it contained no copper. It was the freest milling ore I ever saw; and a most remarkable feature was that the ore became freer from base metals with depth, although it contained very little near the surface. The vein follows the strata, both downward and lengthwise. Near the surface the ore was in short lenses, being about as broad as long. The largest discovery lens was about 30 ft. wide and 40 ft. long; but gradually this changed until at the 500-ft. level the ore formed one continuous pay-shoot about 3½ ft. wide and 500 ft. long. Many faults were found, varying in amount of throw and in direction. The greatest movement, beyond which the ore was again found, was 600 ft. Finally the main fault was encountered and the vein was not found again, although the line of the fault was followed from a little below the 1000-ft. level, where the ore was finally cut, to the 2000-ft. level. By this time all the ore had been worked out, and the company did not care to levy assessments to prospect further. I favored another effort, since shortly before closing the mine I discovered what I believed to be the main fault, in the foot-wall of ore then followed, and concluded the prospecting had been conducted in a wedge-shaped piece of country rock which had been shoved up from below. I hope some day to interest capital in further prospecting on the foot-wall or what I believe to be the main fault. The vein was as strong and the ore as good where faulted and lost as at any point above.

The last sample taken from the lowest point assayed $40 per ton. This is almost three times the general average of all the ore treated. Waste finds its way into all mills, which increases the tonnage but reduces the value. At the Fortuna a total of 180,780 tons was milled; it yielded on the plate $2,505,931. A considerable quantity of the tailing was lost by cloudbursts washing it away, but that treated by cyanide returned $377,144. The total gold recovered was $2,883,075, which gives an average value of $15.94 per ton of all ore worked. The general store, operated in connection with the mine, made a profit of $30,000. The cost of mining, milling, and cyaniding was $1,377,375. This includes prospecting for the lost vein, and the upkeep of plant. The plant cost in the neighborhood of $200,000, and $155,700 was paid to the locators, Thomas at the last moment insisting on getting $5000 for finding the vein, and the contract making it expedient to pay this. The locators also received $100 per month during the life of the bond, seven months. The balance, $1,180,000, was paid out in dividends.

When Mr. Lane decided to buy and equip the property, he organized a company and invited numbers of his old employees and friends to join him on equal footing with himself, guaranteeing them against all losses. He considered himself entitled to a bonus of $5 for every dollar he had risked in proving the property a safe investment, and all stockholders agreed in this. This bonus amounted to $75,000. All those invited to join took advantage of this offer, with the result that many a little 'nest-egg' was laid by and several good men were enabled to get upon their feet.

It is a notorious fact that almost all the good mines on the desert have been found by drunkards, who sold for a shoestring to get quick money to go on a spree, or if they happened to get a fortune for their find, it only meant a more protracted spree. There have been exceptions to this rule, and the La Fortuna, which was happily named, was a striking one. Everyone in any way connected with the mine did well. Even Pool, the recorder, received $5000 for his small pains in having notified his friend Straus of the find. Thomas bought a walnut grove near Santa Ana, Albert went back to France, Halbert engaged in the ice business, the stockholders got back over $5 for every $1 invested, and all blessed the day the La Fortuna was found.

Gold-Mining Companies in Russia

Russian and foreign gold-mining companies operating in Russia and Siberia, with the capitalization of each, are listed by the *Mining Journal*. The list, with some additions and corrections, is as follows:

1.	Russian Gold Co.	rubles	3,375,000
2.	South Urals Gold Co., 'Rossia'	"	300,000
3.	North-Eastern Siberian Co.	"	3,000,000
4.	Troitsk Goldfields, Ltd. (Katchkar district, Orenburg)		£625,000
5.	Tushetushanovsky and Tzentzenshanovsky Aimaki (Mongolia)	rubles	1,800,000
6.	Alexandrovsky Gold Co.	"	80,000
7.	Amur Gold Co.	"	3,000,000
8.	Draga (Dredge) Gold Co.	"	500,000
9.	Transural Mining Co.	"	4,500,000
10.	Société Anonyme des Mines d'Or du Katchkar (Orenburg government)	"	4,500,000
11.	Industrial Co.	"	7,000,000
12.	Lena Gold Mining Co.	"	11,100,000
13.	Lena Goldfields, Limited		£1,405,000
14.	Orsk Goldfields, Limited		£920,000
15.	Borovinsk Gold Co.	rubles	844,308
16.	Verchinsk Gold Co., Limited		£1,100,000
17.	Central Ural Gold Co.	rubles	1,000,000
18.	Tumninsky Gold Co.	"	1,000,000
19.	Phedorovsky Gold Co.	"	2,000,000
20.	Wagransky G. M. Co. (North Ural), Ltd.		£100,000
21.	Siberian Gold Dredging Co., Ltd. (Great Kujah river, near Tomsk, Western Siberia)		£200,000
22.	Siberian Proprietary Mines, Ltd. (holds interests in the Orsk Goldfields, Ltd.; Troitsk Goldfields, Ltd., and Kluchi Gold Mines, Ltd.)		£135,000
23.	Kluchi Gold Mines, Ltd. (Merchinsk district, Eastern Siberia)		£400,000
24.	Pioneer Company of Siberia		£100,000

In Durango, Mexico, about 50 miles northeast of Cedros, a large vein carrying cerussite occurs. It is 50 ft. wide where cut through by a small creek; below this it lies on a side-hill slope, dipping about 45°, and exposed by erosion for 1500 ft. in length and 500 to 1000 ft. on the dip. There is an old inclined shaft, 50 ft. deep, at the point where the creek cuts it; the ore is there much oxidized, some of it assaying 20% lead, $1.50 gold, and 5 to 8 oz. silver per ton; occasionally a little zinc occurs. The country rock is andesite. The mine is on the east side of the Coast range, close to the foothills of the Sierra Madre, and quite inaccessible. A few miles north of it is an old trail leading up into the mountains which can only be followed in places where hewn out of the rocks. The trail is in a mild unsettled section, and it is possible that it leads to the lost Tiopa mine which so many have hunted for.

Iron ore deposits at Gogo Soco, in Minas Geraes, Brazil, are to be developed by the Gogo Soco Syndicate, Ltd., of England.

Industrial Lead Poisoning

By James O. Clifford

Introduction

There are few matters worthy of greater consideration by American lead-mining and smelting men than preventive measures to insure to employees freedom from plumbism. The subject has been given attention by lead pigment manufacturers, but mining and smelting companies have remained indifferent. Prior to the year 1900 the same condition existed in Europe, but a thorough investigation of the danger from plumbism to which lead-workers were subjected led to governmental legislation. The regulations imposed by European nations in this connection have been attended by highly gratifying results. Experience having pointed the way, there is reason to believe that similar legislation in America would prove equally beneficial. Employers can, however, anticipate such action by affording their employees all necessary protection. In two or three states statutes have been enacted regulating the conditions under which laborers may be employed in the lead industries. While the effort to protect employees by state legislation is highly commendable, it is not comparable to federal supervision.

Plumbism

Lead is a subtle poison. Of all industrial poisons it is the most productive of ill health. Some persons are more readily influenced by it than others; there is, however, no special type of constitution which is the more likely to be influenced thereby, nor is there any racial predisposition. Generally speaking, young persons are more susceptible to its influence than those of maturer years. Alcoholic excess and the use of tobacco have been conclusively demonstrated to be harmful factors in predisposing to plumbism.

Primarily, plumbism is a question of elimination of the lead taken into the human body failing to keep pace with its absorption. The repeated entrance of lead into the system in minute quantities over a lengthened period of time is more productive of harm than the absorption of that element in larger doses upon only a few occasions.

There is no specified length of time of exposure necessary to produce plumbism. Physical condition of workmen's health and other general circumstances determine this factor. At lead mines and smelters, where even ordinary precautions are not taken by either employers or employees, it is not unusual for laborers to evidence symptoms of the disease within a week following their engagement. Acute lead colic is often induced within periods of from two to six weeks. Recurrences of plumbism in employees engaged in lead mining or smelting are frequent; instead of conferring immunity, one attack of poisoning prepares the way for another.

Lead is dangerous, whether in the solid, liquid, or gaseous form. The solubility of lead compounds by the secretions of the body is an index to the development of plumbism. By experiment it has been determined that, in order of their solubilities by the stomach and the respiratory organs, lead oxide is the most soluble, followed by lead carbonate, lead sulphate, lead sulphide, and metallic lead, in the order given.

Lead enters the body through the skin, the respiratory organs and the alimentary canal. Of these the skin is the least important. Lead dust or fume, carried into the bronchi, trachea, and lung cells is there deposited, and by the influence of heat and moisture the lead compounds are moistened by fluids rich in carbonic acid coming from the lungs and converted, first into carbonate, and subsequently into bicarbonate, in which form it is fairly soluble. The entrance of lead through the alimentary canal is, next to the respiratory organs, the most common mode of entrance. Lead dust, caught in the mouth, is partly dissolved by the saliva and swallowed. Entering the stomach, the lead is acted upon by the gastric juices where the lead dissolved is converted into a soluble and diffusible chloride, in which form it is readily absorbed by the blood. While the entrance of lead through the skin is not so important as the two modes above outlined, it can readily be absorbed through the pores of the skin, exposed membranes (cuts, bruises, and sores), and the inner surface of the eyelids.

Symptoms

One of the earliest signs of plumbism is the peculiar anemic appearance of the victim. This is accompanied by a disagreeable metallic taste in the mouth, a feeling of sickness, with tendency to vomit. The tongue is coated, and the breath fetid. Disturbed digestion, poor appetite, obstinate constipation, and a sense of fatigue disproportionate to the amount of energy expended is also complained of. At about this period there is developed a severe pain in the abdomen, accompanied by vomiting. Swelling of the gums and severe headaches often accompany the above symptoms.

Upon examining the victim's gums a persistent blue line is observed close to the teeth. If the patient is toothless the blue line is absent. Occasionally the surface of the tongue shows a similar coloration. The urine is scanty and frequently contains traces of albumen. On chemical examination of any vomit lead will be detected. As a rule the saliva of the patient contains no sulpho-cyanate of potassium. On the addition of a few drops of ferriperchloride solution to the saliva of a healthy person a brownish red ring will be seen where the two fluids meet. This characteristic is absent in the saliva of a lead colic patient.

The blue line on the gums is, when accompanied by other symptoms, a valuable aid in diagnosing plumbism. Too much importance cannot be attached to this blue line, however, as similar blue lines often develop on the gums of persons who have taken, internally, large doses of bismuth, or have used a bismuth mouth-wash for ulceration of the gums and mucous membranes of the mouth. Also, there is occasionally observed on the gums of persons using carbolic acid solutions, or charcoal tooth-powder, a bluish black line. On the gums of copper-workers a bluish green line is apparent. In many instances a blue line on the gums of lead-workers is present when other symptoms are absent. The reverse of this is correspondingly true. In consequence of the foregoing, the presence of a blue line on the gums is not, in the absence of other symptoms, a conclusive indication of plumbism.

Effects

For a varying period there may be an elimination of lead from the body which bears a constant ratio to its absorption. It is when a check is placed upon elimination that there commences a storage of the poison. Plumbism is not always a question of any stated amount of lead being present in the body. The reason for this is that some are more susceptible to its influence than others; and besides, lead may, by destroying the functional activity of the eliminating organs, favor the retention within the body of poisons generated by the individual himself, autointoxication, so that the patient suffers, or dies, from a mixed form of toxemia.[1]

The effect of lead varies with the constitutions of the individuals attacked thereby. There cannot be any fixed rule. Common results of plumbism are: lead blindness; temporary loss of hearing, smell, and taste; stimulation into activity of neurosal tendency, to which the patient is hereditarily or otherwise predisposed; loss of teeth, accompanied by serious ulceration of the mucous membranes of the mouth; continuous headache, dizziness, sleep-

[1]Oliver, 'Gulstonian Lectures.'

lessness, tinkling in the ears, and weakening of will and intellect; chronic constipation; and paralysis of the hands and feet.

Another item of interest and importance is the length of time lead may remain in the body. Years after the symptoms of poisoning first show themselves, and apparently have disappeared, there may be fresh signs of intoxication, even though the individual had not been exposed to the absorption of lead following the first instance.

The main channels of elimination of lead from the body are the kidneys and intestinal canal. During the period of elimination, which may extend over many years, these eliminating organs often undergo structural changes, and in view thereof may induce death either as contributory or immediate causes.

From the foregoing paragraph it might be of interest to state that as the result of numerous post-mortem examinations of victims of plumbism, that disease was determined to have been either a contributing or immediate cause of death, depending upon the individual case. In the instances mentioned, the immediate causes of death were as follows: acute plumbism; chronic plumbism; acute gastritis; chronic gastritis; apoplexy; Bright's disease; paralysis; heart disease, and cirrhosis of the liver.

Prevention

In the prevention of plumbism cleanliness of the individual and work places cannot be too strongly insisted upon. Lavatories with a sufficient supply of hot and cold water should be furnished by the employer and daily bathing encouraged. In dusty atmospheres, respirators should invariably be used. Food should not be eaten at any time or at any place until after the face and hands have been washed, and the mouth and throat rinsed thoroughly with an alkaline mouth-wash. In this connection a mouth-wash of 0.2% solution of sulphite of soda will be found highly beneficial. The use of alcoholic liquors and tobacco should be prohibited. Employees should never begin the day's work without first having had food. Perfect ventilation should be established in all places where there is danger of dust or fume. Employees should take care to keep the bowels open. Proper foods, rich in fats (and in this milk is included) have a preventive value beyond question. The most effective protectives against the disease are cleanliness and sobriety. Medical examination of employees once or twice monthly should be made compulsory. Some companies provide tabloids containing 5 grains of hyposulphite of soda to be taken by employees once daily.

Danger to Employees

Lead Miners.—There are comparatively few miners who have worked in lead mines for any considerable period of time that have not suffered from plumbism. The majority of cases have been the acute form, but there are numerous examples of the effects of chronic poisoning. In lead mines (or in other mines where lead is a constituent of the minerals mined) great danger of plumbism to miners is occasioned by the dust given off from the ore and which they cannot avoid inhaling. This condition is intensified in poorly ventilated mines by reason of the fumes from the powder used in blasting and the smoke from candles. In consequence of the two latter evils, miners often suffer from fibrosis—a hardening of the lung tissues due to mild inflammation of the supporting texture of the lungs. Impure drinking water, poor food, and unsanitary living quarters are harmful factors. Alcoholism and the absence of cleanliness among certain classes of miners, are important contributory influences. In small mining camps medical attention is not always available.

Lead Smelters.—The danger from lead-smelting operations is not confined to the immediate property. The dust and fume liberated from smelter stacks are a source of danger to inhabitants in the immediate vicinity of the plant unless the diffusion of the gases therefrom is complete and the quantity of lead and other harmful components relatively low.

Calcining and Reverberatory-Furnace Workers.—The main danger to employees operating either of the two furnaces named lies in the drawing off of the charge. It is not unusual to note that, in drawing the furnace charge, workers often suffer from smothering, resulting from the fumes and dust given off by the hot or molten material.

Blast-Furnace Workers.—The dangers incident to lead-smelting in blast-furnaces are, the dust given off when placing the charge, and the inhalation of fumes escaping from the charging-floor, lead-well, slag tap-hole, open hearths, matte and slag cars. Slags vary in melting point from 1000 to 1500°C., whereas the melting point of lead is 325°C. Under these conditions the danger from lead vapors given off is apparent. From analyses of fume escaping from molten lead and molten slag it has been calculated that in eight hours a man might breathe seven grains of lead.[2] The danger from dross raked from lead melting-pots and deposited on the floor to cool is a source of great danger.

Zinc Smelters.—According to Ingalls:[3] "Fumes of zinc oxide appear to be quite harmless to human beings, but when the ore subjected to distillation contains lead there is danger of poisoning by the fumes of that metal." In view of the foregoing, it might be of interest to state that, while the lead content of the average grade of zinc ores subjected to distillation by American smelters is comparatively low (averaging from 1 to 8% Pb), it is not unusual to treat ores containing as high as 20% lead.

Refiners.—While electrolytic refining of silver-lead bullion has superseded, to a great extent, the Parkes, Pattinson, and other older methods, the latter, where used, are a source of great danger to employees.

European Governmental Regulations

In Europe laws have been enacted by several nations relative to the protection of employees engaged in the lead industries. Of especial interest are the regulations imposd by the British, German, and French governments, excerpts from which are given herewith.

Great Britain.[4]—Employers shall, (*a*) provide respirators and overall suits for the use of all persons employed in cleaning the flues, and take means to see that same are used; (*b*) they shall arrange that no person be allowed to remain at work more than two hours at a time in a flue (a rest of half an hour before re-entering will be deemed sufficient); (*c*) they shall provide sufficient bath accommodations for all persons employed in cleaning flues, and everyone so employed shall take a bath before leaving the works; (*d*) they shall provide washing conveniences, with a sufficient supply of hot and cold water, soap, nailbrushes, and towels.

In cases where co-operation of the workers is required for carrying out the foregoing rules, and where such co-operation is not given, the workers shall be held liable under Section 2, Workshop Act of 1891, which is as follows: "If any person who is bound to observe any special rules established for any factory or workshop (in which is included smelters) under this act, acts in contravention of, or fails to comply with, any such special rule, he shall be liable on summary conviction to a fine not exceeding £2."

Germany.[5]—The main requirements in this country are:

1. The rooms wherein lead is roasted, raked out, and worked, where lead containing silver is ladled off, where oxides and other compounds are made * * *, also where zinc scum is distilled, must be spacious, high, and so arranged that there is sufficient and continuous change of air; (*b*) the rooms must be provided with a level and solid floor, permitting of an easy removal of dust by wet methods; (*c*) the walls must have a smooth surface so as to prevent accumulation of dust, and must be washed or whitewashed at least once a year. In roasting sheds with wooden walls this regulation is not enforced.

[2] *Bulletin de l'Inspection du Travail*, 1906.
[3] 'Metallurgy of Zinc and Cadmium,' page 631.
[4] Regulations and Special Rules in Force, January 1908.
[5] Regulations of the Imperial Chancellor Concerning Erection and Management of Lead Smelting Works, June 16, 1905.

2. For workmen engaged at the furnaces and melting-pots there must be a sufficient supply of drinking water in a convenient and completely protected place. In the neighborhood of the furnace there must be arrangements for spraying the ground. The floors of all places mentioned in rule 1 are to be cleaned once a day in the moist state.

3. Lead ore and smelted products containing lead, if not moist, are to be crushed in machinery so constructed that dust will, as far as possible, be prevented entering the work-rooms. This does not apply to the roasted material removed from the converters. Sacks in which lead ore or lead products have been packed must only be cleaned in closed apparatus.

4. Materials containing lead oxides, if dusty, must be moistened before being mixed with other materials preparatory to being placed in the furnace.

5. Dust, gases, and fumes escaping from furnaces, converters, slag spouts, and receiving pots, from sump, slag, slag-cars, slag heaps, and from the glowing remains removed from the furnaces, as well as from the refining pots, must be caught near their point of origin and removed. Flues and furnaces must be properly cooled and ventilated before workmen enter.

France.[6]—The principal regulations may be summarized as below:

1. Lead-melting pots must be placed in airy places separated from other workshops. Hoods or any other efficient means for the removal of fumes shall be installed, above the sink containing the molten lead or slag in the metallurgy of lead.

3. All work which deals with oxides and other lead compounds liable to give off dust must be carried on as far as possible in the moist state. If this is impracticable in the presence of water or other liquid, the work must be carried on mechanically in a closed and air-tight compartment.

(Where one or other of the regulations in article 1 and 3 cannot be carried out, the work in question must be done under a powerful exhaust installed in such manner that the harmful products are arrested by suitably placed appliances. Finally, if none of these methods can be adopted, the workmen must wear respirators.)

8. The introduction of food or drink into the workrooms is forbidden.

9. Employers are obliged to place at the disposal of the employees, and to gratuitously maintain, overalls and other clothing to be used exclusively in the work; also gloves and respirators.

10. In a part of the factory separated from the workshops there must be for the use of workmen exposed to dust or any other lead emanations, a well kept dressing and washing room, provided with taps and basins in sufficient number, and with an abundant supply of water as well as soap, and for each workman one towel, the latter to be renewed at least once a week.

11. A warm bath or spray shall be at the disposal of workmen exposed to dust or other lead emanations, once a week. At the close of each day's work an opportunity of taking a warm bath, or of having a warm spray, must be offered to every workman occupied in emptying or cleaning flues or dust-chambers, or repairing of furnaces, in lead smelters.

12. Employers must post, in readily accessible places, a copy of the regulations, which impose upon the workmen the following requirements: They must make use of the tools, gloves, respirators, and working overalls provided at the expense of the employer; and must not introduce into the workshop either food or drink. They must take care that before each meal their mouth, hands, and nostrils are properly cleansed, and that they take weekly or daily baths stated in No. 11.

Conclusion

From the foregoing brief outline, the need of special precaution for the protection of those employed by lead-mining and smelting industries is apparent. The solution of the problem is simple. Workmen should invariably be informed concerning the peculiar risks they run. The lead mining and smelting industries in America should be made as safe as are the same industries in European countries.

[6]Decree of April 1908, Prescribing Special Regulations for the Hygiene of Industries in Which Workmen Are Exposed to Plumbism.

Clarifying Cyanide Solutions

The following notes on an experiment relating to the clarifying of cyanide solutions are given by Chester Steinem, Mogollon, New Mexico, in the *South African Mining Journal.* The disadvantages of the proposed method are obvious.

Probably the worst two zinc-box troubles are: (1) the deposition of fine ore particles on the zinc from cloudy solutions, and (2) the deposition of a zinc slime from complex zinc compounds in solution. The principal effect of the latter is to coat the zinc-shavings, making them inefficient, while the former not only has this effect, but makes much 'short zinc' and a low-grade precipitate. This low-grade precipitate necessitates more time and flux in melting. To clarify cyanide solutions, it has occurred to me that the process long used for purifying city water might be useful. This method consists essentially in adding a small quantity of potash alum in solution to the water to be purified, which coagulates the impurities in the water. The mixture is run through a settling-basin where the coagulated portion is settled out. The water is then put through a special type of sand-filter to finish the work. The process is used on river water containing the minutest clay slime and the water is so purified as to be clear and practically free from bacteria. H. W. Miller and myself made experiments to determine the effect of the alum on cyanide solution. First a sample of muddy 'box-heads' running about $2.25 in gold and silver, was treated with alum (about 2 lb. per ton, which is a comparatively large quantity). A voluminous precipitate immediately appeared and a slight odor of HCN was noticeable. The precipitate was allowed to settle. In less than an hour all had settled except a small quantity which floated on the surface. After settling, the solution was titrated for cyanide and was found to be slightly higher than the original. The settled precipitate gave a good test for zinc. The solution was assayed for gold and silver and was found to have lost about 5c. per ton. Not having facilities for a quantitative analysis at hand, the relative amount of zinc precipitate was not determined. Considering the results, the following suggests itself for mill work: A long narrow reservoir containing baffle walls similar to those in zinc-boxes. If the final compartment is filled with oakum, excelsior, or a similar material, the sand-filter can probably be dispensed with. The other compartments should have facilities for drawing off the coagulated material at the bottom. An extra set of zinc-boxes would do for experiment. Such a scheme, while it would probably require considerable storage space, would be cheap, as alum costs but $1.75 per 100 pounds.

Asbestos properties situated twenty miles southwest of Llano, Texas, are being extensively developed. The outcrop is 250 ft. wide and 1600 ft. long. It was located a few years ago by N. J. Badu, who has made an exhaustive exploration of this region. Mr. Badu recently sold the deposit to the National Asbestos Co. of Chicago, and it is this concern which is now arranging to exploit the property. It is claimed that the surface mineral shows that it belongs to the chrysolite variety of asbestos, which is in great demand for commercial purposes. The other variety known to the trade is amphibole and comes chiefly from Italy.

Panama has only one mine in operation, that of the Darien Gold Mining Co., but altogether 169 mines, including gold, silver, copper, iron, sulphur, asbestos, and limestone have been denounced in the republic.

Flotation of Minerals

By Kenneth A. Mickle

*The various flotation processes which are now being so largely used for separating metallic sulphides from sulphide ores depend upon differential gas and liquid attachment phenomena. The sulphides are floated on aqueous solutions as a sort of scum or froth by the agency of either gases alone or by oily substances.

In a paper by Lord Rayleigh it was shown that the presence of small amounts of various impurities in water materially affected its frothing properties. Pure water, on being vigorously agitated with air, shows very little tendency to produce a froth. This tendency is much increased by the addition of small amounts of some substances, as saponine and acetic acid. These include not only substances which are soluble in water, such as saponine and acetic acid, but substances which are insoluble in water, such as various oils and certain finely divided solid substances. Without doubt liquid cohesion and attachment effects are important factors in determining froth-producing variation, but it seems apparent that gas attachment is the chief factor, and a comparison of the various proportions of froth produced would therefore afford an approximate measurement of the attachment of air to water and to various aqueous solutions and mixtures. A series of experiments has permitted the ranging of the common materials in order according to their power in this particular.

The effect of oils in protecting minerals from being wetted by water, owing to the oiling of their surfaces, and also the affinity of oils for metals and many metallic substances has long been known. As no accurate method of measuring this effect has suggested itself, and as minerals may occur in many different forms with varying physical characters, no attempt is made here to make a definite classification on this basis. Tests were, however, carried out to show the amount of oil absorbed by minerals, and the character of the resulting product.

Mixtures of the mineral to be tested, water, and oil (with and without a small quantity of acid) in definite quantities were taken and agitated thoroughly till the character of the product became constant.

The results of these tests showed that while there are undoubtedly differences in the degree of attraction between a given sulphide and various oils, and between various sulphides and a given oil, the general behavior between various sulphides and various oils in the presence of water is practically the same in character, that is, all sulphides will become attached to all oils in preference to water. With the silicates and other rock minerals usually found in the gangue material of ores, the character of the product varies with different minerals. From an elaborate series of tests, the following was deduced.

Adsorption of Oil in Water.—1. Finely divided sulphides when suspended in water will adsorb varying amounts of oil. Large proportions of oil tend to form magma, and smaller proportions plastic masses and coherent aggregates. The character of these oily magmas depends upon the amount and the character of the oil used. Thick oils give viscous coherent products, and thin oils give less coherent products. Oily magmas containing considerable proportions of oil will entangle and hold gaseous bubbles with a degree of persistence which depends on the viscosity of the oil. Sulphides having an adsorption of about 5% of oil tend to attach gaseous bubbles, and this tendency increases as the proportion of oil diminishes, until a certain limit is reached, which is 0.5% or thereabouts.

2. The adsorption is more pronounced with sulphides than with such minerals as quartz, feldspar, and most of the acidic rocky minerals forming the gangue of ores.

3. Some of the silicates and other gangue forming minerals will adsorb oils in a manner approaching that of the sulphides; for example, rhodonite, garnet, magnetite, and calcite.

4. As shown by the tests on sized minerals, the amount of oil adsorbed depends upon the extent of surface exposed.

Adsorption in Acidulated Solutions.—1. The sulphides will adsorb oil in the same manner to form oily magma, plastic masses, and coherent aggregations, as in the case of water and oil without acid. The amount depends on the extent of surface exposed by the minerals, as previously.

2. The gangue minerals will not adsorb oils to nearly the same extent as when no acid is present.

3. The maximum amount of oil adsorbed by sulphides in a stable manner when crushed to pass through an 80-mesh sieve (linear inch) is in the neighborhood of 10 to 15% of their weight. This is shown by the absence of excess of oil on the surface of the solution in the above tests when the percentage of oil to mineral was at or near these values. The tendency of the plastic magma to break up and form less coherent aggregates at this point also indicates this limit of true adsorption.

These determinations permit of the conclusion that when finely divided metallic sulphides are vigorously agitated with an excess of water and a small proportion of oil, the oil is adsorbed by the sulphide particles. As shown by tests on the sized material, the quantity of oil adsorbed depends upon the extent of the surface exposed. This being so, it seems safe to assume that the adsorbed oil is evenly distributed over the surface of the particles. When the quantity of oil adsorbed is very small, the general appearance of the sulphide does not differ from that of unoiled particles. With a sulphide such as galena, which has been crushed to pass through an 80-mesh sieve, this point of apparent difference is reached when the proportion of oil adsorbed (in the case of oleic acid) is between 0.05 and 0.10%. Even with these small proportions, various physical tests indicate that the particles are oiled. This can be shown by their aversion to being wetted by water, and by the fact that the odor of decomposed oil is noticed on heating.

Such a quantity as 0.1% cannot be separated by squeezing, centrifugal force or other mechanical means, and any such quantity of adsorbed oil as 0.1% may be regarded as a true adsorption of the oil by the mineral. When more oil is added, it is probable that a secondary envelope of oil becomes attached to the primary film. When this oil is thin, there is still the attraction of the oil for the sulphide, but as the film becomes thicker the subsequent overlapping envelopes of oil are held by the attachment of one oil film for another. These overlapping films are less persistently held than the primary films, and some of the oil can be separated mechanically, as by pressure or centrifugal force. The point at which the secondary film is thickest and still stable is represented in the above tests, when no excess of oil shows on the surface of the solution.

The various stages between the primary adsorption and the putty-like product represent the gradual thickening of the secondary oil envelope. The strength of the attachment of the secondary film depends largely on the cohesion of the oil itself, the more viscous oils forming more coherent products and the thinner oils less coherent products.

In the test on sized galena crushed to pass an 80-mesh sieve but retained on a 20-mesh sieve, it was found that all the oil (5 gm. oleic acid) was adsorbed by 60 gm. of the galena. From these data, the approximate thickness of the oil film at this stage in the adsorption can be calculated. Assuming that the average size of the particles is 0.25 cm., and that the particles are cubes, the thickness of the oil film would be 0.003 centimetres.

Diagrammatic representation of oil adsorption shows the gradual thickening of the secondary film of oil from the primary adsorption to the oily magma. The oil films around the mineral particles show as concentric rings.

Oil attachments and water attachments present many similarities. A sulphide carrying 2 or 3% oil cannot be deprived of its oil by gravity, centrifugal force, or other mechanical means. Similarly in the case of wet sand carrying a like proportion of water, the water cannot be readily separated mechanically. In both cases with the

*Abstract from a paper read before the Royal Society of Victoria and reported in the *Australian Mining Standard.*

small attachments the laws of gravity are not obeyed. With larger proportions the oil and water will separate out by gravity.

There is also a similarity between the gradual wetting of a finely crushed mineral with water, from the feebly coherent damp mineral to the thick coherent pulp, and the feebly coherent sulphide with a small proportion of oil to the various stages of oily magma. Whether the mineral particles are feebly coherent, due to the presence of a small quantity of water, or when under the surface of a solution the mineral particles are feebly coherent, due to the presence of a small quantity of oil, in both cases the interstitial spaces remain unfilled, in the first case with water and in the second with oil.

In the presence of excess of water and when the mineral has adsorbed as much oil as it will, the interstitial spaces become filled with the respective liquids to form coherent pulp or magma.

Mineral particles adsorb gases to an extent not generally suspected, and they also retain the gas adsorptions with such a persistence that they can neither be easily separated by mechanical means nor much affected by gravity and gas expansion. It has been shown that in the case of adsorption consisting of a mixture of gases, the respective gases may be separated fractionally, the law of gaseous diffusion apparently not being obeyed. With the view to further investigating these gas adsorption phenomena, a series of experiments were conducted that led to the following conclusions:

1. That the persistence of the attachment of the gas bubbles is increased when the surface is contaminated with some oily substance.

2. That perfectly cleaned needles and iron wire will float on the surface of distilled water under the following conditions: (*a*) if the water is allowed to stand for some time in contact with the air, (*b*) if the needles and wire are allowed to remain exposed to the air for sufficient time. In the first case, probably a layer of fine dust collects on the surface of the water, and in the second case probably the attachment of the air becomes greater after a certain time has elapsed. [This is extremely improbable; doubtless dust collects upon the metal.—Ed.]

3. That the oil probably acts as an agent by which the gas bubbles are more tenaciously attached, but that it is the mineral itself which in the first place determines the gas attachment.

4. That the acid treatment tends to prevent gas attachment in the case of the gangue particles, while it does not to the same extent similarly prevent gas attachment in the case of the sulphides.

5. That attachments of carbon dioxide still cling to the particles of sulphide on settling beneath the surface of the liquid, and after the visible gas bubbles forming the scum have become disengaged. The analysis of the disengaged gas shows that it is mainly composed of nitrogen. Assuming that a proportion of oxygen that would give with the nitrogen found a mixture corresponding to atmospheric air, was originally present, the fact that the gas evolved from the sulphides themselves when subjected to reduced pressure is carbon dioxide, shows that the latter is attached more persistently than is the air.

MINERALS' SEPARATION COMPANY'S PLANT AT THE CENTRAL MINE, SULPHIDE CORPORATION, BROKEN HILL.

A series of measurements and analyses of gases evolved from minerals showed that from the sulphides and material containing sulphides, such as the Broken Hill tailing and slime, as a rule more gas was obtained than from the calcite and quartz. This gas consisted mainly of carbon dioxide. The residual gas, after absorbing the carbon dioxide and oxygen, was largely in excess of the proportion of nitrogen in atmospheric air, and may contain hydrogen or an excess of argon. That the carbon dioxide in these tests is not derived from the decomposition of carbonates during the experiment is shown by the negative results shown by cerussite and calcite.

These results indicate that there is apparently a concentration or condensation of gas consisting mainly of carbon dioxide on the surface of the sulphides, and to a much less extent on the other minerals tried. This gas is held persistently, and does not obey the laws of gaseous diffusion,

and may therefore be present in the liquid form. This is indicated by the fact that it is the more easily condensed gas, that is the more persistently attached. The fact that finely divided material in the form of slime will attach more gas than similar material in a coarser state indicates that the action is a surface action. It may be akin to the action of charcoal, which will absorb large volumes of the more readily condensible gases as carbon dioxide, sulphur dioxide, and ammonia. It is known that water vapor will cling most persistently to some surfaces even at high temperatures.

It had previously been found that carbon dioxide was obtained from all the sulphides tried by the aid of heat and exhaustion in the presence of water. It is probable that the gas film can only be expanded for removal in appreciable quantities in the presence of water, and that exhaustion in the dry state does not remove all the gas present. The film can be removed by solvents. The thickness of the film is probably analogous to the thickness of adsorbed oil and adsorbed water films.

When an excess of oil is attached to a sulphide it can be separated to some extent by stirring or by pressure. Similarly, if a sulphide flotation product which was floated by gas is stirred, a large proportion of the excess gas is given off. This can be seen by the larger bubbles bursting, and the shrinkage in volume of the flotation product on standing. If a flash is completely filled with some of the flotation product, and the flask is then stoppered, on standing, it will be noticed that the scum occupies a lesser volume, partly due to cooling and partly to the bursting of the bubbles and disengagement of the gases. For instance, in a large Winchester quart bottle originally completely filled with the flotation product, on standing the sulphides only occupied about two inches on the bottom of the bottle. The remainder of the space (six inches), except for five inches of solution, was occupied by the disengaged gases.

The different stages of oil and gas adsorption are analogous to a certain extent. In the test of the latter, where there is insufficient gas to buoy the mineral to the surface, but aggregates are formed (such as are brought about by weak chlorine and nitric acid solutions in the cold), there is a similarity to the aggregation stage in oil adsorptions, where a thin secondary film of oil is attached to the primary film. In the case of gaseous aggregations, flotation can be brought about by increasing the amount of attached gas; that is, by adding a saturated solution of carbon dioxide, the bubbles of the latter gas becoming attached to the aggregates, and buoy them to the surface.

Thus the stages in producing flotation of a sulphide by oil without the aid of gas are: (1) primary adsorption film; (2) secondary attachments, which will form aggregates; (3) oily magma formed by excess attachments; (4) oil sufficient to bring about the production of magma of such a specific gravity as will float in water.

Similarly, the stages gone through in bringing about the flotation of a sulphide with gas are: (1) primary adsorption film; (2) aggregates formed by secondary attachments; (3) fairly stable aggregates which float by the aid of heat or reduced pressure; (4) a scum or froth containing an excess of gas, which is mostly disengaged by agitation, after buoying the aggregates to the surface.

The results of the experiments show that (1) without the addition of acid the flotation produced by oil contains much gangue material, and (2) that the addition of acid up to a certain point decreases the amount of gangue in the flotation product.

According to *Engineering*, a London firm mainly concerned with copper-plating wood applies the name 'kupronizing' to the process it employs. In the plating of wooden hand-rails, the wooden core is first impregnated with a preservative material and then flashed with either plumbago or a metallic salt. The actual copper deposition is then carried out in a bath in the usual manner. It is the present practice to deposit a layer about $^1/_{16}$ in. thick. Iron window-frames and iron pump-rams are now kupronized.

Mining at Cripple Creek

By William H. Storms

Mining methods in the Cripple Creek district are not unlike those generally in use throughout the metal-mining regions of the West. The veins are stoped with the use of as little timber as possible, and many large open stopes are the result, as well as caves, which in numerous instances have extended to the surface. Some of the ground stands very well, and some of it caves readily, but it has been the practice, I may say the necessity, to hoist to the surface nearly all the rock broken underground, so that as little of the valuable mineral be lost as possible. The practice in each mine is determined by the existing conditions. The value of the ore is chiefly in gold, either metallic or occurring as some telluride of gold, generally sylvanite or calaverite, and as a rule it occurs in the softer parts of the rock, in clay seams, and on the fracture joints and cleavage planes of the rock. The miners are therefore careful to send all fine material to the surface, as well as every pound of coarse rock broken showing any indication of value, that nothing may be overlooked or wasted. As a result of these conditions, the cost of mining per ton of ore eventually recovered is high. One thing that attracted my attention was the unusual size of the ore-chutes connecting the main gangways with the stopes. These are seldom less than 3 ft. wide, and are often as much as 4 ft., and constructed of 3-in. plank. The object of this is that large masses coming to the chute may be block-holed and blasted in the chutes without serious injury to them. This is common practice in the Cripple Creek district, though I have seldom seen it elsewhere. The block-holing is done with an air-hammer drill. The greater part of the large ore masses blasted down in the stope is broken by rock hammers, or by block-holing, but large pieces are often buried beneath tons of the broken débris and these work down to the chutes as the ore is drawn off, and when exposed in a chute are broken as described.

At Cripple Creek an important factor in both the mining and the metallurgy of the ore is concentration. This commences in the mine, whenever possible, or expedient, by a rough hand-sorting of the rock broken in the vein. Upon reaching the surface the ore usually goes to a crusher and then to a washer, commonly a revolving trommel, occasionally a shaking-screen, provided with jets of water under pressure. The mines are mostly wet, and the ore comes up covered with clay and mud, so that it is often impossible to distinguish it before a clean surface is presented, and this is obtained by spraying with water in the revolving trommel, or on the shaking screen. From the washer the coarser pieces of ore pour in a continuous stream upon a belt-conveyor, along which are stationed a number of men or boys who pick out either the ore or the waste, depending upon which occurs in greater abundance; this practice varying at the different mines according to conditions. The fine material passing through the trommels is generally the richest portion; the hand-sorted rock being the next best, the coarse rock in most cases goes to the dumps. The sorted ore goes by car to bins at the nearest railroad siding, or is sent down in buckets on an aerial tramway, as at the Cresson Consolidated. The railways haul the ore either to the mills near Colorado Springs or to the smelters situated at various points.

Coke is made in Colorado, New Mexico, and Utah. Colorado's coal made into coke in 1911, according to the U. S. Geological Survey, amounted to 1,424,251 short tons, or 14% of the total output of the state. New Mexico consumed 767,108 short tons, or 25% of the total production of the state, in the manufacture of coke, and Utah 381,696 short tons, or 15% of the total output. The total quantity of coal consumed in the manufacture of coke at the mines of the Rocky Mountain states was 2,573,055 short tons, a little less than 10% of the total production.

Mother Lode of the Klondike

By Harold French

In the early years of the Klondike excitement every 'sour dough' and 'cheechaco' had a guess coming as to how the gold came to get into the gravel. Some practical prospectors, pointing to the coarseness of certain nuggets, insisted that they were melted by volcanoes and blown all over the surrounding country. One eminent savant sagely stated for publication that he had discovered indisputable evidence to prove that in the glacial epoch, the valleys of the Klondike and Indian rivers were covered by a vast lake, into which rivers of ice debouched, and that mighty bergs, bearing countless tons of auriferous rock, turned turtle and deposited their precious cargoes in the bottom of the lake.

Most California miners, accustomed to the conditions of the Golden State, were positive that these rich gravels could be traced to a belt of rich quartz veins, which, as in the Sierras, they would call the Mother Lode. Fabulous fortunes are awaited the lucky prospectors who located these exiles from Sunland. When rich pay-dirt was found high on the benches of French hill and along the courses of the old channels of Bonanza, Hunker, and Dominion creeks during the winter of 1898-9, the source of the Klondike's gold was deemed near at hand. Numerous quartz locations were made on the neighboring ridges. Almost every stranded boulder was staked and re-staked by pencil and hatched prospectors. Here and there stringers of pearly white or rose-pink quartz, barren as barnacles, protruded from the prevailing country-rock, a mica schist. With sublime faith these faint indications of something better below were proclaimed to be the outcroppings of the Mother Lode of the Klondike.

During 1899 quartz prospecting was in full blast, and in that year I had the pleasure of running an assay office in Dawson for the Alaska Commercial Co. Part of my contract was to keep a lookout for a bona fide quartz mine. While most of my time was taken up in melting and assaying the company's bullion, I was permitted to do a certain amount of custom assaying of ores and to 'mush' out and inspect sundry coyote holes and prospective Comstocks and Witwatersrands. Impecunious prospectors flocked to the office with samples which they hoped I would assay 'on a lay.' Others paid their half ounce of dust for gold and silver determinations which dashed down their hopes, for the average of hundreds of ore assays was about $1.50 per ton. Disseminated throughout the country rock were tantalizing veinlets, or *fahlbands*, containing small amounts of gold. That the erosion and stream-transportation of vast quantities of this country rock resulted in the concentration of this gold became the generally accepted theory, but the existence of a Mother Lode seemed highly probable.

Among my clients was a mining promoter of the old school, a certain Colonel T. His credit was so good that I gladly did scores of scorifications and fusions on account. Gradually the account grew into a half partnership. I had hitched my wagon to a star. That startling developments would follow, I never doubted. He knew the West like a great stone book. He had studied the strata of almost every ridge of the Rockies, and had memorized the history of every mining camp. His genial optimism was at times most intoxicating. Certainly he and I were hiking along the high road to Bonanza and El Dorado.

One August night, the twentieth of the month, I was lounging on the porch of the company's hotel, with all the optimism of an after-dinner mood, when a trail-worn 'musher,' just in from the creeks, paused at the gate. Over his back he carried a sack that half-concealed his identity, but a familiar finger summoned me, and I awoke to the realization that this was the Colonel. Tired as he was, his face was radiant. "My boy," he greeted me, "twenty's my lucky number. Tolay's the 20th, and this afternoon I've walked 20 miles. The stuff I have here is from a ledge 20 ft. wide, 20 ft. down. I want you, first of all, to start up your furnace, buck down some samples as quick as you can, put 'em through tonight, so we can get the returns as soon as possible. All I need is a few hours sleep, and in the morning I'll mush right out and locate some extensions along the strike of the ledge."

I opened the bag of samples and my eye was caught by the lustre of metallic particles disseminated through the mass. Steel-gray graphic crystals studded the quartz. Pointing to these, the Colonel shouted: "Tellurides, don't you know 'em when you see 'em? Why that's pure sylvanite, the stuff that made Cripple Creek the greatest gold camp in America. I've seen little seams like knife-blades of these here tellurides that ran one-quarter solid gold. But out on the divide between Hunker and upper Bonanza the ledge is, think of it, 20 ft. wide, and 20's my lucky number." I wasn't much over 20 myself, and I began to think that 20 was my lucky number, too. "I think I had better test this before I fire up," I ventured. "Fire up your furnace fust, and test afterwards," the Colonel commanded. I obeyed. The samples were readily pulverized on the bucking board, and in a few minutes were spread on scorifiers and placed in the muffle. Then I turned my attention to testing the powder with sulphuric acid on a porcelain plate. It gave the unmistakable pink tinge of tellurium. I told the Colonel that he was right, that he had surely struck telluride ore, and off he went, rejoicing, to sleep—perchance to dream of golden rewards.

Meanwhile, as the furnace glowed, I applied a knife to a larger particle of the steel-gray metal. It was soft, softer than copper, and under 2 in the scale of hardness. In the muffle curling clouds arose from the scorifiers, a mingling of sulphurous and tellurous vapors. The 'bullseye' winked at me and I withdrew the molten charges, poured the lead alloy into molds, and, after cooling, hammered out some rather brittle buttons and placed them on cupels and awaited further results.

Without, the busy life of this boom mining camp kept up its clamor. The ceaseless music of 'A Georgia Camp-Meeting' rang out from a neighboring dance hall in riotous reiteration. At intervals the howling of hurt *malamutes*, wailing over their wounds, bespoke the breaking up of a street fight, while, thump, thump, thump, over the board walk sounded the beats of gum-booted feet. The shadows of returning winter darkened the window at ten o'clock, so that I could with difficulty watch operations in the cherry-red muffle. Suddenly, the buttons in the cupel, one by one, seemed to brighten, and in the dim light I removed them, and to my unspeakable excitement, I found their size sufficient to account for at least $10,000 in gold and silver in every tone of this bonanza rock.

Needless to say, I could not sleep; I could hardly wait until three in the morning, when, with stronger light I would part the buttons and compute their exact composition. Somehow, they seemed more dull at early dawn than they had appeared a few hours before. It occurred to me that possibly the cupellation was incomplete. I replenished the fuel of the furnace and, wrapping the buttons with lead foil, replaced them when the muffle had reached its proper heat. Then followed a disheartening, harrowing ordeal. At intervals I saw the smoking buttons dwindle away to half their size, to a quarter, then, as they steadily diminished, I realized the sickening truth, that in the poor light of the late evening the buttons had simply chilled. Gradually my hopes volatilized, and at five in the morning, as the cooks began to raise a racket with their pans in the company's kitchen, I saw, in each of the cupels, a tiny sparkling bead. Three of these I combined and weighed, and found that this wonderful telluride ore only contained about a dollar per ton in silver, and only the faintest trace of gold. A few tests confirmed the fact that, while this ore contained tellurides, they were only sulpho-tellurides of lead and antimony, corresponding to a compound of galena and stibnite. When the Colonel arrived and I broke the news to him, his only reply was to grab the samples and rush to a rival assayer, who told me the following evening how he had received some fairly good antimony ore, but

couldn't recommend it as commercially valuable. As my client, the discoverer of the Mother Lode of the Klondike, turned his back on me, the breakfast bell was ringing its cheerful summons to all, save me, for my appetite had gone a glimmering as had my midsummer night's dream of fortune.

The Action of Mineral Sulphates and Arsenates on Cyanide Solutions

By Andrew F. Crosse

*It has long been known that both sulphate of magnesia and sulphate of lime decompose cyanide solutions. The mineral kieserite is not rare, and has the composition $MgSO_4 + H_2O$, and according to 'Comey's Dictionary of Chemical Solubilities,' is but slowly dissolved in cold water. Hydrated sulphate of calcium or gypsum is also common, but it interests us more because sulphate of calcium is produced when the acidity in tailing and slime is neutralized with lime, and I have also found alumina taken up in cyanide solutions, so that probably some aluminum sulphate or double sulphate was in the ore. The first point I would like to mention is that an ordinary analysis of a mineral or sample of the ore to be treated by the cyanide process is nearly valueless.

For instance, take a common example—a certain ore contains iron, sulphur, magnesium, and other elements, according to the analysis. This analysis is no help to the cyanide manager. What he wants to know is, what will take place when the finely crushed ore comes in contact with an ordinary cyanide solution? The Mount Morgan ore near Barberton is a good example. I have seen analyses of this ore, but as far as I can remember, none of them showed any sulphate of magnesium; magnesia was mentioned and so was sulphur, and as this ore is highly pyritic, I did not think of the presence of sulphate of magnesia until I began treating the ore. I found on making a preliminary test that the ore, digested in warm water, gave a neutral reaction. In my first experiments I used an ordinary amount of caustic lime, and found the protective alkali gradually disappearing, and eventually free HCN was being given off. Then I digested some of the finely ground ore in warm water, and found magnesium sulphate in the solution. I determined the sulphuric anhydride in solution, but I found out in subsequent experiments that more SO_3 was taken up when using carbonate of soda solution, or cyanide solution. I consider the best method to determine the amount of soluble sulphates present in an ore, is to take 100 gm. of finely ground ore and shake it up with 500 c.c. of warm water containing say 2 gm. of carbonate of sodium of known percentage of Na_2CO_3. I prefer to leave the mixture all night and shake it up again next morning, and then titrate the Na_2CO_3 left, taking 50 c.c. of the filtered solution, and the amount of carbonate of sodium used per ton can be easily calculated. In the case of the Mount Morgan ore it was 10 lb. per ton of ore, but the same ore after treating with warm water only required 4.4 lb. of Na_2CO_3 per ton of ore to precipitate the $MgCO_3$ and $CaCO_3$ from the aqueous solution, so that even if the ore were washed, it would still decompose a cyanide solution; therefore carbonate of sodium is necessary. This is quite an important point, for if the sulphates were easily removed by water, this would take place during crushing in the mill.

There is a peculiar vein found in the Machavie mine on the Black Reef, between Potchefstroom and Klerksdorp. The pyrite is in a globular form, and there is a large amount of graphite in this ore (the Mount Morgan ore also contains graphite). Some of the tailing from that mine after washing four times decomposed cyanide of potassium (without using protective alkali) at the rate of 0.64 lb. per ton. The unwashed sand, however, under the same treatment, decomposed 3.2 lb. of cyanide of potassium per ton of ore. This ore contained sulphate of magnesium.

I made a long series of experiments with various proportions of CaO in solution (lime water) added to a mixture of equal parts of decinormal pure cyanide of potassium solution, and decinormal sulphate of magnesia. This seemed very nice and simple, and I thought that I should get some definite results. There was a time not so very long ago when it was imagined that all chemical reactions could be nicely expressed in equations, but unfortunately the more the mysteries of the physical world are studied the more it is found that nature does not arrange things to suit preconceived ideas. A nice equation is the following:

$$2KCN + MgSO_4 + 2H_2O = 2HCN + Mg(OH)_2 + K_2SO_4$$

When equal portions of the decinormal solutions of the above salts are mixed, a precipitate of magnesium hydrate is formed, and free hydrocyanic acid is given off, but I doubt whether the reaction is as complete as the equation indicates. I thought that if I added lime-water, gradually increasing the amount till no more hydrocyanic acid was liberated (when tested by a drop of nitrate of silver solution placed on the lower side of a glass cover on a beaker) I should arrive at some definite result, but as sulphate of calcium was formed, which also dissociates cyanide of sodium or potassium, it made things complicated. Again, as more CaO solution was added, weakening the cyanide of potassium solution, hydrolysis took place. I found, however, that all the magnesium became precipitated as a hydrate. Then I also found that free hydrocyanic acid was given off, notwithstanding that, using the ordinary test, protective alkalinity as CaO was present. I am not satisfied that when a cyanide solution containing sulphates of lime and magnesia is tested by a nitrate of silver solution, that a correct result is obtained. The solutions I used were pure; but of course in practice the solutions contain zinc, which complicates matters still further. The ordinary practical man will shrug his shoulders at all this, but after all, the question is how to get over the decomposing action of sulphate of magnesium in the cheapest way. Carbonate of sodium might be found useful. No caustic soda would be formed, as carbonate of magnesium and sulphate of sodium would be produced.

Scorodite, or ferric arsenate, is not a rare mineral. It occurs often in conjunction with limonite, a hydrated ferric oxide. Probably these minerals, when found together, are the result of the oxidation of arsenical pyrite. Scorodite has the formula $FeAsO_4 + 2H_2O$. According to 'Comey's Dictionary of Chemical Solubilities,' it is insoluble in water, but soluble in weak hydrochloric acid. SO_2 in solution also acts on it. When a finely ground mineral containing scorodite is left in contact with a weak caustic soda solution, arsenate of sodium is slowly formed. Cyanide of sodium or potassium acts in the same way, this accounts for the slow and continuous decomposition of cyanide solutions when treating ores containing arsenates. The solution becomes charged with arsenates which are reduced in the zinc-box, and the precipitated gold carries arsenic, which is not a very pleasant thing to have in the sulphuric acid treatment, as arseniuretted hydrogen, a poisonous gas, is evolved.

I have made many experiments in order to discover a method of overcoming the injurious action of arsenates on cyanide solutions, and have devised the following method: A solution of arsenate of sodium and calcium hydrate gives the following reaction:

$$2Na_3AsO_4 + 3CaO + 3H_2O = Ca_3(AsO_4)_2 + 6NaOH$$

The calcium arsenate is insoluble, and the sodium hydrate is regenerated. I ascertained by a series of experiments that, using an excess of lime and a small quantity of sodium hydrate, all the arsenate that was possible to dissolve was taken up by the sodium hydrate, then precipitated as calcium arsenate, no arsenic being left in the solution. The cyanide of sodium was unaffected by this reaction. The method I used in order to determine the amount of lime required was as follows: 200 gm. of finely powdered ore was shaken up every now and then, for seven or eight hours, with 200 c.c. of 1% NaOH solution, the amount of NaOH

*From the *Journal* of the Chem. Met. & Min. Soc. of S. A.

used up being determined in the usual way, and for every pound of NaOH required per ton, 0.7 lb. of CaO is required in actual practice, but of course some sodium hydrate must be present in addition to act as a solvent or carrier.

For one sample of ore I treated, which contained scorodite, 13 lb. of NaOH was required per ton of ore; by this simple method I prevented the abnormal decomposition of the cyanide, and also prevented arsenic going into solution; and by regulating the proper proportion of lime, enough was left in solution to cause perfect settlement of the slime. It will be evident that ores containing soluble sulphates or arsenates may require a large amount of lime per ton in order to settle the slime; in the case of arsenates, if there is no sodium hydrate added, the sodium in the cyanide will effect solution of arsenate, and if only a small amount of lime is used, every trace of lime will be precipitated as an arsenate of calcium, and the cyanide of sodium will be decomposed. Roasted concentrate originally containing $MgSO_4$ and $CaSO_4$ still contains these salts after roasting, and an arsenical concentrate after roasting will possibly contain some ferric arsenate.

Dividends

The El Paso Con. M. Co. has declared a dividend of 1c. per share, payable June 29.

The Hedley G. M. Co. has declared a regular quarterly dividend of 3% and an extra dividend of 2%, payable June 29.

The Tonopah M. Co. has declared a regular quarterly dividend of 25c. per share and an extra dividend of 15c. per share, payable June 29.

The Hudson Bay Mining Co., Ltd. (Temiskaming mine), has declared a quarterly dividend of 3%, payable July 18. This brings the total dividends to date to 47% of the capitalization.

The United States Smelting, Refining & Mining Co. has declared a dividend of 50c. per share on common stock and 87½c. per share on preferred, a total to date of $16,098,162.

A Light Prospecting Drill

By R. Y. Hanlon

What I consider to be an excellent prospecting drill for deposits not exceeding a depth of 50 ft. is in extensive use in Australasia and the Philippine Islands. The drill, known as the 3-in. New Zealand, is a light compact hand machine, requiring six men to operate it; four upon the platform and two revolving the tubes. It consists of 3¼-in. flush-joint tubing in 5-ft. lengths, 1¼-in. squared rods fitted with ¾-in. straight threads, platform of lumber, and clamps for arranging same upon the tubes, together with the usual complement of drill, auger, and pump. The pump is usually made 5 ft. long and fits the tubes snugly. It is equipped with a thin chilled cutting edge and a large metal check-valve ground to a close seat. This pump is very efficient in either clayey material or fine gravel, and in the Paracale district of the Philippine Islands, where this style of drill is used exclusively, I have seen five 30-ft. holes sunk in one day with only the pump employed within the tubes.

In order to pull the tubes it merely becomes necessary to loosen and drop the platform clamps, allowing them to remain loose upon the tubes, and inserting a lever and fulcrum. In this manner a 50-ft. string of tubing can be removed in an hour under ordinary conditions. The weight of each tube is a trifle less than 20 lb., and the entire weight of a 50-ft. outfit is approximately 300 lb.; easily transportable by the crew at one trip. I have attempted to use this drill in coarse gravel, but have found it unsatisfactory; principally because its lack of weight prevents it from being kept steady, and sunk vertically, any large stone deflects the tubing. But it has proved especially efficient in loam or clayey material and fine gravel or sand, also in deposits of fairly coarse and compact gravel covered with a thick subsoil or clay.

One of these drills made of ⅛-in. tubing and thoroughly equipped, costs $175 in Manila, $125 in Hongkong, and $150 in Japan, so that it would perhaps be fair to strike

3-in. DRILL — GOLD 0.06¢ per mg.

Depth ft.	1	2	3	4	5	6	7	8	9	10 mg.
10	03.30	06.60	09.90	13.20	16.50	19.80	23.10	26.40	29.70	33.0
11	02.90	05.80	08.70	11.60	14.50	17.40	20.30	23.20	26.10	29.0
12	02.75	05.50	08.24	11.00	13.74	16.48	19.20	22.00	24.72	27.5
13	02.54	05.08	07.62	10.16	12.66	14.24	16.70	20.32	22.82	25.4
14	02.34	04.68	07.02	09.36	11.76	14.04	16.40	18.72	21.08	23.4
15	02.20	04.40	06.60	08.80	11.00	13.20	15.40	17.60	19.80	22.0
16	02.05	04.10	06.14	08.20	10.24	12.28	14.34	16.40	18.44	20.5
17	01.94	03.98	05.84	07.76	09.72	11.68	13.82	15.52	17.50	19.4
18	01.83	03.76	05.54	07.32	09.20	11.08	12.84	14.64	16.48	18.3
19	01.74	03.47	05.18	06.94	08.66	10.36	12.06	13.88	15.62	17.4
20	01.64	03.28	04.92	06.56	08.16	09.84	11.52	13.12	14.72	16.4
21	01.56	03.12	04.70	06.24	07.82	09.40	10.98	12.48	14.02	15.6
22	01.45	02.90	04.34	05.80	07.18	08.68	10.12	11.60	12.98	14.5
23	01.42	02.84	04.28	05.68	07.08	08.56	09.98	11.36	12.80	14.2
24	01.37	02.74	04.12	05.48	06.86	08.24	09.58	10.96	12.36	13.7
25	01.32	02.64	03.96	05.28	06.68	07.92	09.26	10.56	11.86	13.2
26	01.26	02.52	03.80	05.04	06.34	07.60	08.86	10.08	11.38	12.6
27	01.22	02.44	03.68	04.88	06.12	07.36	08.62	09.76	10.98	12.2
28	01.17	02.32	03.52	04.64	05.84	07.04	08.18	09.38	10.54	11.7
29	01.14	02.28	03.42	04.56	05.78	06.84	07.94	09.12	10.30	11.4
30	01.10	02.20	03.30	04.40	05.50	06.60	07.70	08.80	09.80	11.0
31	01.07	02.14	03.20	04.38	05.34	06.40	07.46	08.56	09.68	10.7
32	01.03	02.06	03.09	04.12	05.14	06.18	07.22	08.24	09.24	10.3
33	01.00	02.00	03.00	04.00	05.00	06.00	07.00	08.00	09.00	10.0
34	00.97	01.94	02.88	03.88	04.84	05.76	06.76	07.76	08.72	09.7
35		01.89	02.82	03.78	04.74	05.64	06.60	07.56	08.52	09.4
36		01.84	02.78	03.68	04.62	05.56	06.46	07.36	08.26	09.2
37		01.78	02.66	03.56	04.42	05.36	06.22	07.12	08.00	08.9
38		01.72	02.60	03.44	04.32	05.20	06.10	06.88	07.78	08.6
39		01.70	02.54	03.40	04.24	05.18	05.92	06.80	07.62	08.5
40		01.64	02.46	03.28	04.12	04.92	05.76	06.56	07.38	08.2

TABLE FOR COMPUTING GOLD CONTENT OF GRAVEL, 3-IN. DRILL.

an average and place its price at $150, more especially as it is hardly likely that another place can be found upon the earth which is comparable to Manila for expensiveness.

The foregoing table has been calculated upon the basis of 3-in. diameter for the tubing, this diameter checking very closely with the measured volume and with the actual extraction, and upon a gold value of 0.06c. per milligram, fineness 875 to 925. For greater depths than 30 ft. and weights over 10 milligrams, the necessary interpolation is simple and easily performed. Similar tables may be made for any other diameter of drill and fineness of gold. Where large numbers of holes are drilled such a table is a great convenience and saves much time.

The Estimation of Ore in a Mine

By H. S. Munroe

*In connection with the subject of mine valuation, some charts which I use in my lectures on the subject at the School of Mines of Columbia University may be of interest. The first of these charts is intended to emphasize the importance of taking into account the specific gravity of the ore in obtaining the average value from a series of samples. For the purpose of illustration I assume five samples taken at uniform distances in a galena vein, varying in thickness from 10 to 60 in., and the ore varying from 10 to 80% of lead.

Thickness, Inches.		Lead, %.		Inch-Per cent.
60	×	10	=	600
20	×	40	=	800
50	×	25	=	1250
10	×	80	=	800
10	×	60	=	600
5/150		5/215		150/4050
Averages 30 in.		43.0% (Arithmetric)		27.0% (Volumetric)

Calculating the average in the usual way by multiplying the thickness in inches by the percentage of lead and dividing by the total number of inches, an average value of 27% is found, which may be called the volumetric average. This is less than the arithmetric average, which in this case is 43%. Neither of these results, however, is correct, as the result obtained by sampling must be given weight in proportion to the tons of ore which each sample represents. In the following table I have introduced specific gravity as well as thickness.

Thickness, Inches.		Specific Gravity.		Inch-Gravity.		Lead, %.		Inch-Gravity-%.
60	×	3.0	=	180	×	10	=	1800
20	×	5.0	=	100	×	40	=	4000
50	×	4.0	=	200	×	25	=	5000
10	×	7.5	=	75	×	80	=	6000
10	×	6.0	=	60	×	60	=	3600
150				150/615				615/20400
				4.1 Average Spec. Grav.				33.17 Average Per cent.

If the thickness in inches is multiplied by the specific gravity of the sample, a product is obtained which may be called the inch-gravity value, which is a unit proportional to the tonnage represented by the sample. Multiplying this by the percentage of lead found by assay gives an inch-gravity-per cent product. Dividing the sum of these last products by the total of the inch-gravity column gives as the average 33.17%, which lies between the volumetric and the arithmetric average. This may be called the gravimetric average. The following example illustrates the necessity of pursuing the same plan when dealing with a gold or silver ore in which the gangue consists largely of heavy sulphides.

*From *Bulletin* of Mining & Metallurgical Society of America.

VOLUMETRIC (USUAL) METHOD.

Thickness Inches.		Value Per Ton.		Inch-Dollar.
15	×	2.00	=	30.00
10	×	1.00	=	10.00
5	×	12.00	=	60.00
3	×	20.00	=	60.00
2	×	15.00	=	30.00
5/35		5/50.00		35/190.00
Averages 7 in.		$10.00 (Arithmetic)		$5.43 (Volumetric)

GRAVIMETRIC METHOD.

Thickness, Inches.		Specific Gravity.		Inch-Gravity.		Value Per Ton.		Inch-Gravity Value.
15	×	2.6	=	39	×	2.00	=	78.00
10	×	2.8	=	28	×	1.00	=	28.00
5	×	3.8	=	19	×	12.00	=	228.00
3	×	4.0	=	12	×	20.00	=	240.00
2	×	3.5	=	7	×	15.00	=	105.00
35				35/105				105/679.00
				3.0				$6.47

The volumetric average obtained by the inch-dollar basis is $5.43; the real average value based on tonnage will be $6.47. In both cases it will be seen that the errors that result from neglecting the specific gravity of the ore may be serious. The specific gravity of the different samples may be readily determined by the bottle method, using for this purpose material from the portions of each sample which are rejected when crushing and working down the mine sample to the usual bottle sample for assaying.

I shall also call the attention of the members to the use of the well known formula for determining the probable error of the arithmetric mean of a number of observations. The use of this formula for the study of sampling data will give valuable information as to the accuracy of the final result and enable one to deal intelligently with high assays. If n = number of observations, and d = difference of each from the arithmetical mean, then the

$$\text{Probable Error} = 0.6745 \sqrt{\frac{d^2_1 + d^2_2 + \ldots d^2_n}{n\ (n-1)}}$$

In the *Transactions* of the Institution of Mining and Metallurgy for January 1907, E. H. Garthwaite has given some interesting results from the sampling of a gold mine in Rhodesia. In one case, the second example cited, 71 samples were taken at 2-ft. intervals. A summary of these results, as worked out by Mr. Garthwaite, is given below. It will be noticed that there are a number of high assays and, apart from this, that the range is great.

SUMMARY OF ASSAY RESULTS.

Assay Value.	No. of Samples.	Assay Value.	No. of Samples.
0-5 dwt.	13	50-75 dwt.	6
5-10 "	17	75-100 "	5
10-20 "	17	100-200 "	3
20-30 "	3	200-300 "	1
30-40 "	5	300-700 "	none
40-50 "	none	700-800 "	1
			71

Including all assays, the average value is 43.35 dwt. Applying the formula, a probable error of ± 8.15 is obtained, that is, the value lies somewhere between 35.20 dwt. and 51.50 dwt. If the one high assay, which lies between 700 and 800 dwt., is omitted, the average of the remaining 70 samples lies between 31.08 and 33.49 dwt., or, say, 32.29 dwt.; or somewhat less than the lowest probable value. Even omitting this high assay, the probable error is ± 4.16 dwt., which still leaves much uncertainty as to the real value of the ore. It is evident, in this particular case, that the ore is unusually variable, and that a safe average value can be obtained only by increasing the size of each sample or the number of samples taken. If large samples had been taken, it is possible that the variation in value would have been less and the probable error much smaller.

Mr. Garthwaite made some interesting comparisons of results that would have been obtained with other sampling distances. For example, taking every alternate sample in

the mine, he obtained two sets of results for a 4-ft. sampling interval. By taking every third sample he obtained three results, which would have been obtained by sampling at 6-ft. intervals. By taking every fourth sample, he obtained four sets for an 8-ft. sampling interval, and in a like manner, by taking every fifth sample, he obtained five different values for the mine with a sampling distance of 10 ft. These results were as follows:

Sampling Distance. Ft.	Average Value. Dwt.	Average Width. In.	Sampling Distance. Ft.	Average Value. Dwt.	Average Width. In.
2	43.35	32.0	8	22.74	32.0
4	35.16	32.0	10	20.26	32.5
4	50.84	32.5	10	90.37	30.0
6	28.17	32.0	10	44.85	30.0
6	66.57	29.5	10	29.97	34.0
6	33.52	33.0	10	29.87	32.0
8	35.13	31.0	Independent Sampling.		
8	79.34	32.0	10	14.60	35.3
8	33.18	33.0	10	16.00	32.0

Making the proper substitutions in the formula, we find the probable error in each case is shown in the table.

Sampling Distance. Ft.	Samples Taken.	Average Value. Dwt.	Probable Error	Extreme Values. (Theoretical)	RESULTS OBTAINED.
10	15	43.35	± 17.74	25.51 — 61.09	14.60 — 20.26 — 29.87 — 29.97 — 44.85 — 90.37
8	18	"	± 16.42	26.93 — 59.77	22.74 — 33.18 — 35.13 — 79.34
6	24	"	± 14.12	29.23 — 57.47	28.17 — 33.52 — 66.57
4	36	"	± 11.45	31.90 — 54.80	35.16 — 50.84
2	71	"	± 8.15	35.20 — 51.50	43.35 Sampling distance actually used.
1	141	?	± 6.12	37.23 — 49.47	28.6% Probable variation.
0.5	281	?	± 4.10	39.25 — 47.45	18.7% " "
0.25	561	?	± 3.10	40.25 — 46.45	14.3% " "

Comparing the theoretical range, it will be seen that with the 10-ft. sampling interval the results actually obtained in the mine ranged from 14.60 to 90.37 dwt. The error of the mean is only a probable error; therefore, the actual error is certain to be more than this probable error in some cases. The same will be observed in the case of the probable and actual errors in the 8-ft. sampling interval, although the number of results being small, the variation is not so great. The 6-ft. sampling interval with only three results shows a close correspondence with the theoretical value. The 4-ft. sampling interval with only two results does not reach the theoretical extreme value. The application of the formula may be extended by computing the probable results for 1-ft., 6-in., and 3-in. sampling intervals. Under the last supposition, 561 samples would have been taken, forming a sample practically continuous, but even in this case the values would range from 40.25 to 46.45 dwt., or a range of 14.3% if referred to the 43.35 dwt. average.

The Utilization of Atmospheric Nitrogen

The importance of nitrogenous compounds to the agricultural and industrial interests of Europe and America has prompted the Bureau of Manufactures to issue a monograph on the subject of utilizing atmospheric nitrogen in the production of such compounds. The nitrogen problem, one of the most pressing of the twentieth century; is unique from the fact that the material is unlimited. The atmospheric nitrogen above one square mile of land, amounting to about 22,000,000 tons, is equivalent to what the world would require in the next fifty years at the present rate of consumption. The problem is to utilize this nitrogen economically, and thus free the world from its dependence on the nitrate deposits of Chile, which are not particularly extensive and are likely to be exhausted at a comparatively early date.

Remarkable results have been obtained in Norway by means of electric furnaces in which atmospheric nitrogen is oxidized in the form of nitric oxide, which is used in making calcium nitrate, or Norway saltpetre. This Norwegan product is already an important rival of Chile saltpetre, but as the success of the process depends upon a very cheap supply of electricity, it will probably not be used to any great extent in the United States until the furnaces have been made more efficient. Cyanamide, another nitrogenous fertilizer of growing importance, is being manufactured in America, and the industry should prove successful, as the production in this country of the calcium carbide required by the process is second only to that of Norway.

Goldfield Consolidated Report

During May the total production of the Goldfield Consolidated Mines Co. was 30,215 tons, containing $550,656.69, or an average of $18.22 per ton; of which 29,029 tons was milled with an average extraction of 91.44%, and 1186 tons of an average value of $28.25 per ton was shipped, the net recovery from all ore being $16.69 per ton. The total net realization was $309,622, or $10.17 per ton. Of development work, 2911 ft. was performed during May. The total cost of mining, development, transportation, milling, office, and general expense was $6.72 per ton, distributed as follows:

Mining:		
Development	$0.82	
Stoping	2.45	
		$3.27
Transportation		$0.08
Milling		2.20
Marketing		0.07
General expenses		0.67
Bullion tax		0.11
Marketing ore shipped		0.25
Construction		0.07
Total cost of operation		$6.72
Miscellaneous earnings		0.12
Net cost per ton		$6.60

The new stope in the Reilly vein, southeast of the Combination shaft produced 1100 tons of ore that averaged $56 per ton. The 328 sill produced 50 tons of ore, averaging $30 per ton. The downward extension of the 402-C stope, about 300 ft. north of the shaft between the fifth and sixth levels, produced 260 tons of ore which averaged $28 per ton. This is the greatest depth at which ore has been found in this mine. The sill floor of the 3-D stope in the Sheets-Ish workings on the 150-ft. level of the Mohawk produced 200 tons of $39 ore. The 215-X intermediate drift under the 111 stope, about 200 ft. south of the shaft, has been extended about 80 ft. through ore that has averaged $12 per ton. This orebody is the downward extension of the big 111 stope and will produce a large tonnage of good ore. The 307-V raise, 150 ft. southeast of the shaft on the third level, passed through 10 ft. of ore that averaged $80 per ton. This ore is the upward extension of the 307 stope that was cut off by the Mohawk fault. The 354-Q, at the south end of the 354 stope on the 450-ft. level, produced 260 tons of $45 ore. A new section of the 407 stope on the 600-ft. level produced 648 tons which averaged $52 per ton.

The greater part of the development in the Clermont is being done on the lower levels, where good results are being obtained, especially on the 1300-ft. level of the Grizzly Bear. From this level the third compartment of the shaft is being raised to the 1000-ft. level, and is progressing at the rate of 20 ft. per day. A drift being driven on the new orebody has been advanced about 80 ft. through ore that has averaged $20 per ton. An average sample from the face on June 27 assayed $76 per ton. The cross-cut has been stopped until the shaft has been enlarged and a double-drum hoist installed. After this work is completed, development on this level, as well as sinking the shaft to the 1450-ft. level, will be carried on more rapidly. In the Laguna the sump below the 720-ft. level pump station and main station have been completed, and a pump installed to raise the water in one lift to the surface. The work of prospecting the large quartz mass on this level is now in progress. The Jumbo has been connected on the 250-ft. level with the workings on the south end of the property.

Discussion

Readers of the MINING AND SCIENTIFIC PRESS are invited to use this department for the discussion of technical and other matters pertaining to mining and metallurgy. The Editor welcomes the expression of views contrary to his own, believing that careful criticism is more valuable than casual compliment. Insertion of any contribution is determined by its probable interest to the readers of this journal.

The Calumet & Hecla Mill

The Editor:

Sir—In the issue of the *Mining and Scientific Press* of June 8, a note appeared on page 809, under 'Michigan', to the effect that the Calumet & Hecla was installing Huntington mills in its new re-grinding plant. This is an error, for the machinery which has been ordered is sixty-four 8-ft. diameter Hardinge pebble-mills.

SUBSCRIBER.

Lake Linden, Michigan, June 20.

Mutual Liability Insurance for Mine-Owners

The Editor:

Sir—A. J. Pillsbury's article in the *Mining and Scientific Press* of May 11 interests me, and I would be glad to have his opinion of a plan for mutual liability insurance confined to mine-owners of California, exclusive of coal properties. Unless the laws of this state preclude it, I would suggest that a mutual company be formed to issue policies, limiting liability to $1000 for a single accident, or the face of policy if for less. Premiums would be such as the directors determine; perhaps the first year 5 or 10%; thereafter as statistics of losses would make necessary. A yearly dividend or return premium might accrue after the amount for a reserve or guaranty fund was set aside. This fund should be invested only in state, municipal, railroad, or other so-called 'gilt-edged' bonds. Each policyholder to be entitled to one vote, and directors and other officers to be elected by policyholders each year.

The fixed expenses need not be large; only the president, vice-president, engineers, and secretary-treasurer should be paid a salary. A small corps of inspectors would be necessary in the engineering department. The vice-president and secretary-treasurer need be the only active officers. Risks should be assumed only on properties conforming to the company's by-laws and laws of the state as to safety appliances. Of course, policies would have to be assessable, but only a *pro rata* fixed amount. I should be glad to have criticism of this plan, and also information as to whether any state laws would interfere with it.

CHARLES E. PARSONS, 2nd.

Washington, California, June 18.

The Editor:

Sir—I am not enough versed in mining to know whether there is sufficient similarity in risk and mechanism to warrant the organization of mining for the precious metals into a mutual insurance association for carrying each others' risks. I am not certain that there is a sufficient similarity between the hazards of deep quartz mining and drift mining or mining with dredges or hydraulic power to afford a sufficient community of interest to enable such miners to work together in harmony.

Again, I do not know if there is enough mining in any one of the classes of mining enterprise in the state to afford such an experience with industrial accidents as would amount to a general average risk, upon which alone a satisfactory basis of rate-making can be had. These are questions for mining engineers and mining men to determine, and not for me. They are only unanswered questions in my mind. The Legislature of California, at its recent extra session, so modified the laws relating to inter-insurance (Chapter 22) as to permit certain occupations having a similarity of risk to unite in insuring each other, but I think little use has been made of the law so far and for the reason that employers, even those who are inter-insured as to fire risks, feel that the next Legislature will so deal with the insurance problem as probably to undo whatever might be done under this law as it now stands.

The laws of California do not now permit the formation of mutual insurance companies for covering liability or compensation risks because of industrial accident. The Industrial Accident Board is at work on the formulation of bills to submit to the next Legislature for covering the whole insurance problem, but I do not know what direction such legislation will take. There is a considerable feeling that the state should undertake insurance against industrial accident, but I am inclined to favor a rigid state control, coupled with the authorization of properly regulated mutual associations and supplemented by such a nucleus of state insurance as will make provision for the compulsory insurance of the industrial hindermost, which otherwise, through its carelessness and neglect, would be most likely to result in throwing the injured upon public or private charity. This is a rough outline of a policy that is taking shape in my own mind, but I cannot speak for others in that regard. However, I feel very certain that something definite will be done at the next session of the Legislature, and I regard it as extremely important that the mining interest, as well as others, prepare themselves for taking an intelligent and broad-minded interest in what the Legislature shall undertake to do. Meantime this Board will be very glad of suggestions from all persons who have ideas or information that will be of value to us in doing the preparatory work for legislative action.

A. J. PILLSBURY.

San Francisco, June 21.

Mining Reports

The Editor:

Sir—In the United States it is comparatively easy for a mining manager to report to his headquarters by telegraph, and the expense of the operation is never a serious item, because the mines and company's main office are so situated that the telegraph rate, especially with the night lettergram, is reduced to a minimum. However, for those mining companies whose headquarters are in London and whose mines are situated at various points of the globe, it is necessary to condense in a telegram the maximum of information in order to save the expense of cabling at 75c. or a dollar per word. Most of the mining companies have arranged private codes, so that the development work can be reported in a way to save as many code words as possible; and as a usual thing, the telegraphic reports, which, according to a very good custom, are here published in the financial daily papers, are remarkable for their conciseness and the amount of information they contain. They not only keep the shareholder fully advised of the progress of the development work, but being published immediately on their arrival, take considerable responsibility from the shoulders of the directors. As a brilliant example of what not to do, and showing to what extremes a mine manager may be driven when he has nothing to report, the following report from the Brazilian Golden Hill mine which was published in the *Financial News* (London) is a good illustration:

"The General Manager on January 13th reports as follows:—Second level west drive shaft No. 1 driven 30 feet, total 50 feet. Stope driven west No. 1 shaft at 58 metres, driven 11 feet, total 26 feet. No. 2 adit driven 20 feet, total 315 feet. At 312 feet quartz leader was met; it is barely one inch in width and carries no value. *There is now every indication that we are close upon the first reef.*" (The italics are mine.)

With such brilliant development and under such able management, there is no doubt that this company's operations should be highly successful.

C. S. HERZIG.

London, June 11.

Special Correspondence

SALT LAKE CITY, UTAH

REORGANIZATION PLANS OF OHIO COPPER. — PATENTS OF MINING CLAIMS.—REPORT OF SILVER KING COALITION COMPANY.

Stockholders of the Ohio Copper Co., after a long wait, are beginning to get some direct information about the property. Unfortunately, the information is not of a reassuring trend. Back of the announcement of a plan to reorganize on a basis which will amount to an assessment of $1 per share, it is said on authority worthy of credence, is the recent report of Henry Krumb, who was employed by bondholders and other creditors to make an examination of the Ohio. According to his report, the developed tonnage in the Ohio was sufficient only to pay the interest on the outstanding bonds for about ten years. In its anxiety to make a showing on low cost of mining, apparently the management has been cutting down the prospecting expense below the proper limit. The annual report gives the cost of mining at 26.73c. per dry ton of ore. The same report declares there are 3,200,000 tons of developed and between 9,000,000 and 10,000,000 tons of 'probable' ore in the mine. The mill has been treating about 50,000 tons per month, and the plans, if properly financed, call for a 50% increase in that capacity. During the six months from October to March, inclusive, the mill treated 311,068 tons of ore having an average copper content of 1.176%, with a total production of 3,754,866 lb. While the Ohio Copper, controlled by F. A. Heinze, is in difficulties, it is noteworthy that the Mascotte tunnel, owned entirely by Mr. Heinze, is proving a highly profitable venture through its contract with the Ohio for transportation of ores. The revenue for the six months mentioned was close to $50,000, and it will increase in proportion with any enlargement of tonnage. The royalty is 15c. per ton. The plan of reorganization on which the stockholders will vote provides for a reduction of the par value of the stock from $10 to $5. The number of shares will be 1,600,000. One share of old stock plus $1 will call for one share of the new, which has been underwritten at $1.25 per share. This disposes of 1,260,879 shares of the new company; 250,000 will be set aside for the conversion at par of the $1,250,000 of bonds outstanding; leaving 89,130 shares, out of which not to exceed 39,000 shares may be used as underwriters' commission. The directors state that this plan, if carried through, will pay off the floating debt, complete the mill at a cost of not over $50,000, and leave the company approximately $350,000 working capital.

Utah mining men are again stirred up over the attitude of the Interior Department of Washington over application for patent of mineral claims. The Department has taken the position in several cases, notably in the East Tintic case, that ore in paying quantities in place must be developed before application for patent will be granted. Geological conditions, the development of ore in adjoining properties at depth trending into the claim, neither of these may count if ore of commercial grade is not actually developed. The Commercial Club of Salt Lake City, the Salt Lake Mining Exchange, and other organizations appealed to the Utah delegation in Washington to take the matter up with a view to influencing the attitude of the Interior Department to one more encouraging to the development of mining. Assurances were received that the Department would be more liberal in the future. Now comes, however, a formal letter in defense of the Interior Department, from Samuel C. Adams, First Assistant Secretary, reiterating the former position, and giving the poor prospector little encouragement unless he has the money to open a paying mine before he applies for patent. This gives rise to the belief that only a change of administration in the Department or a change in the laws will offer hope for an altered position of the authorities.

The management of the Silver King Coalition Mines Co. has not been in the habit of giving complete, detailed information about the property, but the annual report recently issued is an exception. It shows a profit for the year ended April 30, 1912, of $583,017.25, despite extraordinary expenditures for new equipment and purchases. An interesting feature is shown in the accumulation of a fund to pay the judgment of the Silver King Consolidated Co., in case the higher court affirms the immense verdict, and still resume the payment of dividends. The Silver King Coalition and its predecessor, the Silver King, has paid a total of $12,334,885 in dividends. The average assay of 21,506 tons of shipping ore marketed during the year was: lead, 28.35%; silver, 50.06 oz.; gold, 0.0833 ounce.

JOHANNESBURG, TRANSVAAL

RESULTS OF CONSOLIDATION OF RAND PROPERTIES.—REPORT OF DIRECTOR OF CROWN MINES, LTD.

A feeling has been growing on the Rand that the practice of merging the different mines into one concern has not been to the advantage of shareholders. Where large areas of worthless or lower-grade properties have been absorbed, the merger can scarcely be expected to help the shareholders when the nominal capital of the concern and costs of management have both been enormously increased at the same time. Several instances of this kind on the

SOUTH RAND SHAFT, CROWN MINES.

Rand might be mentioned, and stockholders have had to suffer, rather than those who control the management. The way out of the difficulty has not yet been discovered. Such mergers have tended to bring well meant combinations into contempt, although when consolidations are well planned and carried out, they must act to the benefit of all concerned. At the last meeting of the Crown Mines, S. Evans, the managing director, set himself the task of showing that the consolidation of the Crown, Crown Deep, Robinson Central Deep, and Langlaagte Deep had really been to the advantage of all the shareholders concerned, and in the long run the shareholders would realize that fact. He was able to point to better results in the shape of higher working profits and to some of the promises made at the time of incorporation being more than fulfilled, but he failed to convince shareholders in his explanations of why working costs had increased from 15s. 11d. in 1909 to 19s. 3d. in 1911, or that dividends of 120% in 1910 and 110% in 1911 were satisfactory when L. Reyersbach in 1909 had forecasted 130% dividends for the stockholders as a result of the merger. The managing director, however, explained that since the merger the profitable ore reserves had been increased from 3,916,593 tons with gold content valued at over £6,000,000, to 10,124,072 tons with a total value of nearly £15,000,000 of recoverable gold content, which meant, in other words, that the profits in sight, to be realized later, had been nearly doubled since consolidation, and were estimated at over £6,000,000. When, however, the managing director came

to deal with the actual results of the combination, there were many explanations to make, more particularly with regard to the fact that at the time of consolidation the cash capital available, amounting to £721,000, had not only been spent, but another £900,000 in addition, not to mention the £300,000 spent in development, which would have to be deducted from future profits. The principal reasons for this heavy outlay were, the increasing of the capacity of the ore-reduction plant by no less than half a million tons per year more than arranged for at the time of consolidation, unforeseen expenditure in other directions, and the work having turned out to be very much more costly than was set forth in the engineers' estimates. The following striking figures were quoted as showing the results before and after consolidation:

	5 Years Before Consolidation.	Since Consolidation: 1910.	1911.
Yield per ton....	38s. 7d.	33s. 5d.	35s. 1d.
Costs per ton....	19s. 8d.	18s. 1d.	19s. 3d.
Profits per ton...	18s. 11d.	15s. 4d.	15s. 10d.

The better grade obtained in 1911 is due to closer sorting, the percentage sorted out being increased from 8.3 to 11.7%. It was calculated that at the time of consolidation 166,000 tons per month would be milled, but up to the end of 1911 this had not been attained, for in 1910 only an average of 126,000 tons per month was milled, and in 1911 134,875 tons. These disappointing results are claimed to be due to scarcity and inefficiency of labor and to troubles with the shafts at the Crown Deep and Robinson Central Deep mines. Despite all these drawbacks, the managing director claimed it only needed patience and the completion of the enlarged program to make the merger a success. The capacity of the ore-reduction plants had been increased to 212,000 tons per month, the work of seven shafts was being concentrated at two shafts whose combined output was estimated at 11,000 tons per day of ten hours, and a drift 15 ft. wide was being driven for a distance of over three miles throughout the whole length of the property, of which two-thirds had been already driven. This was to be worked by electrical haulage. Large crusher stations have been erected at the two main shafts, and it might require two or three months to get the whole of the new equipment working on a smooth-running basis. When that was achieved he felt certain that all the benefits of combination such as lower working costs, higher profits, more uniform and stable results would be achieved.

BOSTON

ACTIVITY IN BUTTE & SUPERIOR.—UNITED STATES S. R. & M. CO. ACQUIRES COAL PROPERTY.—SPECULATION IN LONDON COPPER.

The wide swath which Butte & Superior is cutting in the market here has had the effect of broadening Boston into a general mining share market. On Wednesday, June 12, Butte & Superior reached its high mark of 51¾ in the market here and represented a larger volume of trading than any other railway, industrial, or mining enterprise on either Wall or State streets, with the single exception of Reading on the New York Stock Exchange. The following day the *News Bureau*, the official organ of State street, made this most important statement as a combination of fact and comment: "On Wednesday the Boston market became the zinc market of the country, and during the past week Boston has probably dealt in more copper stocks, zinc stocks, and coal stocks than any other exchange in the world. Boston is fast becoming the most important mining market in this country." Butte & Superior has, indeed, created a profound sensation in both Boston and Butte. People, who were hitherto entirely ignorant of zinc conditions, now take the liveliest interest in everything concerning them. American zinc has enjoyed an active market contemporaneously with Butte & Superior, and inquiry extends to various zinc situations throughout the country. New capital is going into Joplin. New mining deals of considerable magnitude have been made there lately and big syndicates are securing options on additional tracts of territory. The New Jersey Zinc Co. is one of the closest corporations in the country and is reported to have paid out over 100% in dividends in a single year. Its New Jersey mine contains a remarkable body of ore running more than 20%, and a large profit is made from sulphuric acid in Wisconsin. Butte & Superior ore runs from 20 to 40%. Butte & Superior is claimed by many to be the biggest and richest zinc mine in the world, though it has not more than 3,000,000 tons of ore blocked. The breast of every drift is in ore and the bottom of the mine, at the 1600-ft. level, shows a continuation of the orebody. Engineers who have seen Butte & Superior recently, are of the opinion that it will yet turn into a copper mine at depth. The stock was first put out at Duluth, and sold as low as $5 per share. It was reluctantly considered by Hayden, Stone & Co., bankers of Boston, until D. C. Jackling examined the property, and he recommended that $1,000,000 of the company's convertible bonds, convertible at $10 per share, be underwritten. Last January the stock was listed on the Exchange here and trading began around $20 per share. It has since sold up to 51¾, and predictions are made that $75 per share will yet be reached. W. A. Clark is largely interested in Butte zinc mining and believes that there are other coming producers of zinc in Butte, namely the Elm Orlu, which he controls; the Alice mine, belonging to Amalgamated; and the Moulton. He is rebuilding a mill for the purpose of concentrating the local zinc ores. At present he is shipping to the Washoe smelter. The treatment of Butte zinc ores is still in an experimental stage, but the Butte & Superior mill and that of Mr. Clark's will undoubtedly work out the problem. During the activity of Butte & Superior the coal issue of Hayden, Stone & Co., Island creek and Pon creek, have also been at times active. These coal and zinc movements have contributed signally to the broadening of the Boston market, suggesting that in the future it will be a general mining share market, no longer confined to copper. This is easily the most important phase of mining and market developments in Boston for the past year.

The recent activity in the shares of the United States Smelting, Refining & Mining Co. has attracted no little attention. Recently the company, which is a securities-holding corporation, issued $10,000,000 in five-year 6% notes in order to acquire the Castle Valley Coal Co., the Black Hawk company, and the Consolidated Utah Fuel Co., in central Utah. The company has ownership and control covering approximately 100 mines in the United States, Mexico, and Alaska. It is believed that, notwithstanding the new financing necessary to acquire the coal properties in Utah, which are already self-sustaining, the company will soon increase its dividend rate of $2 per year on the common stock. After having written off a million dollars for plant depreciation each year since organization in January 1906, the company is now earning annually about $10 per share on the common stock. With silver at 61c. and copper at 17½c., the company's affairs are in excellent shape. Over 40% of the revenue comes from silver. The acquisition of the Utah coal properties places United States Smelting in a favorable strategic position, as it controls the bulk of the large coal deposits of Utah. The coal produced there is of excellent quality and makes good coke. With Utah coal and California oil, Boston interests figure that the Far West will get all the fuel it needs, this being in great contrast to conditions there a generation ago. The United States is largely a Boston company, though its American offices are in Salt Lake and its Mexican offices in Mexico City. James J. Storrow, formerly candidate for mayor of Boston, and a member of the banking house of Lee, Higginson & Co., is a member of the board of directors. Lee, Higginson & Co., act as the company's bankers. The common stock sold up to $70 per share in the first year of its history and prospects are excellent for it to reach that figure again. It is now selling around 45, having advanced ten or eleven points above the low price of the year.

A few days ago a break in G. M. B. was reported from London, and the cabled advices were that the unexpected drop in price was due to the rumor of large hidden stocks of copper in the United States. This rumor was cabled to the London *Times* from New York, and it is now believed that Thomas W. Lawson, who is reported to be conducting a market manipulation in the metal on the bear side, had something to do with furnishing the information. While it is admitted that there are some speculative lines on the long account in both Europe and America, it is held here that there is no warrant for the belief that there are large invisible supplies of copper anywhere, or that there is any break coming in the demand for consumption. The loss thus sustained in London, due to the bearish rumor cabled to the *Times*, was quickly regained in the subsequent market quotations. In fact, it is reported that the leading copper interests in London took advantage of the break to buy copper at reduced figures. It is believed here that copper will be 20c. per pound before the end of the year, but the public is still slow to credit as substantial the progress being reported in the market.

TORONTO, CANADA

PORCUPINE MILLS IN OPERATION.—MEETING OF THE DOME STEEL CORPORATION.

Both the Hollinger and the Vipond mills are in operation. High-grade ore will be treated at the Hollinger, the mill being constructed strictly for rich ore. The dump at No. 1 shaft contains thousands of tons of $20 ore extracted when the property was being proved in 1910. At the Vipond the ore in the 100-ft. level in the Godfrey vein has been broken down and will be milled first, and the dump ore, averaging $10 to $14 per ton, will also be worked. At the Dome, all the stamps and three of the tube-mills are working steadily. Twelve raises have been put through to the surface, and drills are breaking down the ore from above. The mine will be quarried to the 100-ft. level, there being sufficient ore in sight above this level to supply the mill for some years. No development is being done at lower levels at present. Diamond-drill operations have demonstrated the continuity of the ore-body toward the Dome Extension line. It is understood that the Dome has taken an option on the La Pahue property in the Three Nations district, on which considerable work has been done with encouraging results. F. P. Schwindler has resigned his position as manager of the McIntyre, and the mine will be under the direct management of C. B. Flynn. A heavier hoist is being installed at No. 4 shaft for working the deeper levels. The Hughes is installing a compressor plant, and a large portion of the working force has been laid off until the power is available. The Dome Lake, which is installing a compressor plant, has found a wide vein in the shaft at a depth of 48 ft. The Crown Chartered has cut the fissure zone at the 200-ft. level at a distance of over 100 ft. from the shaft. On the first level over 800 ft. of underground work has been done, which revealed a number of quartz veins. Active operations have been resumed at the Pearl Lake. A station had been partly cut in No. 1 main shaft at the 300-ft. level when work closed down. This will be completed and sinking continued to the 800-ft. level. A carload of 30 tons of ore, sent by the McEneany to McGill University at Montreal for testing, is stated to average $18 per ton. As a further test, to decide on the character of the process to be adopted, 100 tons more will be put through the McIntyre mill. D. F. King, formerly manager of the Vane syndicate, has been appointed manager of the Achilles. The stock market continues inactive and declining, speculative buying has practically ceased. The public has completely lost faith in prospective and rose-colored anticipations of future profits, and no return of activity need be expected until practical results from the operations of the big mills are forthcoming. Hollinger, however, has shown marked strength, the stock for the last few days selling above $13, on favorable reports sent from the mine. The Standard mine has been closed down, as the ore-shoots, though wide, proved to be very short.

The annual meeting of the Dominion Steel Corporation was held at Montreal on June 12. The reports presented showed net earnings for the 21 months from July 1, 1910, to March 31, 1912, after payment of dividends, amounting to $1,484,945. Of this sum $700,000, written off as a special appropriation for depreciation and renewals, was deduceted, leaving a surplus of $784,945. A dividend of 4% was declared. The increase in output came up to expectations, but the Steel company's earnings reflected the unsatisfactory conditions of the trade in the United States as regards prices, and conditions as to counties and duties also affected this department adversely, as part of the product had to be sold in competition with duty-free imports from the American side. The coal business was satisfactory, the output for the year ended March 31 having increased from 3,862,161 tons in 1911 to 4,406,263 tons in 1912. During the year, $1,576,931 had been expended on new collieries in Cape Breton, and $23,353 on the Cumberland property. The new mines in the Lingan district made an excellent showing, both in the tonnage and quality of the coal, and there continues to be a good market for all coal produced. Expenditures on capital account for the Steel company amounted to $2,714,539. The nail mill will shortly be in operation and the company will then turn its wire bars into nails, which are protected by the tariff, instead of having to sell them in competition with rods imported duty free.

REPUBLIC, WASHINGTON

POWER DEVELOPMENT FOR CHEWELAH DISTRICT.—NEW CONCENTRATOR FOR THE TUNGSTEN CONSOLIDATED MINES COMPANY.

It is anticipated that the Washington Power Co. will construct a high-potential line from its plant at Long Lake the coming summer to supply for Chewelah district a long-felt need of motive power. A large sum has been spent in remodeling the mill at the Napoleon mine, near Bossberg, and placing new machinery to handle the oxidized ore. The sulphide material will be shipped to the Greenwood, British Columbia, smelter, in which the leading stockholders of the Napoleon company are interested. At the Clugston mine, east of Bossberg, an adit is being driven on a silver-lead vein, on a good grade of ore, and a considerable quantity of high-grade ore has accumulated ready for shipment. During the summer J. R. Brown, the manager, expects to push development work and make regular shipments. The lessees of the Gold Hill mine, near Myers Falls, shipped a carload of ore recently to the Tacoma smelter, which brought returns of $48 per ton. The Granby Mining, Smelting & Power Co. of Grand Forks, British Columbia, has purchased from Jay R. Graves a 60-acre tract, bordering the Columbia river, and the island at the cataract, at the Kettle falls, and an improvement is anticipated to entail an expenditure of $2,000,000. The deal leads people familiar with the situation to believe that the Granby company will go to Kettle falls for its power. In the Orient district a night shift has been put on at the First Thought Extension mine, to push development and work on a larger scale. A new road to the mines will be completed with the view of shipping ore to the smelter. At Loon Lake the Tungsten Consolidated Mines Co. is installing a new concentrator at the mine and expects to begin shipping concentrate in thirty days.

Chewelah district is more active than ever before in its history, and is regarded as a future producer. The United Copper Co. is now shipping a carload of high-grade ore daily and is driving a new adit with 8-hour shifts, to intersect the main vein at a depth of 1200 ft., about 3000 ft. from the portal. On the Copper Queen, owned by the same company, an adit is being driven to cut the southwest extension of the United Copper vein at a distance of about 400 ft. The company is employing 70 men. In the opposite direction, on the same vein, at

a depth of about 100 ft., Oppenheimer brothers are running on a large body of high-grade ore in the Amazon claim. R. J. Davis, who has bonded the Blue Star mine from the owners, is sinking a shaft on the vein and shipping a carload of high-grade ore monthly.

The King Solomon mine, in the Clancy district, taken over some time ago by a party of Eastern and Western capitalists in the name of a company incorporated as the Calumet & Montana, has been closed down, pending the adjustment of some difficulties which have arisen over financial matters.

NEW YORK

Political Situation Causes Inactive Markets.—Reorganization of Mining Companies.—The Copper Situation.

The centres of interest east of the Mississippi river during the past fortnight have been Chicago and Baltimore, with such financial centres as New York, Boston, and Philadelphia marking time in a rather dispirited manner. The political atmosphere is considerably overcharged, and almost anything may be expected. Market activity has come to an almost complete standstill. Such developments as have occurred have been without any great public interest. In the reorganization of Ohio Copper, which is to be made over into the Ohio Copper Mining Co., with the capital stock of the company cut in two by the reduction in par value from $10 to $5, the present stockholders are to have the privilege of exchanging their holdings for new stock upon the payment of $1 per share to the old company. The Heinze interest is to be reduced, though 'F. Augustus' retains his seat at the directors' table. The new company is to be headed by W. O. Allison, president of the National Reserve Bank of New York. The new company, if all of the shareholders take care of their assessments, will start out with a cash balance of $350,000, which will put Ohio Copper in considerably better financial shape than has been the case for some time under the Heinze regime. Some of the bondholders are much dissatisfied, as the floating debt is to be paid off at 100 cents on the dollar, while the bonds get nothing. The Old Alpha Copper Co., near Somerville, New Jersey, has once more changed hands, this time at sheriff's sale under a mortgage held by the Manhattan Trust Co. of New York. This old copper mine has been in many hands, and its career is a much-checkered one. Enough money has been spent in the various attempts to produce copper from it at profit to have made a real copper mine in almost any of the copper districts of the West or Southwest. The sheriff sold the property to the new owner for the sum of $5000. It is announced that one of the preliminary consolidations in the Cripple Creek district is completed as to details, and that the El Paso Consolidated, the Mary McKinney, and the Henry Adney are to be consolidated as a first step in the general merger that is to take in all of the important properties tapped by the Roosevelt tunnel. Some big mill plans are being prepared, and the treating of the low-grade ores will be done at the lowest possible cost. The new concern is to be called the El Paso Consolidated Gold Mining Co. The United Verde Extension is to go through another reorganization. Jerome, Arizona, seems to be destined to remain a one-mine camp. The United Verde Extension and the other properties which surround W. A. Clark's mine have been in course of development for a long time with very little progress apparent.

The copper situation remains for the most part unchanged, with a record production from many important properties. The Utah Copper in May made its highest record in the life of the property, outputting 10,068,336 lb. Nevada Consolidated production is running well above 6,000,000 lb. But notwithstanding these figures, copper authorities state that a further decrease in copper stocks may be expected in June. From which it is evident that the most important element in the copper situation at the present time is the unknown amount of copper which is held in the refineries. It is a little too much to ask the public to believe that copper stocks can continue to shrink in the face of increased production, when in all other lines there has not been any more of a marked business revival than has yet occurred. While it is admitted upon all sides that manufacturers in Germany are—and have been for some time—going at top speed, it is also recognized that that country is very much overextended, and looking ahead as copper producers and selling agents do, a market reaction is to be expected in that quarter, rather than a continuation of the present high pressure. Last week showed a vicious drive at the copper metal market, and many stories were started to account for the break said to be about to make its appearance. Among other yarns that were revamped was the old one to the effect that the Tanganyika Concessions had a huge amount of copper about to be released from storage. This yarn is something of an old favorite in London, though it never has had any very serious consideration from those who are familiar with 'Tanks,' as the issue is known in the 'House.' The increased price in copper metal has given engineers some new and interesting problems to work out. One item is a saving in initial expense by using copper-clad steel wire in high-tension transmission. There is no development or line of industry in which the public is taking greater interest than that of hydro-electric power, and the transmission of electrical energy generally. While the idea is not welcomed by the coal roads that haul anthracite into New York, still there are to be found engineers who claim that it would be cheaper to transform the coal into power and transmit it to centres such as New York than it is to maintain a railroad to haul the coal. Experiments are said to show that a copper-clad steel wire, 0.8 in. diam., in which the amount of copper is a comparatively small item, costs no more per mile than a solid-copper wire ½ in. diam., and that more than twice as much power can be transmitted. Construction costs are much cheaper, as steel has a greater tensile strength, and supports can be placed at wider intervals. It is a rather favorable phase of the situation that, while the uses of copper multiply, the use of substitutes and methods for saving copper should also increase.

Among those unfortunates who were lost at sea in the wreck of the *Titanic* was Edgar J. Meyer, of the house of Eugene Meyer, Jr., & Co. The late Mr. Meyer was a member of the board of directors of the Braden Copper Co., and his house has always been looked upon in the Street as a connecting link between the Guggenheim interests and the house of J. P. Morgan & Co. Stephen Birch, until recently in charge of the Bonanza mines in Alaska, controlled by the Guggenheim-Morgan syndicate, has just been elected to the Braden board to fill the place left vacant by the death of Mr. Meyer. Pope Yeatman, consulting engineer for the Guggenheims, is returning this week from Chile, South America, and detailed figures as to the developed tonnage of the Braden are expected. The Guggenheims expect Braden to be one of the low-cost producers of copper, and if prophecies in this direction materialize, interests in South American copper properties should be augmented. It was recently reported that J. B. Haggin and his associates had undertaken the development of a property in Peru that was to rival or exceed in importance the Cerro de Pasco mine, controlled by Mr. Haggin, J. P. Morgan, the estate of the late D. O. Mills, and one or two associates. Inquiries at Mr. Haggin's headquarters, however, developed the fact that nothing of the kind has been undertaken. The Tennessee Copper Co., it is announced semi-officially, is to pay a quarterly dividend of $1. With the completion of its sulphuric acid plant practically at hand, Tennessee Copper will undoubtedly remain in the dividend list for a long time to come. The British Columbia Copper Co. is operating under full swing and is earning some $60,000 net monthly. Last month the company moved 240,000 tons of ore at one blast. This is held to be something of a record for blasting operations in mining, although larger quantities of material have undoubtedly been moved in railroad construction, by the use of giant powder.

General Mining News

ALASKA

Fairbanks

The mill at the Newsboy mine commenced operation in June and is treating 15 tons of ore per day. This ore comes from a 4-ft. vein which is worked from both the 115 and 215-ft. levels.

Kenai Peninsula

The Kenai Dredging Co., which owns a group of claims on Kenai river near Seward, has ordered a dredge for delivery on the company's property this season. Prospecting has proved the profitable gravel on the claims to be deeper than 25 feet.

ARIZONA

Gila County

(Special Correspondence.)—The Inspiration Con. Copper Co. is sinking three development shafts and one working shaft, and is opening the Inspiration orebody by drifts and raises. The development of the Live Oak orebody will begin as soon as the sinking of development shafts No. 1 and No. 2 is finished. The working shaft is being temporarily retimbered with 8-in. timbers. After it reaches the desired depth it will be lined with concrete, beginning at the bottom and working upward, removing the timbering as the concrete is poured. There will be three compartments, each 5 ft. 11 in. by 5 ft. 6 in., and the concrete walls will be 10 in. thick. It is being sunk on contract, there being three shifts with six men on each. A 25-hp. gasoline hoist is being used for sinking. About 480 men are employed. At the Miami concentrator, additional rolls are to be placed in the crushing plant so that all ore will be reduced to ½-in. size before going to the mill-bins. The new rolls, which are expected soon, will be 15 by 42-in. spring rolls of unusually heavy construction, specially built by the Traylor Engineering Co. All the rigid rolls now in use will be gradually replaced. The Chilean mills will be replaced by Hardinge conical pebble-mills. While the cost of steel and pebbles consumed by the latter is said to be about the same as that of steel for the former, the repair cost of the Chilean mills far exceeds that of the Hardinge mills..

F. A. Woodward, of Boston, vice-president and general manager for the Iron Cap Copper Co., is inspecting the Iron Cap mine at Copper Hill, preparatory to resuming development. The mine, which adjoins the Coper Hill mine of the Arizona Commercial, was closed in 1910 owing to exhaustion of funds of the National Mining Exploration Co. The Iron Cap Copper Co. is virtually a reorganization of that company and is capitalized for 200,000 shares, par value $10, of which 85,000 shares are outstanding, the rest being treasury stock. There is also outstanding a $50,000 bond issue. Mr. Woodward states that there is sufficient money in the treasury to carry on development during the coming year. A second shift has been put on at the Copper Reef mine, 12 miles south of San Carlos, and 22 men are now employed. The California adit is in 1095 ft., and has just cut what is believed may be the Daylight vein, having passed out of the limestone into a vein of porphyry and clay gouge carrying considerable calcite, red hematite, and manganese. The drift on the California vein is in 175 ft. in well mineralized matter. A fault was encountered at 165 ft., and the drift is still in this faulted zone, the amount of displacement being yet undetermined.

Globe, June 27.

Pinal County

(Special Correspondence.)—At the old Queen mine, operated by the Magma Copper Co. at Superior, a large shoot of high-grade copper ore has been opened on the 650 and 800-ft. levels. On the 650-ft. level it was 150 ft. long and 5 ft. wide. In the 800-ft. level it is from 5 to 20 ft. wide, and has been opened for a length of nearly 300 ft., with neither end in sight. The ore from development is being shipped and averages from 20 to 25% copper and considerable silver. Two cars averaged over 50% copper. The copper occurs as chalcocite and bornite. The mine was taken over on the advice of Henry Krumb, about two years ago, by the Gunn-Thompson Co., which organized the Magma Copper Co. and started development. Results have exceeded expectations, and the mine bids fair to become a rich producer.

Globe, June 27.

Santa Cruz County

The R. R. R. mine, recently purchased by N. L. Amster, has commenced shipments to the Copper Queen smelter at Douglas at the rate of 40 tons per day. This ore, which is expected to run over 10% copper, is taken from a cross-cut at the 260-ft. level from an orebody 10 ft. in width. The output will be increased and by September 1 shipments of 100 tons per day are expected.

Yavapai County

The Mildred mine, near Stanton, in the southern part of the county, has found a rich body of ore in a cross-

MAP OF ARIZONA.

cut from the shaft. The vein, which is 5 ft. wide, was cut 300 ft. below a well defined outcrop. The ore is made up of galena and other sulphides, with some gold and silver. The property is equipped with a 10-stamp mill, with amalgamation plates and concentration tables. The management intends to install an aerial tramway from the shaft to the mill to carry the ore automatically through the plant with one handling. Some of the ore in the mine is rich enough to ship, but the company is planning to construct a cyanide plant if a test-run on the ore shows that an improved saving could be made by this process.

Yuma County

The D. & W. Mining Co. has enough ore in sight on its property to warrant the construction of a mill, according to a report made by John W. Fink, president of the company, to the stockholders. The mine, which is 18 miles northwest of Parker, has more than 3500 ft. of underground work completed and a large supply of ore opened on five levels to a depth of 700 ft. Every level is well timbered, is in good condition, and is ready for stoping. Air lines of iron pipes have been laid to supply the drills, and tracks have been laid in the levels for tramming the ore to the shaft. The mechanical equipment includes one Ingersoll-Rand, class 'J', two-stage air-com-

pressor, driven by a 42-hp. Commercial company gas engine, using distillate; one Western Gas Engine Co. 18-hp. single-drum hoisting engine, with 1000 ft. of 5/8-in. steel cable; buckets, and cars; a Buffalo blower driven by a 5-hp. vertical gas-engine, with full equipment of pipes for ventilating the various levels; a Knowles pump and piping to lift the water from the third level of the mine to the surface. The mine was closed on June 1, but is ready to resume operation on the completion of the mill.

CALIFORNIA

Alpine County

The Curtz Con. M. Co. has purchased the adjoining property of the Alpine Mining Co., which consisted of four partly developed mining claims, an aerial tramway, three-fourths of a mile in length, with a 100-ton stamp-mill, cyanide plant, dam, and power-plant on the Main Carson river. The Curtz company intends to develop more power and transmit it to Mogul, where a concentrator will be built on its property, to treat the ore now developed in its mines. There are two orebodies, one 40 and the other 60 ft. wide, which have been opened for 600 ft. in length, at depths ranging from 200 to 500 ft. This development has been carried on for four years, and over 6000 ft. of adits, shafts, and drifts completed. The ore carries copper, gold, and silver in sufficient quantity to warrant treatment by concentration.

Eldorado County

The Beebe mine, in the townsite of Georgetown, has discovered a body of high-grade gold ore. This property adjoins the Eureka mine and is on a continuation of the Eureka vein. Two days before the discovery of the ore it was bonded to Eastern capitalists for $60,000. The Bright Hope mine, a mile north of Georgetown, is being operated, and the owners plan to build a mill on their property this summer.

Plumas County

The Altona mine has been purchased by a syndicate headed by George H. Stephens of Seattle. The Altona was bonded several months ago and development has been in progress since then. The adit was repaired, the old tracks torn out, to be replaced by new equipment, and a station cut for a new hoist which has been placed. The sinking of a shaft on the richest of three veins in the mine, was begun, and a depth of 40 ft. has been reached. Engineers have examined the various veins and old workings of the mine for the purchasers. The mine when formerly operated was stoped to the surface, and future development must begin with sinking on the ore.

The Droege Mining Co. has given a contract to the Indian Valley Electric Light & Power Co. for electric power. This power will be available for the Droege and other mines within two months. A temporary steam plant will be installed as an auxiliary to the present hydro-electric plant at Greenville. The steam plant will develop 200 hp. It is expected, within a few months, to have power in the district from the Seneca plant to be built on the north fork of the Feather river by the Indian Valley company.

Tuolumne County

The Tonopah Belmont Development Co., of Tonopah, Nevada, has purchased the Dreison mine, near Tuolumne, California.

IDAHO

Coeur d'Alene

The Bunker Hill & Sullivan M. & C. Co. has completed the acquirement of patent to about 50 claims in addition to its present territory. Most of these are part of what is known as the Yreka lode, near Kellogg peak, in the Coeur d'Alene, and have been located by the corporation during the past few years. All are supposed to cover mineral ground. As a result of explorations during recent years, the geology of the Bunker Hill district has become much better established. At first the peculiar position of ore, which was found in immense lenses lying outside of the hanging wall of the vein, as well as in the fissure proper, was supposed to indicate a zone of some width which carries all the ore. Later the underground work proved that the conditions were due to a double series of fissures, combined with faulting, which crossed each other at right angles. Acting with this knowledge, the Bunker Hill has proceeded during the past two years to acquire by purchase and location ground previously supposed to be barren, but which covered the general trend of the blind fissures discovered crossing the known system. Some of these are now in the group patented.

Nez Perce County

The Gilmore Mining Co. has let a contract for work on the adit, the terms of which call for the completion of the contract within four months. This adit is started in the Gilmore ground and then cuts under some of the property of the Pittsburg-Idaho and into the Gilmore ground again, giving a depth at the greatest elevation of from 1300 to 1400 ft. By the end of this month there will be completed 800 ft. of the total 2100 ft. When the new contract work starts, it will be possible to work three faces as a drift from the 250-ft. level of the mine, which will by that time be to the adit line and thus afford an opportunity for work in that part of the ground. This adit will be used for exploration and transportation by the two properties.

The Gilmore company is shipping about one 50-ton car per week, the ore being taken out in the course of development. The returns have been showing about $15 per ton, but Mr. Johnson says that the car now on the road probably will net $30. This is a gold ore. The Pittsburg-Idaho is shipping about 100 tons per day, and the veins are reported as showing satisfactory orebodies with depth.

Shoshone County

The Snowstorm Mining Co. is preparing to resume sinking in the winze from the No. 3 adit. A new sinking pump has been ordered, and work will be commenced as soon as it arrives. This work was started last year, and ore was found at a depth of 80 ft. It is also intended to drive a raise from the No. 4 adit level to prospect this orebody. Plans are being drawn for another unit to be added to the mill. Steady shipments of concentrate are now being made to the smelter.

MONTANA

Silverbow County

(Special Correspondence.)—The experimental plant at the Washoe smelter, for the trial of the Bradley process on the concentrator slime, has been closed in order that certain mechanical changes may be made. The principal trouble has been with the dryers, which have not been able to handle the slime and get it in proper condition for the roasters. The Davis-Daly Copper Co. has filed a statement with the county assessor for the year ended May 31. The output for the year was 14,235 tons, with a gross yield per ton of $6.80. There was an operating loss for the year of $96,721.53, but the work of the first four months of the year involved heavy and unusual expense, which included the building of a tramway and the construction of ore-bins at the mine and at the railroad switch. In the last six months of the year the returns from ore shipments balanced the expenses. The report of the Butte-Alex Scott company shows that 25,756 tons of ore was mined in the year prior to June 1. The value of this ore was $15.14 per ton. The total cost of mining and development was $5.17 per ton, of transportation $0.159, and of treatment $3.18. The net profit for the year was $91,584.97. The Butte Central Copper Co., which has operated the Ophir mine, has also filed its report. All the ore taken out was mined in the progress of development, and no attempt was made to do actual mining. The annual statement of the Butte & Superior Copper Co. shows a loss of $358,013.08, as compared with net earnings for the preceding year of $3722.26. The output was 171,796 tons of ore with a value of $7.45 per ton. The cost of mining was $7.89, of transportation $1.54, and of reduction $9.43 per ton. At present the new concen-

trator is treating from 300 to 500 tons per day, and the operating costs will undoubtedly be reduced. The Butte-Duluth has been incorporated in Butte, by local men, with a capital of $250,000. The company is supposed to have a lease and bond on a group of claims southeast of the East Butte property. Several years ago these claims were under option to the Lewisohns, who turned them down after an examination made by J. Parke Channing.

Butte, July 1.

The report of the Tuolumne Copper Mining Co. for the year ended June 1 shows that the company mined during that period 34,324 tons of ore of an average value of $13 per ton. Net earnings were $24,768, a decrease of $91,847 from the preceding year. The cost for mining was $3.53 per ton, and for the reduction of the ore at the Washoe smelter $4.56 per ton. The cost of labor was $40,954, of machinery $65,657, and of supplies $53,572. After making a deduction for improvements, the report shows that the company operated at a loss of $67,078 for the year.

NEVADA

Churchill County

The Nevada Hills M. Co. has given the International S. & R. Co. a contract for the smelting of the concentrate produced in the Nevada Hills mill, and two carloads have been shipped to Tooele. This product is expected to carry about 600 oz. of silver per ton.

Clark County

The property of the Quartette Mining Co. has been taken over, under lease, by C. H. Jones, formerly foreman and superintendent for the company. The mine has been operated by a few lessees for some time, and Mr. Jones intends to sublet as many new blocks of ground as possible. At the mill 20 stamps have been dropping, and it is reported that enough ore is now in sight to keep the mill in operation throughout the summer. A cyanide slime plant with a capacity of 50 tons per day is working in connection with the mill.

Esmeralda County

(Telegraphic Correspondence.)—The production of the Goldfield Con. Mines Co. for June is estimated at 32,360 tons. The gross value of this output was $542,000, and the operating expenses $200,000 leaving $342,000 as the estimated net earnings for the month.

Goldfield, July 2.

Lyon County

The Mason Valley Mines Co. has reported the output of the smelter at Yerington for the first five months of operation as follows, in pounds of copper:

January	709,135
February	1,013,601
March	1,285,543
April	1,582,164
May (estimated)	1,600,000
Total	6,190,443

This plant was started in January with one furnace, and the increased production since then is largely due to the favorable ore treated. The company is now handling 800 tons per day on an estimated capacity of 400 tons. The management has not yet determined the proper charge for depreciation of the smelter, so that no definite figure as to the cost per pound can be given. In addition to depreciation, there must also be charged to the sinking fund, as provided in the company's mortgage, 20c. per ton of ore. The matte has been shipped to the A. S. & R. Co., which has a contract for the treatment and sale of the product of the Mason Valley plant.

Nye County

The Tonopah Merger Mining Co. has cut a promising vein in the Golden Anchor shaft at a depth of 940 ft. Since the company resumed the sinking of the shaft from the 840-ft. level it has been carried down in a well mineralized formation with small stringers of quartz. These stringers gradually widened into an almost solid orebody, through which the shaft has been driven for 20 ft. without cutting the foot-wall of the vein, which has a general east and west course, dipping north at an angle of 35°. The importance of this discovery comes from the fact that the Golden Anchor shaft is several hundred feet outside of the proved ore-zone, being about 900 ft. west of the workings of the Midway, and about 900 ft. north of the Tonopah Extension shaft. The vein occurs in rhyolite, above the trachyte formation. Samples from the quartz stringers have given assay returns of $50 to $390 per ton, and the whole body of the vein would yield milling ore. Sinking will be continued to the 1050-ft. level, in the hope of cutting other orebodies. The new concentrating plant of the West End Con. M. Co. is ready to operate. This addition has been built on the north side of the mill and contains 4 Callow cones, through which will pass the product of the tube-mills, from there to be distributed to 12 Deister tables. The tailing from these tables will be pumped back to the Dorr classifier, and from there will go to the cyanide plant. It is expected that the capacity of the mill will be increased 20% by these additions, and that the plant will be able to treat a better grade of ore with a higher recovery. A reduction in the milling cost is also anticipated. It is planned to eventually increase the plant to a capacity of 150 tons per day, which can be done without installing any additional regrinding machinery. At the Tonopah Belmont property the hoisting of ore from the main shaft commenced on June 30, and the crushing plant of the new mill was started the next day. The ore-bins at the crusher plant have a capacity of 1000 tons, and the mill-bins have a capacity of 2000 tons. The latter will be filled before the mill is started.

A world's championship drilling contest, for a prize of $1000, was one of the features of the Fourth of July at Tonopah. The second prize was $400, together with the entrance fees of the contestants at $10 per hammer.

NEW MEXICO

Grant County

The Battleship Mining Co. has filed incorporation papers with a capitalization of $500,000. The incorporators and directors are R. M. Henningsen, Frank Oliver, Drew Pruitt, and E. Oliver, of Los Angeles, and James T. O'Hara, of Lordsburg.

Lincoln County

The Cat mine, in the White Oaks district, is preparing to build a mill for the treatment of its ores. Development has been in progress for some time, a pipe-line for a water supply has been built, and a coal seam has been opened to supply the mill with fuel.

Socorro County

(Special Correspondence.)—The output of the Ernestine Mining Co. for the first 10 days of June amounted to 11,300 oz. of bullion, and 5½ tons of concentrate, from a daily treatment of 100 tons. The mill of the Deadwood Mines Co., handling an average of 60 tons of ore daily, produced 4375 oz. gold and silver bullion, with about 2½ tons of concentrate during the same period. The Ernestine company has placed a new triplex electrically driven pump in the mill to handle the battery solution, replacing a steam pump formerly used. The adit at the Pacific mine of the Oaks Co. is in 510 ft., and the vein shows an 8-ft. width of good ore. The South shaft is now 187 ft. deep. Development in the last two weeks produced 80 tons of ore averaging $21 per ton.

Mogollon, June 28.

Incorporation papers have been filed by the Mines & Metal Co. of Socorro, with capitalization of $120,000. The incorporators are J. L. Terry, John A. McDonald, W. R. Dobson, James Redmond, and Joseph Brown, of Kelly, and H. M. Dougherty, of Socorro. The company will operate at Kelly and Magdalena, Socorro county. The directors are J. L. Terry, John A. McDonald, and H. M. Dougherty.

UTAH

Beaver County

The Mines Development Co. has taken a bond and lease for four years, from April 1, 1912, on the Atlas property. The company was organized to search for a mining property which has a large tonnage of low-grade ore which could be treated by the Kidder dry-concentration process, and the officials believe that the ore of the Atlas mine can be successfully treated by this method. A deep shaft is being sunk, and there is already developed about 10,000 tons of milling ore which averages 10% lead, 8 oz. of silver, and 50c. in gold per ton. Tests have been made by J. W. Thompson, of Park City, and from the results a mill has been planned with 100 tons daily capacity. It is estimated that 85% of the lead and 80% of the silver can be saved by the Kidder process, with a ratio of concentration of four into one. This would yield 25 tons of concentrate daily, with an average value of $37.50 per ton.

Salt Lake County

The Utah-Apex Mining Co. is producing from 100 to 125 tons of shipping ore and about 50 tons of concentrate per day. The high-grade ore comes from the Parvenue

MINE OF UTAH-APEX MINING CO.

adit-level, which is now 3200 ft. long and has attained a depth of about 1000 ft. The milling ore comes from the two levels above this adit, and is treated in the company's mill. The first-class ore and the concentrate are both sent to the Murray plant of the American S. & R. Co. The Parvenue adit is now being equipped for electric haulage. Two electric locomotives have been purchased, and the management expects to handle an increased output at reduced cost on account of this improvement in transportation facilities.

Summit County

The Utah Ore Sampling Co., which was organized in Salt Lake City for the purpose of taking over the Taylor & Brunton mill at Murray, the Pioneer sampling plant at Sandy, and the Silver City mill in the Tintic district, has now purchased the McIntosh ore-sampling mill at Park City. This plant, although one of the oldest in the State, is in good condition, and has a capacity of 500 tons per day.

WASHINGTON

Ferry County

(Special Correspondence.)—The new mill of the San Poil Con. M. Co., which is ready for operation, will give the district of Republic two modern mills for the treatment of the large reserves of low-grade ore left in the mines after shipping rich ore out of the district for smelting. The first mill, owned by the North Washington P. & R. Co., was described in the *Mining and Scientific Press* in the issue of July 8, 1911. The new mill of the San Poil company differs from the North Washington plant chiefly in the coarse-crushing department. Here a Williams pulverizer is used, treating the mine-run ore and reducing it to 3/16-in. at one operation. This machine consists of a trommel with 32 swinging hammers on the central shaft. The trommel, which is about 9 ft. long, exclusive of driving pulleys and discharge spout, is made of 1 by 2-in. bars set 3 16 in. apart. The hammers, which revolve about 2 in. inside these bars, are rectangular pieces of special steel, about 3 by 3 by 4 in., each being attached to a collar on the central shaft with several links of chain and a pin. The central shaft with the hammers revolves at 600 r.p.m. while the trommel revolves at 100 r.p.m. in the same direction. From trial runs it is claimed that 25 hp. is required to start the crusher and 22 hp. to keep it running when once started. The output is estimated from trials at 20 tons per hour, and the full capacity of the mill, 125 tons per day, will be crushed in one shift, leaving the remaining time for repairs if necessary. The product of this crusher will be treated by rolls and then by a spitzlutte. The heavy pulp from this classifier will go to a tube-mill, and the overflow to a Dorr thickener. An Oliver filter will be used.

Republic, June 29.

The Faithful Surprise Mining Co. has developed two veins, both of which have been intersected by an adit 1268 ft. long. No. 1 vein was cut at a distance of about 400 ft. in from the portal, at a depth on the pitch of 440 ft. The ore found is free-milling gold quartz, of an average assay value of about $8 per ton. Two other levels were opened in the same vein, higher up the hill, and some ore was shipped which assayed $16.85 per ton. The No. 2 vein, at the end of the adit, is iron sulphide, of an average value of $22.15 per ton, and the depth is somewhat over 500 ft. On the No. 1 vein drifts have been driven over 1000 ft. and pockets of ore were found that assayed thousands of dollars per ton.

Pierce County

(Special Correspondence.)—The plant of the Tacoma Smelting Co. is being overhauled and enlarged. A new copper blast-furnace is under construction, and work on another will be started as soon as the first is ready for operation. These new furnaces will be larger than those in present use, and will have 60% greater tuyere area. Only the two copper furnaces are now in operation, the lead plant is shut down and partly dismantled. One basic converter handles the output of these furnaces, and the shells of the old acid converters have been discarded. The electrolytic refinery treats about 30 tons of blister copper per day, and the rest of the product is sent to Eastern refineries.

Tacoma, June 28.

CANADA

British Columbia

The Provincial Bureau of Mines has arranged to make assays for platinum free of charge, within the reasonable requirements of prospectors, with a view toward encouraging the search for this metal, which is known to exist in the basins of the Tulameen and Similkameen rivers. Platinum is worth $46 per ounce at present. The assay office of the Canadian Consolidated company at Rossland was completely destroyed by fire last week, and the apparatus was a total loss. Three diamond-drills are in use at the Granby company's Hidden Creek mine, in addition to underground work. Grading for the smelter site is also in progress. Work is in progress on the Duncan property, near Beaverdell, which is under bond to the Phoenix Mining, Smelting & Development Co., and a promising showing of high-grade silver ore is being made. The mines in the Boundary district have shipped a total of 912,000 tons in 1912 to date, and the Grand Forks and Greenwood smelters have treated a total of 917,000 tons.

The British Columbia Copper Co. has a force of about 60 men employed in the development of the claims which it has under bond at Voigt's Camp on Copper mountain, about ten miles southwest of Princeton. Active work is at present being done on the 14, Ada B., Silver Dollar, Triangle Fraction, Red Eagle, and on the main working adit which is to cut a number of veins east of Voigt's

Camp. Three diamond-drills are being used at present, under the direction of W. J. Mitchell of the Northwestern Diamond Drill Contracting Co. Arrangements are being made for operating three additional machines. The orebodies at Voigt's Camp lie in a series of parallel veins running nearly north and south. Alternating with the veins are a series of porphyry dikes of varying widths up to several hundred feet; these prophyry dikes bear an important relation to the occurrence of the ore. There are some twenty of these veins, all of which carry copper, though all are not of working grade. The ore varies from a rather basic or neutral character on the eastern side of the series of dikes, to an acid character on the western side. The largest amount of work has been done on the 14 claim, which lies to the east of the main camp. A wagon-road has been built to this property, and two steam boilers and a hoist erected. A shaft is being sunk and is now down over 140 ft. on the incline. From the 90-ft. level a cross-cut was run through very good ore, which, in addition to copper, carried several dollars in gold. The ore consists of hematite, with calcite and chalcopyrite; its peculiarity being that the hematite carries the largest part of the gold. Several drifts were run from the cross-cut, and in two of these diamond-drills are being operated at present, to determine the size and position of the orebodies. The drills are being run by steam, but a compressor is on the way, and compressed air will be available in the near future. In addition to the underground showings, several prospect shafts and a series of trenches show the size of the orebody. The ore can be reached by an adit which will have to be driven 2300 ft. This has been started of large size to accommodate two car-tracks. A diamond-drill hole has also been started at a point 25 ft. over the adit, which will be run in a line parallel to the adit, to cut all formations and not only prospect for ore, but also furnish information in regard to the rock which will be found in driving the adit.

The thirteenth general meeting of members of the Western branch of the Canadian Mining Institute convened at Greenwood, June 27, for the transaction of routine business, and the reading and discussion of several papers having particular reference to the mining industry.

Ontario

The excavation for the new 10-stamp mill of the Swastika Mining Co. has commenced. Development at the 200, 300, and 400-ft. levels has opened orebodies from which the management hopes to produce a large enough tonnage to warrant a future addition to the mill.

JAPAN

Formosa

A rich vein of copper ore has recently been discovered near the port of Karen on the eastern coast of Taiwan. The vein is being examined by Junkichi Kusaka of the Sendai mine inspection office.

MEXICO

Sonora

At the San Nicolas mine, south of Nacozari, a rich body of ore has been opened by two drifts on the 100-ft. level. Some of the samples taken have yielded assay returns as high as $500 per ton in gold and silver. Shipments of the ore, which is highly silicious, have been made to the Copper Queen smelter at Douglas, Arizona. The company operating the mine has the property under bond and lease, with an option at $75,000. A company was recently organized at Bisbee, Arizona, to be known as the Cienega Gold Mines Co., to operate properties, in the Altar district, which are reported to have gold ore in commercial quantities. The company was capitalized at $20,000, and is a close corporation. The Nacozari Con. Copper Co. is planning to build a concentrator at its property adjoining the Pilares property of the Moctezuma Copper Co., at Nacozari. A sufficient tonnage of milling ore has been developed to supply a small mill for an indefinite period.

Personal

Professional men are invited to send news of their engagements and travels. Such news is interesting to friends.

E. T. Dumble is here.

Ralph Arnold has gone to New York.

Edmund Juessen has gone to Arizona.

E. H. Nutter has returned from Seattle.

H. W. Turner has left London for Russia.

W. F. Kett is at Lake Tahoe upon his vacation.

T. H. Leggett was at Bowie, California, last week.

Royal P. Jarvis is spending the summer in Colorado.

J. Morgan Clements was in San Francisco this week.

F. B. Van Horn sailed from New York for Tampico, July 5.

J. W. Malcolmson has returned to Kansas City from Sonora.

J. B. Hoeing has been appointed State Geologist for Kentucky.

E. P. Mathewson and family spent the Fourth at Santa Barbara, California.

G. L. Carlisle, Jr., has gone from Reno, Nevada, to Nantucket, Massachusetts.

George J. Rockwell is manager for the El Tajo Mining Co., San Sebastian, Mexico.

F. L. Garrison is visiting the Comstock and will be in San Francisco about July 10.

Alfred Fox, manager of the Caylloma mine, has returned to Peru from England.

K. Morimura and O. Takayama, of the Nippon Artesian Well Co., are in San Francisco.

G. A. Swanquist is with the Butters Divisadero Co., Divisadero, Salvador, Central America.

Henry Krumb is at the Keystone mine making an examination for the Inspiration Consolidated.

George I. Adams will be in San Francisco during the week and expects to sail for China on July 12.

J. Volney Lewis will spend the greater part of the summer visiting mining districts in the Western states.

C. L. Severy, having completed his engagement with the Poderosa Mining Co., Ltd., has left Collahuasi for London.

Henry B. Kaeding is in New York and may be addressed temporarily in care of the American Institute of Mining Engineers.

F. Julius Fohs, after several years service as Assistant State Geologist of Kentucky, has retired to enter private consulting practice.

Edward L. Dufourcq sailed on the *Mauretania* for England and France, expecting to return to New York about the second week in August.

Ezequiel Ordonez and J. M. Nicol have been nominated as rival candidates for the presidency of the Mexican Institute of Mining & Metallurgy.

Corey C. Brayton has resigned as manager for the rock-crushing department of the Natomas Consolidated, and will engage in gold-dredging on the Seward peninsula, Alaska, with headquarters at Solomon.

Obituary

Cecil Brunswick Smith died at his home in Toronto, Canada, recently. Mr. Smith, who was a graduate of McGill University, was 48 years old, was well known in the field of hydro-electric power development, having designed and built many important plants. A former president of the Canadian Society of Civil Engineers, he was the author of several texts on engineering, and his death is a great loss to the profession.

Market Reports

LONDON QUOTATIONS

(By cable, through the courtesy of C. S. Burton & Co., New York.)

	July 3.
Camp Bird Ltd	$ 6¾
El Oro	4
Esperanza	7¼
Oroville Dredging	1¼
Santa Gertrudis	7¼
Tomboy	5⅛

COPPER SHARES—BOSTON

(By courtesy of J. C. Wilson, Mills Building.)

	Closing prices, July 3.		Closing Prices July 3.
Adventure	$ 9⅛	Mohawk	$ 70
Allouez	47	North Butte	31½
Calumet & Arizona	75½	Old Dominion	57⅛
Calumet & Hecla	532	Osceola	119
Centennial	24	Quincy	92
Copper Range	59	Shannon	16⅛
Daly West	5⅜	Superior & Boston	2⅛
Franklin	12	Tamarack	43
Granby	54¼	Trinity	6⅜
Greene Cananea, ctf.	10¼	Utah Con	11
Isle-Royale	34¾	Victoria	3⅜
La Salle	7⅛	Winona	6¼
Mass Copper	7	Wolverine	112

NEVADA STOCKS

(By courtesy of San Francisco Stock Exchange.)

San Francisco, July 2.

Atlanta	$ .23	Mayflower	$ .02
Belcher	.53	Mexican	2.75
Belmont	10.00	Midway	.49
B. & B.	.10	Montana-Tonopah	2 57
Booth	.09	Nevada Hills	2.05
Chollar	.02	Ophir	1.05
Combination Fraction	.15	Pittsburg Silver Peak	1.05
Con. Virginia	.49	Round Mountain	.42
Florence	.95	Savage	.13
Goldfield Con.	3.90	Tonopah Extension	2 00
Gould & Curry	.02	Tonopah of Nevada	6.65
Jim Butler	.61	Union	.53
Jumbo Extension	.37	Vernal	.14
MacNamara	.23	West End	1.70

OIL SHARES

(By courtesy of San Francisco Stock Exchange.)

San Francisco, July 2.

Associated Oil	43.50	McKittrick	$ .09
Caribou	.91	Paraffine	.50
Claremont	.65	Palmer	.53
Coalinga National	.21	Palmer Union	.18
De Luxe	.80	Premier	.46
Empire	1.25	Republic	.32
Maricopa 36	.60	Turner	.87
Maricopa National	.18	W. K. Oil	2.00

MINING STOCK QUOTATIONS—NEW YORK

(By wire from C. S. Burton & Co., New York.)

	Closing Prices. July 3.		Closing Prices. July 3.
Amalgamated Copper	$ 85¼	Miami Copper	$ 28⅜
A. S. & R. Co.	86½	Mines Co. of America	3½
Braden Copper	7¼	Nevada Con	22¼
B. C. Copper Co.	5⅛	Nipissing	7⅛
Chino	33¾	Ohio Copper	1
First National	2¼	Ray Con	22⅛
Giroux	5⅛	Tenn. Copper	45⅛
Goldfield Con.	4	Tonopah Belmont	10
Greene-Cananea	10½	Tonopah Ex	2
Hollinger	12⅜	Tonopah Mining	6⅞
Inspiration	19⅝	Trinity	6½
Kerr Lake	2⅞	Tuolumne Copper	3⅜
La Rose	3⅜	Utah Copper	63¾
Mason Valley	13¼	West End	1⅝
McKinley-Darragh	1⅜	Yukon Gold	3⅞

ASSESSMENTS ON COMSTOCK MINES.

Company	No.	Del. Board	Sale Day	Amt.
Overman	39	June 29	July 23	.10
Hale & Norcross	30	July 2	July 29	.05
Sierra Nevada	30	July 4	July 30	.10
Yellow Jacket	41	July 4	Aug. 12	.10
Chollar	17	July 7	Aug. 5	.10
Union Con.	30	July 12	Aug. 7	.15
Utah	15	July 12	Aug. 6	.05
Confidence	59	July 15	Aug. 9	.20
Gould & Curry	23	July 19	Aug. 12	.05

LOCAL METAL PRICES

San Francisco July 3.

San Francisco is not a primary market for the common metals except quicksilver. The prices quoted below therefore represent sales of small lots and are not such as an ore-producer could expect to realize. Ore contracts usually call for settlements on the basis of Eastern prices, less freight and treatment charges. The prices quoted are in cents per pound, except in the case of quicksilver, which is quoted in dollars per flask of 75 pounds.

Antimony	11—11½c	Quicksilver (flask)	43
Electrolytic Copper	18—18½c	Tin	50—51½c
Pig Lead	5.00—5.95c	Spelter	7¼—7⅝c

Zinc dust, 1400 lb. casks, per 100 lb., small lots $9.50—9.75; large $7.50—8.50

METAL PRICES

(By wire from New York.)

NEW YORK, July 3.—Copper is now very quiet. Buyers are still holding off for better terms. Lead is firm and consumption is excellent. Spelter is firm and steady in price.

Average daily prices for the past week, in cents per pound, based on wholesale transactions, standard brands, are given below.

Date.	Electrolytic Copper.	Lead.	Spelter.	Silver, per oz.
June 27	17.30	4.50	7.00	61⅝
" 28	17.30	4.50	7.00	61⅜
" 29	17.30	4.50	7.00	61¼
" 30	Sunday.	No market.		
July 1	17.30	4.50	6.95	61½
" 2	17.30	4.50	6.95	61⅛
" 3	17.30	4.50	6.95	61⅛

SILVER

Below is given the average New York quotation, in cents per ounce, of fine silver for the months indicated:

	1911.	1912.		1911.	1912.
Jan.	53.81	56.25	July	52.57	....
Feb.	52.23	59.06	Aug.	52.17	....
Mch.	52.76	58.37	Sept.	52.43	....
Apr.	52.32	59.20	Oct.	53.37	....
May	53.31	60.88	Nov.	55.77	....
June	53.04	61.34	Dec.	54.85	....

COPPER

Daily quotations on copper as published in this column represent average wholesale transactions on the New York market and refer to electrolytic copper. Lake copper commands normally from 1-5 to 1-4c. per lb. more. Below are average monthly quotations in cents per pound:

	1911.	1912.		1911.	1912.
Jan.	12.29	14.09	July	12.47	....
Feb.	12.26	14.08	Aug.	12.41	....
Mch.	12.14	14.68	Sept.	12.20	....
Apr.	12.02	15.74	Oct.	12.19	....
May	11.99	16.03	Nov.	12.61	....
June	12.39	17.23	Dec.	13.55	....

COPPER SURPLUS

Figures showing the visible supply of copper at the beginning of each month are now widely available. Below are given the amounts, in pounds, known to be available at the first of each of certain months.

		U. S.	European.
January	1910	141,766,111	244,961,280
January	1911	122,030,195	230,264,280
October	"	140,894,856	191,945,600
November	"	134,997,642	176,816,640
December	"	111,785,188	164,151,680
January	1912	89,454,695	178,329,920
February	"	66,280,643	153,820,800
March	"	62,939,988	141,125,680
April	"	62,367,557	137,806,000
May	"	65,295,368	134,176,000
June	"	49,615,643	117,801,600

UNITED STATES PRODUCTION AND CONSUMPTION

(Compiled from reports of the Copper Producers' Association)

	Production.	Domestic deliveries.	Exports.
May, 1911	126,962,544	64,543,963	61,078,557
June	124,554,312	61,655,561	71,460,519
July	112,167,934	56,982,582	74,880,658
August	125,493,667	59,935,364	69,885,660
September	115,588,950	57,311,584	50,824,011
October	118,255,442	64,068,656	60,084,349
November	111,876,601	68,039,776	67,049,279
December	122,896,697	65,988,474	79,238,716
Total for 1911	1,431,938,338	709,611,945	754,932,733
January 1912	119,337,753	62,343,901	80,167,904
February	116,035,809	56,228,368	63,148,096
March	125,694,601	67,847,556	58,779,566
April	125,694,001	69,513,846	53,252,326
May	126,737,836	72,702,237	69,485,945

LEAD

Lead is quoted ordinarily in cents per pound or dollars per hundred pounds delivered at St. Louis or New York. The difference is normally 15c. per hundred pounds, and any larger or smaller difference is promptly met by sales. The daily price in New York is published each week in this column. Below are the average quotations by months:

	1911.	1912.		1911.	1912.
Jan.	4.48	4.43	July	4.50	....
Feb.	4.44	4.03	Aug.	4.50	....
Mch.	4.39	4.07	Sept.	4.48	....
Apr.	4.41	4.20	Oct.	4.27	....
May	4.37	4.20	Nov.	4.30	....
June	4.34	4.40	Dec.	4.45	....

ZINC

Zinc is quoted as spelter, standard Western brands, and based upon St. Louis or New York delivery. While New York quotations, as a matter of convenience, are commonly used, relatively little spelter actually goes to or comes from New York. The bulk is shipped direct from the plants in the Mississippi Valley to manufacturers, due allowance being made for freight. New York daily quotations are published in this column each week. Below are given averages by months:

	1911.	1912.		1911.	1912.
Jan.	5.45	6.42	July	5.70	....
Feb.	5.52	6.50	Aug.	5.95	....
Mch.	5.56	6.57	Sept.	5.86	....
Apr.	5.40	6.63	Oct.	6.10	....
May	5.35	6.68	Nov.	6.38	....
June	5.50	6.84	Dec.	6.30	....

Zinc-dust is quoted separately, the price being based upon the cost of spelter in Illinois and the cost of preparation. About half the zinc-dust used in the United States is imported through San Francisco. Delivery prices are determined largely by quantities and contracts.

QUICKSILVER

The primary market for quicksilver is San Francisco, California, being the largest producer. The price is fixed in the open market, and, as quoted weekly in this column, is that at which moderate quantities are sold. Buyers by the carload can usually obtain a slight reduction, and those wanting but a flask or two must expect to pay a slightly higher price. Average monthly quotations, in dollars, per flask of 75 lb., are given below:

	1911.	1912.		1911.	1912.
Jan.	44.60	43.75	July	48.00	....
Feb.	48.40	46.00	Aug.	50.00	....
Mch.	52.50	46.00	Sept.	47.50	....
Apr.	50.90	42.25	Oct.	46.12	....
May	46.50	41.75	Nov.	45.50	....
June	46.50	41.30	Dec.	44.50	...

TIN

New York prices control in the American market for tin, since the metal is almost entirely imported. San Francisco quotations, averaging about 5c. per lb. higher than New York, are quoted weekly in this column. Below are given average monthly New York quotations in cents per pound:

	1911.	1912.		1911.	1912.
Jan.	41.25	42.53	July	42.40	....
Feb.	41.61	42.96	Aug.	43.32	....
Mch.	40.16	42.58	Sept.	39.75	....
Apr.	42.18	43.92	Oct.	41.18	....
May	43.11	46.05	Nov.	43.12	....
June	44.61	45.40	Dec.	44.65	....

Current Prices For Chemicals

(Corrected monthly by Braun-Knecht-Heimann Co.)

Prices quoted are for ordinary quantities in packages as specified. For round lots lower prices may be expected, while in smaller quantities advanced prices are ordinarily charged. Prices named are subject to fluctuation. Other conditions govern Mexican and foreign business.

	Min.	Max.
Acid, sulphuric, com'l, 66°, drums, ℔ 100 lb	$0.75	$1.00
Acid, sulphuric, com'l, 66°, carboy, ℔ 100 lb	1.00	1.50
Acid, sulphuric, C. P., 9-lb. bottle, bbl., ℔ lb	0.13	0.18
Acid, sulphuric, C. P., bulk, carboy, ℔ lb	0.09½	0.12
Acid, muriatic, com'l, carboy, ℔ 100 lb	1.60	3.00
Acid, muriatic, C. P., 6-lb. bottle, bbl., ℔ lb	0.15	0.20
Acid, muriatic, C. P., bulk, carboy, ℔ lb	0.10½	0.15
Acid, nitric, com'l, carboy, ℔ 100 lb	5.25	6.50
Acid, nitric, C. P., 7-lb. bottle, bbl., ℔ lb	0.16	0.22
Acid, nitric, C. P., bulk, carboy, ℔ lb	0.12½	0.15
Argols, ground, bbl., ℔ lb	0.20	0.25
Borax, cryst. and conc., bags, ℔ 100 lb	2.75	3.85
Borax, powdered, bbl., ℔ 100 lb	3.00	4.00
Borax glass, gd. 30 mesh, cases, tin lined, ℔ 100 lb	10.00	13.00
Bone ash, 60 to 80 mesh, bbl., ℔ 100 lb	4.50	5.50
Bromine, 1-lb. bottle, ℔ lb	0.55	0.65
Candles, adamantine, 12 oz., 40 sets, ℔ case	3.50	4.15
Candles, adamantine, 14 oz., 40 sets, ℔ case	4.00	4.55
Candles, Stearic, 12 oz., 40 sets, ℔ case	4.95	5.50
Candles, Stearic, 14 oz., 40 sets, ℔ case	4.65	5.20
Clay, domestic fire, sack, ℔ 100 lb	1.50	2.00
Cyanide, 98 to 100%, 100-lb. case, ℔ lb	0.20¾	0.24¾
Cyanide, 98 to 100%, 200-lb. case, ℔ lb	0.20	0.24
Cyanide, 129%, 100-lb. case, ℔ lb	0.27½	0.28½
Cyanide, 129%, 200-lb. case, ℔ lb	0.26¾	0.27½
Lead acetate, brown, broken casks, ℔ 100 lb	8.75	9.65
Lead acetate, white, broken casks, ℔ 100 lb	10.00	10.25
Lead acetate, white, crystals, ℔ 100 lb	11.75	12.25
Lead, C. P., test., gran., ℔ 100 lb	13.00	15.00
Lead, C. P., sheet, ℔ 100 lb	15.00	18.00
Litharge, C. P., silver free, ℔ 100 lb	10.50	13.00
Litharge, com'l, ℔ 100 lb	7.50	9.00
Manganese ox., blk., dom. in bags, ℔ ton	20.00	25.00
Manganese ox., blk., Caucasian, in casks, ℔ ton (85% MnO_2—½% Fe)	42.50	50.00
Nitre, double ref'd, small cryst., bbl., ℔ 100 lb	7.00	8.00
Nitre, double ref'd, granular, bbl., ℔ 100 lb	6.50	7.50
Nitre, double ref'd, powdered, bbl., ℔ 100 lb	7.25	8.00
Potassium bicarbonate, cryst., ℔ 100 lb	12.00	15.00
Potassium carbonate, calcined, ℔ 100 lb	15.00	18.00
Potassium permanganate, drum, ℔ lb	0.11	0.12½
Silica, powdered, bags, ℔ lb	0.03	0.05
Soda, carbonate (ash), bbl., ℔ 100 lb	1.50	1.75
Soda, bicarbonate, bbl., ℔ 100 lb	2.00	2.50
Soda, caustic, ground, 98%, bbl., ℔ 100 lb	3.15	3.50
Soda, caustic, solid, 98%, drums, ℔ 100 lb	2.65	2.85
Zinc shavings, 850 fine, bbl., ℔ 100 lb	11.80	13.00
Zinc sheet, No. 9—18 by 84, drum, ℔ 100 lb	10.00	11.25

Current Prices for Ores and Minerals

(Corrected monthly by Atkins, Kroll & Co.)

The prices are approximate, subject to fluctuation, and to variation according to quantity, quality, and delivery required. They are quoted, except as noted, f.o.b. San Francisco. Buying prices marked *.

	Min.	Max.
Antimony ore, 50%, ℔ ton	*$20.00	$22.50
Arsenic, white, refined, ℔ lb	0.04	0.04½
Arsenic, red, refined, ℔ lb	0.08	0.09
Asbestos, according to length and quality of fibre, ℔ ton	100.00	350.00
Asbestos, lower grades, ℔ ton	5.00	50.00
Asphaltum, refined, ℔ ton	10.00	20.00
Barium carbonate, precipitated, ℔ ton	42.50	45.00
Barium chloride, commercial, ℔ ton	42.50	45.00
Barium sulphate (barytes), prepared, ℔ ton	20.00	30.00
Bismuth ore, 10% upward, ℔ ton	*75.00	upward
Chrome ore, according to quality, ℔ ton	10.00	12.50
China clay, English, levigated, ℔ ton	15.00	20.00
Cobalt metal, refined, f. o. b. London, ℔ lb	2.50	
Coke, foundry, ℔ 2240 lb	13.50	15.00
Diamonds:		
Borts, according to size and quality, ℔ carat	2.00	15.00
Carbons, according to size and quality, ℔ carat	50.00	90.00
Feldspar, ℔ ton	5.00	25.00
Firebrick:		
Bauxite, ℔ M	175.00	
Magnesite, ℔ M	190.00	275.00
Silica, ℔ M	42.50	47.50
Flint pebbles for tube-mills, ℔ 2240 lb	19.50	22.50
Fluorspar, ℔ ton	10.00	15.00
Fullers earth, according to quality, ℔ ton	20.00	30.00
Gilsonite, ℔ ton	35.00	40.00
Graphite:		
Amorphous, ℔ lb	0.01½	0.02½
Crystalline, ℔ lb	0.04	0.13
Gypsum, ℔ ton	7.50	10.00
Infusorial earth, ℔ ton	10.00	15.00
Magnesite, crude, ℔ ton	5.00	7.50
Magnesite, dead calcined, ℔ ton	23.50	27.50
Magnesite, brick (see firebrick).		
Manganese ore, oxide, crude, ℔ ton	10.00	25.00
Manganese, prepared, according to quality, ℔ ton	30.00	70.00
Mica, according to size and quality, ℔ lb	0.05	0.30
Molybdenite, 95% MoS_2, ℔ ton	400.00	500.00
Monazite sand (5% thoria), ℔ ton	150.00	200.00
Nickel metal, refined, ℔ lb	0.45	0.60
Ochre, extra strength, levigated, ℔ 100 lb	2.25	3.25
Platinum, native, crude, ℔ oz	40.00	45.00
Silex lining for tube-mills ℔ 2240 lb	32.50	35.00
Sulphur, crude, ℔ ton	15.00	25.00
Sulphur, powdered, ℔ ton	40.00	45.00
Talc, prepared, according to quality, ℔ ton	20.00	50.00
Tin ore, 60%, ℔ ton	450.00	475.00
Tungsten ore, 65%	390.00	455.00
Vanadium ore, 15%, ℔ ton	150.00	180.00
Wolframite (see tungsten ore).		
Zinc ore, 50 % up, ℔ ton	*15.00	20.00

Company Reports

SILVER KING COALITION MINES COMPANY

This company was formed in 1902 to acquire 327 patented mining claims, covering 2158 acres, in the Park City district, Utah. Thomas Kearns is general manager. During the year ended April 30, 1912, 107,893 tons of ore was mined, of which 86,387 was concentrated, producing 14,106 tons of concentrate, a ratio of concentration of 6.12 into 1. Details of production follow:

Product.	Dry Tons.	Lead, lb.	Silver, oz.	Gold, oz.
Crude ore	21,506	12,194,390	1,076,711	1185
Concentrate	14,106	9,661,137	715,367	1174
Totals	35,612	21,855,527	1,792,078	2359

Sold for $1,269,827.03.

Average assay value per ton:

	Lead, %.	Silver, oz.	Gold, oz.
Crude ore	28.35	50.06	0.0551
Concentrate	34.24	50.71	0.0833

The total receipts amounted to $1,277,638, and the expenditure to $694,410, leaving an operating profit of $583,018. The assets of the company are valued at $6,768,250, and the company is capitalized at $6,250,000. During the year the company, jointly with the Daly-Judge and Daly West Mining Co. purchased 700 acres of land and constructed an impounding dam for mill tailing. The entire flow of Silver creek is conducted through a concrete flume to the dam, and the outflow is thoroughly settled before being allowed to escape. This will free these companies from the litigation which has harassed them in the past. The judgment which the Silver King Consolidated Mining Co. obtained against the Coalition company has been appealed. Several of the larger stockholders have given individual bonds covering the judgment, and meanwhile the earnings of the company are being set aside for the protection of the bondsmen. Development during the past year has explored the Uintah Treasure Hill and has connected the stopes on the Crescent vein with the apex. This latter work has proved the apex, discovered new orebodies, and provided additional ventilation and means of exit. The mill, sampler, and tramway are now operated by electric power, and operating costs have been materially reduced because of this, the improved ventilation, and the use of hammer-drills in stoping.

BRAKPAN MINES, LIMITED

This company was formed in 1903 to acquire mining rights from the Transvaal Coal Trust Co., Ltd., of which it is a subsidiary. The authorized capital is £750,000, in shares of £1 each, all being issued. Details of operation for the year, as given in the report by W. L. Honnold, the consulting engineer, are as follows:

At the end of the year 241,204 tons had been milled, the average recovery being 27s. 6.58d. per ton as against an average working cost of 18s. 4.16d. These figures were influenced by a number of abnormal circumstances incidental to starting, chief among which were: (1) the initial absorption of gold by the plates, tube-mills, and cyanide works, estimated, owing to the influence of the Merrill and Butters processes, at only about 2400 oz.; (2) partial extraction of the gold contained in about 11,000 tons of sand and slime representing the current stock of the cyanide plant; (3) higher cyanide residues than now obtain; (4) the inclusion of 31,300 tons of accumulated dump ore, the first 16,500 tons of which came from the preliminary opening of stopes and were therefore presumably of about average grade, the remainder coming from the development dump and averaging probably not over half the value of stope ore; (5) an underestimate of tonnage during the first months of milling, due to certain factors not then having been definitely determined; this was partly offset by imperfect sorting in August.

The net significance of the abnormal circumstances justifies the conclusion that, had operations been on the basis since established, and had the ore from current development been normal as to quantity and value, the recovery would have been at least 6d. per ton higher than shown. The working cost of 18s. 3d. per ton reached in December is open to further reduction. To what extent, is a matter of considerable uncertainty. Development for the year totaled 10,675 ft., averaging for the 9701 ft. on ore 10.07 dwt. over 32.89 in. The ore reserve was re-estimated in the light of milling experience, and is returned at a somewhat lower tonnage but higher value, namely, 1,925,346 mine tons at 6.73 dwt., as against 2,035,108 tons at 6.62 dwt. at the beginning of milling. The altered position, apart from the influence of milling and new development, is mainly due to the elimination of certain previously included low-grade narrow areas which, in view of work since done, as well as because of the limitations of machine mining, now looks less promising. Detailed sampling of the stope faces as they have been advanced points to the gold in some sections of the mine being so distributed as to permit of selective mining to a greater extent than was at first thought practicable.

With regard to the underground position, it seems probable that the system followed in laying out the mine will provide the advantages anticipated. In the matter of development it has so far resulted in the opening of an area measuring at extreme points 2800 ft. along the strike by 6600 ft. in the direction of the dip, this area being centrally situated and affording an uncommon degree of evidence as to the nature and future of the property. From this area development can now be simultaneously extended in four directions, and at as many points as circumstances may call for. It should be borne in mind, however, that with levels placed so far apart as is permissible in the case of a flat-lying mine such as Brakpan, more time is required to render a certain developed tonage effective as to stoping than in a mine having closely spaced levels. Perhaps equal effectiveness in this respect will never be realized. Furthermore, it is probable that with the ore reserve developed in such large blocks it would be difficult, until a surplus of stopes were available, to maintain the regularity of output heretofore aimed at on the Rand.

These restrictions, however, quite apart from their more or less transitory bearing, seem relatively unimportant in view of the fact that, for a given expenditure on development, a much more comprehensive and, on the whole, more stable position is secured, as well as certain advantages from the standpoint of working. In the matter of breaking and handling ore it has been necessary, in face of the somewhat unusual conditions which prevail, to adopt certain methods not commonly in practice here. The application of these called for and still calls for a guarded but to some extent experimental attitude. Much progress has been made, however, and it now seems that the initial difficulties will prove of even less importance than anticipated. A point of notable significance is that, owing mainly to the comparatively large reef width and favorable dip conditions, it has been found practicable to utilize machine-drills to a much greater extent than expected, thus relieving an otherwise serious labor shortage.

The equipment promises to fully meet expectations. More time will be required, however, before a definite statement will be possible as to the advantages of its various features, particularly those involving a departure from previous practice.

Capital expenditure has exceeded expectations to about £50,000, say 4½% of the amount involved. This is due partly to the fact that at the earlier date construction was at a stage which precluded exact analysis, partly to the delay in starting milling, and partly to certain unforeseen requirements, more particularly the additional compressed air and machine-drill equipment called for in consequence of the recognition that only by adopting machine mining to an almost exclusive extent could the best results be secured from the labor available.

Book Reviews

Any of the books noticed in this column are for sale by, or can be procured from, the MINING AND SCIENTIFIC PRESS.

HOW TO LIVE IN TROPICAL AFRICA. By J. Murray, M.D. Second edition. Pp. 315. Ill. *The African World,* London, 1912. For sale by the *Mining and Scientific Press.* Price $1.40.

This volume, published by *The African World,* will be of great service and convenience to engineers who may be called upon to visit tropical countries for longer or shorter periods. Much has been written concerning sanitation and hygiene in tropical countries, but the material is widely scattered, and the engineer who is called upon to 'brush up' on these problems will be grateful to Dr. Murray for so concise and comprehensive a summary. The book is not a mere manual of direction, but briefly and lucidly discusses underlying principles, and will be correspondingly serviceable to engineers in other countries than Africa. Much of the information is, indeed, of general service, and the book will be a useful addition to any engineer's library.

PRINCIPLES OF INSURANCE. By W. F. Gephardt. Pp. 313. The Macmillan Company, New York, 1911. For sale by the *Mining and Scientific Press.* Price $1.60.

Social development is gradually making insurance a prime factor of modern life. The growth of insurance companies, spread of fraternal and benefit associations, and, more recently, the expansion of liability insurance, have made it desirable that the ordinary citizen should be possessed of an elementary knowledge of the fundamentals of insurance. But even the policy-holders of insurance companies usually are devoid of any clear conceptions of the principles of insurance, nor are agents usually able to inform them, as their attention is devoted to securing applicants rather than enlightening them. Mr. Gephardt, who is an assistant professor in Ohio State University and a former insurance salesman, writes lucidly for students and general readers, who will be grateful to him for his clear exposition of the theory of life insurance; mortality tables; the selection of lives; the company; the premium; policies; reserve, surplus, and dividends; investments and interests; the relation of the state to insurance; insurance for the wage-earner; and accident and health insurance. The volume concludes with a brief bibliography of insurance which will be useful to those who may wish to push their study of the matter further. The chapter on insurance for the wage-earner contains an excellent discussion on employers' liability, both in America and abroad, and of pension systems, which will be of much service to all employers of labor. The book is marred by crudities of expression, such as the use of 'expressively' for expressly, and the obsolete form 'invalidity' for invalidism, but is readable, nevertheless, and is likely to be widely appreciated.

ANNUAL TABLES OF CONSTANTS AND NUMERICAL CHEMICAL, PHYSICAL, AND TECHNOLOGICAL. By the International Committee of the Seventh Congress of Applied Chemistry. Pp. 727. No index. The University of Chicago Press, Chicago, 1912. For sale by the *Mining and Scientific Press.* Price $6.54 postpaid.

This ponderous volume, replete with data, is the fruit of the efforts of the committee appointed by the Seventh Congress of Applied Chemistry at London in 1909. It has been prepared under the patronage of the International Association of Academics, by a group of over thirty of the best known physical and applied chemists of Germany, France, and England, and is published simultaneously in Paris, Leipzig, London, and Chicago. The volume issues under the date of 1910, but, on account of the necessary labor of preparation, the appearance of the volume has been much delayed. For this reason the index has been omitted, the omission having been partly supplied by the usual French analytical table of contents, which the American reader commonly does not find to be of much service. The amount of care taken in preparing the tables may be inferred from the fact that postcards are enclosed with each volume so that readers may report at once any error that may be detected. The introduction and chapter headings are given in French, German, English, and Italian, but the tables are in French, the language most likely to be easily intelligible to the other nationalities, though the tables might have been improved by departing from Continental usage, such, for example, as the use of the comma for the decimal point. The tables are unusually complete, covering all the most important physical and chemical constants of the elements and their compounds and alloys. The volume is bulky, and it might be wise in succeeding issues to divide it into several parts. An illumination engineer would be grateful for the tables on radiation and reflecting power, but would care nothing about colloids and vapor pressures. Considering its size, the book is very cheap; a valuable feature, since it is scarcely worth while to prepare tables and publish them in so expensive a form that few will feel able to afford them. The volume will be a welcome one to chemists and physicists, and is likely to quickly create a place for itself.

DESIGN OF MILL STRUCTURES. By Milo S. Ketchum. Pp. 459. Ill, index. McGraw-Hill Book Co., New York, 1912. For sale by the *Mining and Scientific Press.* Price $4.

This is a new book in a field never previously covered in any satisfactory manner. The author is a professor in the University of Colorado, and an experienced writer as well as engineer. While the book is supplementary to his 'Design of Steel Mill Buildings' and 'Design of Walls, Bins, and Grain Elevators,' it is self-contained, and is comprehensive.

The general description of the various 'Hoisting Arrangements and Methods,' up to page 21, with examples from actual existing works, is clearly and ably given and covers the subject in a very instructive manner. The subject of 'Hoisting Ropes,' to page 28, details of 'Cages and Skips,' to page 40, are also fully described, and clearly shown in the illustrations. The 'Stresses of Head-frames and Structures,' from page 41 to page 91, are explained and demonstrated thoroughly. The subject is treated in every detail, and is such as will enable the designing engineer to follow the formulæ in making standard calculations. The descriptions of the various head-frames, to page 147, are clear and explicit. The illustrations are complete and amply cover the many types used in good practice. 'Coal Tipples,' to page 197, also are clearly illustrated and described, and the ones chosen form a good typical collection.

The chapter on design of roof trusses, to page 240, while being a reprint from some of Mr. Ketchum's other works, is valuable and makes the chapter on 'Graphics and Calculations' clear and complete in itself. The design of bins and retaining walls, to page 278, is concise, interesting, and complete, explaining the necessary calculations fully. The discussion of 'Coal Washers,' to page 290, is good, fully described, and contains typical illustrations, as is also true of 'Coal Breakers,' to page 305. 'Miscellaneous Structures,' to page 316, covers construction used in mine structures.

Many of the tables in the chapter on 'Design, Costs, and Tables,' to page 371, are new and useful, and the part on 'Specifications' covers the subject fully and is excellent reference in making specifications for any detailed requirement. The various subjects described and illustrated are all based on good practical working plants, and make them particularly valuable reference. The compilation is the best that I have seen; in fact, I do not know of any other book that supplies such information, and treats the subject of mine structures—especially of head-frames—in one volume. The author should be highly commended for producing so useful a book. T. C.

Recent Publications

THE PREVENTION OF THE POLLUTION OF CANADIAN SURFACE WATERS. By T. Aird Murray. 24 pp. Ottawa, 1912.

MAP 14A, PROVINCE OF NOVA SCOTIA, KINGS COUNTY. (Hall Harbour sheet, No. 99.) Canada Department of Mines, 1910.

THE PRESERVATION OF MINE TIMBERS. By E. W. Peters. Forest Service. Bull. 107. 27 pp.; ill., maps, index. Washington, May 1912.

MAP 13A, PROVINCE OF NOVA SCOTIA, HANTS AND KINGS COUNTIES. (Kingsport sheet, No. 84.) Canada Department of Mines, 1911.

MINERALOGICAL NOTES, SERIES 2. By Waldemar T. Schaller. U. S. Geol. Surv. Bull. 509. 115 pp.; ill., tables, index. Washington, 1912.

THE BIRDS OF THE ROSEBUD INDIAN RESERVATION, SOUTH DAKOTA. By Albert B. Regan. From *The Auk,* Vol. XXV, No. 4. 6 pp. Washington, 1908.

UNPRODUCTIVE BLACK SOILS. Purdue University Agricultural Experiment Station. Bull. No. 157, Vol. XVI. 39 pp.; ill., tables. Lafayette, May 1912.

COMMERCIAL FERTILIZERS. Purdue University Agricultural Experiment Station. Bull. No. 156. Vol. XVI. 97 pp.; tables, map. Lafayette, April 1912.

PRODUCTION OF CHROMIC IRON ORE IN 1911. By W. C. Phalen. Advance chapter from 'Mineral Resources of the U. S., 1911.' 10 pp. Washington, 1912.

THE PROGRESS OF THE MINERAL INDUSTRY OF TASMANIA FOR THE QUARTER ENDING MARCH 31, 1912. By W. H. Wallace. 13 pp.; tables. Tasmania, 1912.

LIMING THE SOIL. By John B. Abbott. Purdue University Agricultural Experiment Station. Circular No. 33. 16 pp.; ill., map. Lafayette, February 1912.

THE GABBROS AND ASSOCIATED ROCKS AT PRESTON, CONNECTICUT. By G. F. Loughlin. 158 pp.; ill., maps, index. U. S. Geol. Surv. Bull. 492. Washington, 1912.

MEMOIR OF SAMUEL FRANKLIN EMMONS. By Arnold Hague. Reprinted from the *Bulletin* of the Geological Society of America, Vol. 23. Pp. 12-28. March 14, 1912.

GEOLOGY AND MINERAL RESOURCES OF THE PEORIA QUADRANGLE, ILLINOIS. By J. A. Udden. U. S. Geol. Surv. Bull. 506. 103 pp.; ill., maps, index. Washington, 1912.

REPORT OF THE DEPARTMENT OF SANITATION OF THE ISTHMIAN CANAL COMMISSION FOR THE MONTH OF MARCH, 1912. By W. C. Gorgas. 50 pp.; tables, index. Washington, 1912.

TIN RESOURCES OF ALASKA. By Frank L. Hess. Advance chapter from Bulletin 520, 'Mineral Resources of Alaska, 1911.' U. S. Geol. Surv. Bull. 520-B. 6 pp. Washington, 1912.

SPEECH OF HON. JOHN D. WORKS OF CALIFORNIA IN THE SENATE OF THE UNITED STATES TO ESTABLISH AN INDEPENDENT HEALTH SERVICE. 78 pp. Washington, April 29 and 30, 1912.

GAS ANALYSIS AS AN AID IN FIGHTING MINE FIRES. By George A. Burrell and Frank M. Seibert. Bureau of Mines. Technical Paper 13. 16 pp.; ill., tables, index. Washington, 1912.

THE GYPSUM INDUSTRY IN 1911. By Ernest F. Burchard. Advance chapter from 'Mineral Resources of the U. S., 1911.' U. S. Geol. Surv. 8 pp.; tables. Washington, 1912.

ANNUAL REPORT OF THE MINERAL PRODUCTION OF CANADA DURING THE CALENDAR YEAR 1910. By John McLeish. Canada Department of Mines. 328 pp.; tables, index. Ottawa, 1912.

ANNUAL REPORT OF THE DIRECTORS OF AMERICAN TELEPHONE & TELEGRAPH CO. TO THE STOCKHOLDERS FOR THE YEAR ENDING DECEMBER 31, 1911. 51 pp.; ill., maps. New York, 1912.

THE MINERAL PIGMENTS OF PENNSYLVANIA. By Benjamin L. Miller. Topographic and Geologic Survey of Pennsylvania. Report No. 4. 101 pp.; ill., maps, index. Harrisburg, 1911.

THE MINERALS OF TONOPAH, NEVADA. By Arthur S. Eakle. 22 pp.; ill., index. University of California Publications. Bull. of the Department of Geology. Berkeley, May 17, 1912.

REPORT OF THE STATE GEOLOGIST ON THE IRON ORES OF MARSHALL AND BENTON COUNTIES MADE TO THE GEOLOGICAL COMMISSION. Mississippi State Geol. Surv. 23 pp. Jackson, 1912.

THE PRODUCTION OF ABRASIVE MATERIALS IN 1911. By W. C. Phalen. Advance chapter from 'Mineral Resources of the U. S., 1911.' U. S. Geol. Surv. 22 pp.; tables. Washington, 1912.

THE PRODUCTION OF PHOSPHATE ROCK IN 1911. By F. B. Van Horn. Advance chapter from 'Mineral Resources of the U. S., 1911.' U. S. Geol. Surv. 14 pp.; tables. Washington, 1912.

THE EFFECTS OF COLD WEATHER UPON TRAIN RESISTANCE AND TONNAGE RATING. By Edward C. Schmidt and F. W. Marquis. University of Illinois Bulletin No. 59. 25 pp.; ill. Urbana, 1912.

RESULTS OF CO-OPERATIVE FERTILIZER TESTS ON CLAY AND LOAM SOILS. Purdue University Agricultural Experiment Station. Bull. No. 155, Voy. XVI. 34 pp.; ill., tables. Lafayette, April 1912.

PROTEST AGAINST FURTHER DIVERSION OF WATER FROM LAKE MICHIGAN FOR THE CHICAGO DRAINAGE CANAL. Presented at Washington by Commission of Conservation of Canada. 27 pp.; maps.

THE PRODUCTION OF FULLER'S EARTH IN 1911. By Jefferson Middleton. Advance chapter from 'Mineral Resources of the U. S., 1911.' U. S. Geol. Surv. 7 pp.; tables. Washington, 1912.

QUANTITY AND QUALITY OF CREOSOTE FOUND IN TWO TREATED PILES AFTER LONG SERVICE. By E. Bateman. Forest Service. Circular 199. 8 pp.; ill., tables, index. Washington, May 22, 1912.

DETERIORATION AND SPONTANEOUS HEATING OF COAL IN STORAGE. A preliminary report by Horace C. Porter and F. K. Ovitz. Bureau of Mines. Technical Paper 16. 14 pp.; index. Washington, 1912.

COAL ON DAN RIVER, NORTH CAROLINA. By R. W. Stone. Advance chapter from Bull. 471, 'Contributions to Economic Geology, 1910, Part II.' U. S. Geol. Surv. Bull. 471-B. 35 pp.; map, index. Washington, 1912.

THE GEOLOGY OF THE DUN MOUNTAIN SUBDIVISION, NELSON. By James Mackintosh Bell, Edward de Courcy Clarke, and Patrick Marshall. Department of Mines. Bull. No. 12. 71 pp.; ill., maps, index. Wellington, 1911.

STATISTICS OF THE POTTERY INDUSTRY IN THE UNITED STATES IN 1911. By Jefferson Middleton. Advance chapter from 'Mineral Resources of the U. S., 1911.' U. S. Geol. Surv. 11 pp.; tables. Washington, 1912.

AN INVESTIGATION OF THE COALS OF CANADA WITH REFERENCE TO THEIR ECONOMIC QUALITIES. Vol. II. By J. B. Porter and R. J. Durley. Canada Department of Mines. 194 pp.; ill., tables, maps, index. Ottawa, 1912.

GEOLOGIC INVESTIGATIONS ALONG THE CANADA-ALASKA BOUNDARY. By A. G. Maddren. Advance chapter from Bulletin 520, 'Mineral Resources of Alaska, 1911.' U. S. Geol. Surv. Bull. 520-K. 20 pp. Washington, 1912.

ALUNITE IN THE SAN CRISTOBAL QUADRANGLE, COLORADO. By Esper S. Larsen. Advance chapter from Bull. 530, 'Contributions to Economic Geology, 1911, Part I.' U. S. Geol. Surv. Bull. 530-F. 7 pp. Washington, 1912.

LIGNITE IN THE FORT BERTHOLD INDIAN RESERVATION, NORTH DAKOTA, NORTH OF MISSOURI RIVER. By Max A. Pishel. Advance chapter from Bulletin 471, 'Contributions to Economic Geology, 1910, Part II.' U. S. Geol. Surv. Bull. 471-C. 19 pp.; maps, plates. Washington, 1912.

Concentrates

Most of these are in reply to questions received by mail. Our readers are invited to ask questions and give information dealing with the practice of mining, milling, and smelting.

TUBE-MILLS were first used for the fine grinding of ore in 1894 at the Moulton mill, at Butte, according to R. F. Abbé.

SHOOK is a term applied to the staves and head of a barrel when knocked down and bound together for shipment. Material for boxes, when packed the same way, is also termed shooks.

LITHIUM salts give to the non-luminous flame a carmine red color, which is visible as violet through a blue glass, but is obscured by a green glass, giving a distinction from potassium. LiCl is soluble in absolute or amyl alcohol, while sodium and potassium chlorides are almost insoluble.

QUICKSILVER lost in milling at the Ready Bullion mill of the Alaska United amounted to 35.5% of the total used. Practically all this was lost in the mill, the loss during retorting being less than 2% of the total. The loss per ton milled was approximately 1/15 oz., or a little over 1 oz. quicksilver per ounce of free gold recovered.

GRAPHITE imported into the United States nearly all comes from the island of Ceylon, and the United States has for many years been the principal market for this Ceylon product. Considerable amounts of graphite are also imported into the United States from Mexico, and within the last few years graphite from Korea has entered the market.

AMBLYGONITE was extensively mined in 1907 and 1908 at the Peerless mine, near Keystone, North Dakota, by Herman Reinhold, of the Western Chemical Reduction Co. of Omaha, Nebraska. The mass of amblygonite was about 20 ft. wide, was pearly white, and had one good cleavage plane. It has been worked to only a slight depth, but has produced several hundred tons of ore.

JOINTS in air-transmission lines must be carefully made so as to prevent leaks and to eliminate friction as far as possible; allowance must be made for expansion and contraction, especially if the pipe is carried above ground; pockets in the line without means of emptying the segregated moisture must be avoided, and finally, provision must be made for repairs to the pipe-line should these be necessary.

HOLMES method of riffle tables and launders employs a wide steel tray placed directly under the screen, sloping in the same direction, and fitted either with or without riffles. This steel tray, which catches the screenings, empties on to another trap sloping in the opposite direction, which in turn delivers the material on to a set of divided sluices fitted with riffles and sloping toward the stern.

STEPS by which the miner develops or constructs his title or ownership to a lode or placer claim, are by initiating a possessory right by making a discovery, completing it by acts of location and record, maintaining it from year to year by annual labor; and perfecting it to the fee-simple or absolute title after placing $500 worth of improvements upon it, by obtaining patent for it from the General Land Office at Washington, through entry and purchase at the local land office.

TAILING and dumps which have been abandoned are subject to re-location if upon unoccupied public land, but if the land is in private ownership such material belongs to the owner of the surface rights and is not open to location. Tailing from a mill which is in operation, if it escapes upon the land of other persons or upon public land, ceases to be the property of the mill-owner. Where the land belongs to another, he may claim damages and later exact a royalty for the privilege of reworking the tailing. If the tailing escapes upon public land it is open to location as a placer deposit.

BELTS should not be replaced on pulleys while they are running at high speed if long service is desired. Belts should not be used too tight, nor should the lace-holes be punched too close together, or too near the end. Two large a punch should not be used. It is cheaper to break the lacing than tear the belt, and there is no great objection to allowing the lacing to fold in the holes. Belting should not be allowed to run against the splice, and animal or mineral oil should not be used in dressing rubber belting; boiled linseed oil is best. Idlers should not be used unless absolutely necessary, as a belt running free lasts longer. A long belt should be heavier than the horse-power indicates, otherwise it will whip. A heavy belt requires a larger pulley to give the best service.

NITRATES, solid and in solution, may be detected by the use of a reagent made by treating 5 gm. zinc amalgam with a mixture of 5 c.c. HCl (1.18) and 5 c.c. of 1% solution of strychnia sulphate. Boil, cool, and decant. Of the reagent, 0.5 c.c. is added to 10 c.c. of the water to be tested. Nitrites, if present, give a red coloration at once and can be colorimetrically estimated. If 5 c.c. of H_2SO_4 is added, a coloration due to nitrates appears, which can be estimated in the same manner. If it is desired to estimate nitrates direct, add to 10 c.c. of the water 2 drops of NH_4OH, and 3 or 4 drops of acetic, and evaporate to dryness to eliminate nitrites. A repetition of this treatment may be desirable to effect complete removal. Finally, take up with 10 c.c. of water and test for nitrites as above.

ALLOYS of steel have been extensively investigated by railroads and rolling-mill operators, in order to produce a rail that will give more satisfactory service than the ordinary rail now in use. One of the principal metals used in these experiments, according to the U. S. Geological Survey, is titanium. More than 250,000 long tons of rails were rolled in 1910 from steel to which ferro-titanium had been added. More than 150,000 tons of steel rails in which nickel or nickel and chromium were used as alloy were also made during 1910, and experiments were made with about 80,000 tons of steel rails in which chromium, manganese, vanadium, and other metals were used. Certain steelmakers are now advertising titanium steel, claiming that although no titanium is left in the steel, the removal of gases and impurities effected by it greatly increases the good quality of the steel.

CHROMIUM is mainly used in pigments and in connection with special tanning processes. It is also used in furnace linings, to a small extent in steel alloys, and in the manufacture of other alloys, among which is one known as 'chromax bronze.' Though the domestic production of chromic iron ore in 1911 was small, the importations were large, amounting to 37,540 tons, valued at $407,958. In addition chromic acid and bichromate of potash were imported to the value of $3508. Chromic iron ore is widely distributed through areas of serpentine and associated basic rocks in different parts of the United States. Such areas have been found in a few localities in the old metamorphic rocks east of the Appalachian region from New England to Georgia; at various points in the Rocky Mountain region; throughout the extent of the Sierra Nevada and Coast Ranges in California, and at a few points in the Cascade mountains. It is widely disseminated through many of these areas, but only locally is it concentrated into workable deposits.

Catalogues Received

ALLIS-CHALMERS Co., Milwaukee, Wisconsin. Bulletin No. 1626, 'Hydraulic Turbines.' 8 pages. Illustrated. 8 by 10 inches.

SENN-SMITH CONCENTRATOR Co., Hearst Bdg., San Francisco. Bulletin No. 1, 'Pan Motion Concentrator.' 6 pages. Illustrated. 8½ by 6 inches.

THE LUNKENHEIMER Co., Cincinnati, Ohio. '1912 Catalogue and Price List of Engineering Specialties.' 654 pages. Illustrated. 5¼ by 7¼ inches.

CARNEGIE STEEL Co., Pittsburg, Pennsylvania. Pamphlet 'Structural Beams.' Information and data on new line of I-beam sections. 12 pages. Illustrated. 5 by 8 inches.

THE HAYWARD Co., 50 Church street, New York. Pamphlet No. 588, 'Hayward Buckets and Digging Machinery.' 8 pages. Illustrated. 6 by 9 inches.

LINK-BELT COMPANY, Chicago. Book No. 121, 'Ewart Friction Clutch.' 18 pages. Illustrated. 6 by 9 inches. Also booklet, 'Link-Belt Locomotive Cranes.' 32 pages. Illustrated. 9 by 6 inches.

THE BRISTOL Co., Waterbury, Connecticut. Catalogue No. 1000, 'Bristol Recording Gauges for Pressure and Vacuum.' 64 pages. Illustrated. 10½ by 8 inches. Also, Bulletin No. 132, 'Bristol's Recording Ammeters,' 48 pages. Bulletin No. 144, 'Bristol's Round Form Recording Pressure Gauges,' model 52, 4 pages. Bulletin No. 148, 'Bristol's Round Form Recording Pressure Gauges,' models 50 and 56, 8 pages. Bulletin No. 166, 'Bristol's Patent Automobile Time Recorder,' 4 pages. All illustrated. 10½ by 8 inches.

MERRILL METALLURGICAL Co., 143 Second St., San Francisco. Covering the Merrill Zinc Dust Precipitation Process, the Merrill Automatic Sluicing Pressure Slime Filter, and the Merrill Sluicing Clarifying Filter. Illustrated. 7½ by 11 inches. This series of catalogs is an excellent example of the high-class technical material that is now included in manufacturers' catalogs. Together the pamphlets constitute practically a manual on zinc-dust precipitation and filter-press treatment of sand and slime. Detailed figures of operating costs are given with exact data as to quantities and time. Included in the pamphlets are reprints of several excellent technical articles. The material is attractively printed, well illustrated, and the text is sound as well as excellently presented. No engineer interested in cyanidation can afford not to have a copy.

A most artistic and complete catalogue of mechanical rubber goods has recently been issued by THE DIAMOND RUBBER Co., Akron, Ohio. It consists of 160 pages. Each page is a tint-block with a halftone of the article described at the top and the product in actual service shown at the bottom. Reading matter is attractively arranged around and between the halftones. The color combination is brown and red on a black tint. It is divided into sections on 'Transmission Belt,' 'Conveyor Belt,' 'Hose,' 'Packing,' 'Moulded Goods,' 'Mats and Matting,' and 'Hard Rubber.' Also, an additional section is devoted to Diamond tires and other Diamond products. Valuable information covering data on belting, hose, packing, etc., is scattered plentifully throughout the entire book. A clever scheme is carried out in the end-sheets, which are a series of the Diamond trade-marks with the characteristic word 'Diamond' diagonally across the double-page spread. The cover is artistic. The design illustrates the wide range of industries that use Diamond products.

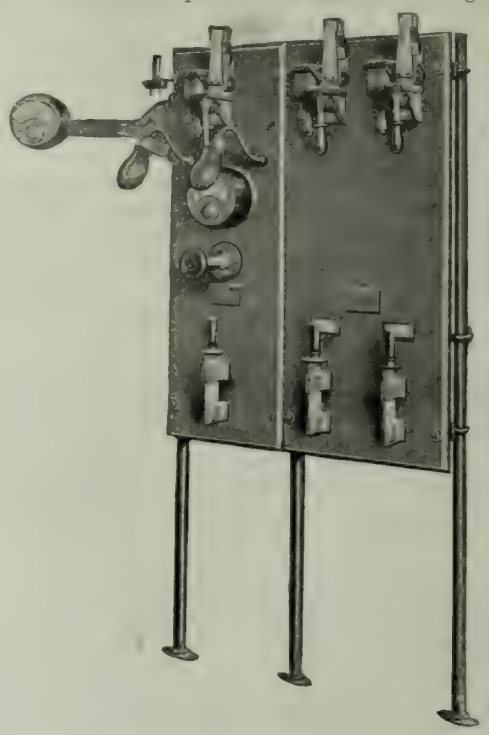
Commercial Paragraphs

J. D. HULL, Seattle, Washington, has recently accepted the agency of the Edgar Allen American Manganese Steel Co. His territory is to be the western half of the state of Washington.

ALLAN W. MARKS, formerly with De La Vergne Refrigerating Co., is now associated with H. W. Johns-Manville Co. as refrigerating engineer, with headquarters at the San Francisco office. Mr. Marks has had extensive experience in installing refrigerating plants for marine and other service.

Switch-Boards for Small Mining Plants

The equipment necessary for the control and distribution of electrical energy for small mining plants is simple, comparatively inexpensive, and in general, similar to that used in street railway systems using direct-current generators for power. Since one side of the system is grounded, the switching, protecting, and measuring apparatus is reduced to a minimum, it being necessary to take care of the generator and feeder circuits of a single polarity only. However, to obtain safe and satisfactory service, there are a few features which, if not absolutely essential, are at least advisable. The equipment should be of sturdy construction and good workmanship, and the panel supports should be insulated from ground to lessen the chance of short circuits. The circuit-breakers in the generator circuits should be connected between the negative brushes and the series field to protect the machines from grounds,



either internal or between the machine and the panel. The switching equipment should be such that when machines are run in multiple, the series field of the incoming machine may be connected in multiple with those of the running machines and the voltage adjusted before closing the main switches, as this arrangement insures the correct polarity of the incoming machine and the least disturbance in paralleling.

Often, too, in small mining plants, a separate source of power is not always available for operating the station and switchboard lamps. This may be taken care of by a lighting switch and fuses on each generator panel, using lamps of the same voltage as the generators or of lower voltage and connecting them in series. The lighting circuits should be connected between the circuit-breaker and the machine and not to the bus-bar, so that the station can be lighted from any machine before the power is thrown on the line, and also to prevent the station from being thrown in darkness should the breakers on all machines open. These points have been taken care of in a new line of 250/275 and 550/575-v. small mining plant switch-boards lately turned out by the General Electric Co. These switch-boards can be ordered direct from descriptive Bulletin No. 4877, containing illustrations, specifications, wiring diagrams, and all other necessary information.

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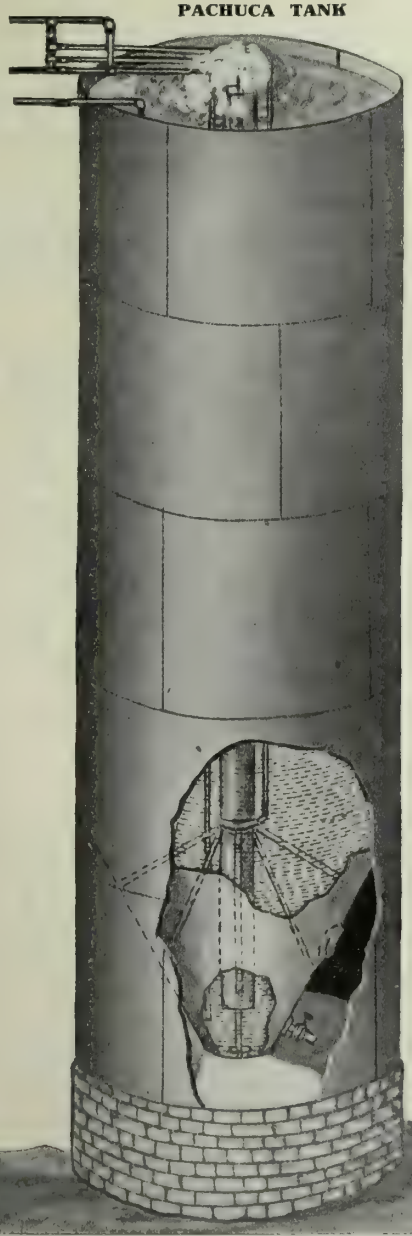

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Holding Capacity in Cubic feet	7671.2	6891.3
Holding Capacity in Metric Tons of Solids,		
Pulp ratio: Solution 2 solids 1	92.8	83.3
" 1½ " 1	139.4	125.3
" 1 " 1	155.3	139.5
Weight of steel plate and all construction		
Material in pounds	14,650	33,000
Pounds Steel per Ton of 2.1 Pulp	157	400
Pounds Air Pressure required for Agitation	8 to 10	30 to 50

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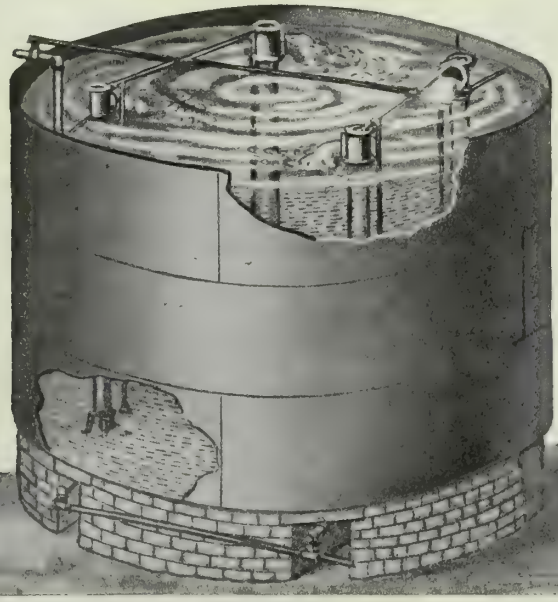

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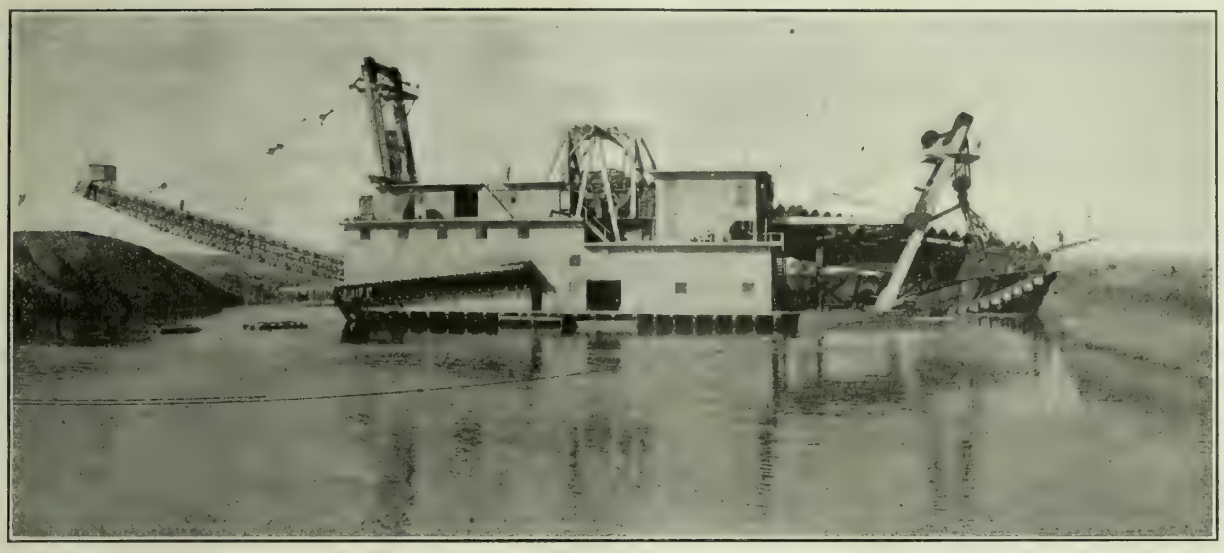

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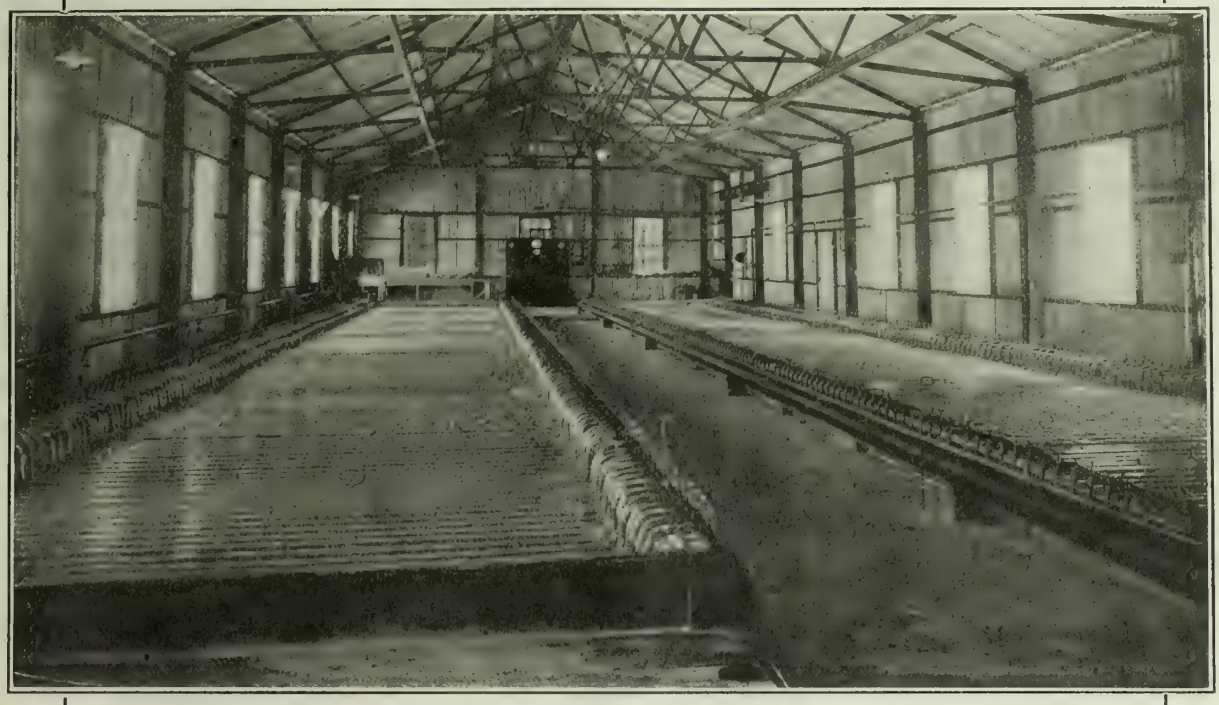

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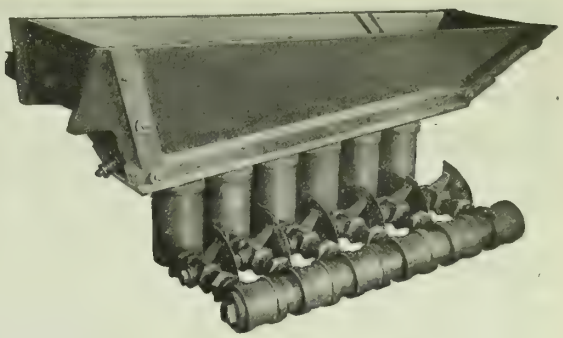

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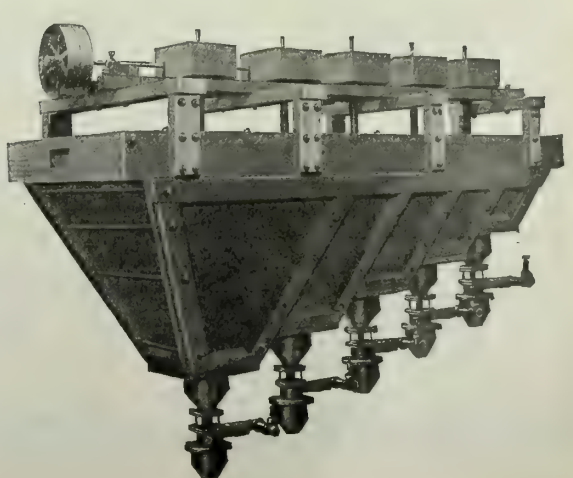

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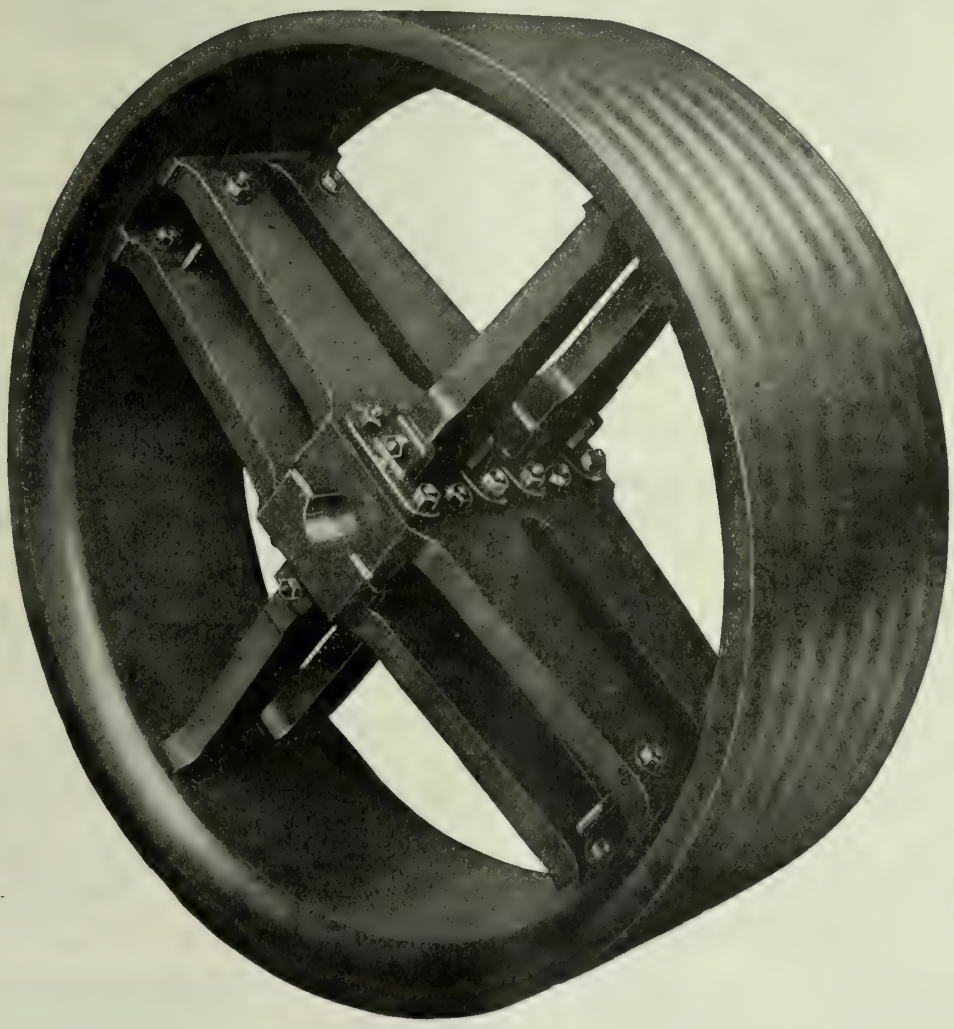

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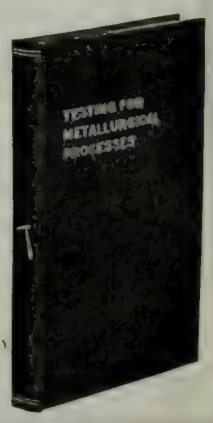

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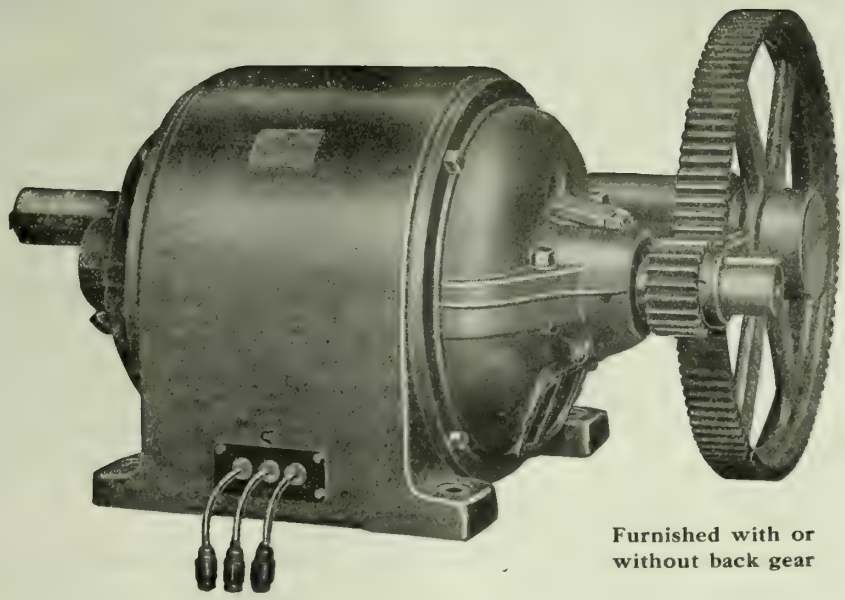

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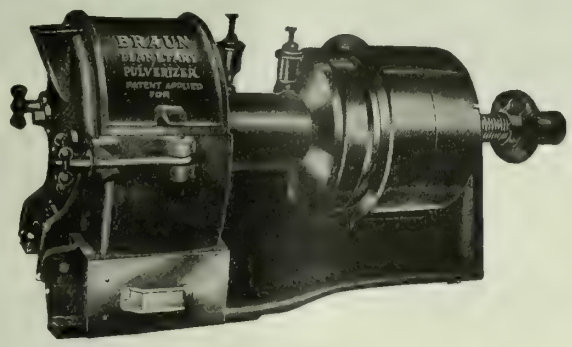

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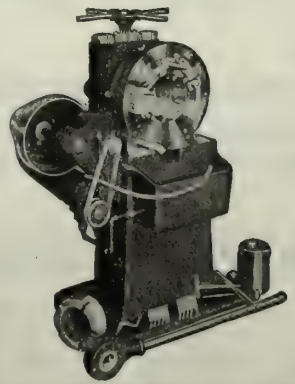

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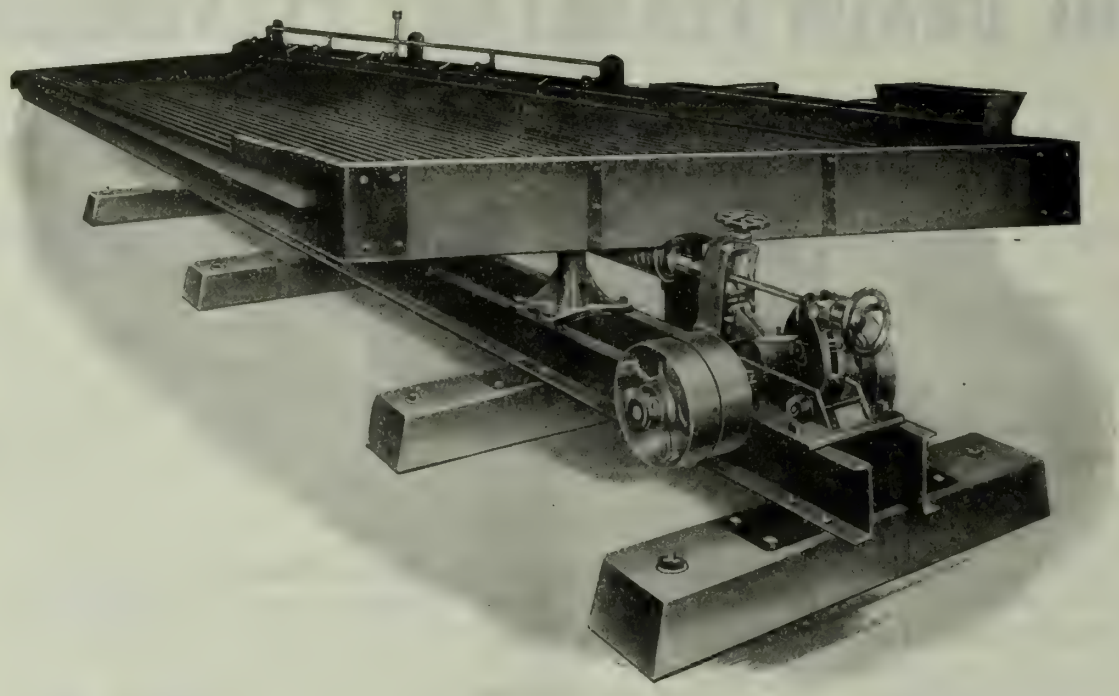

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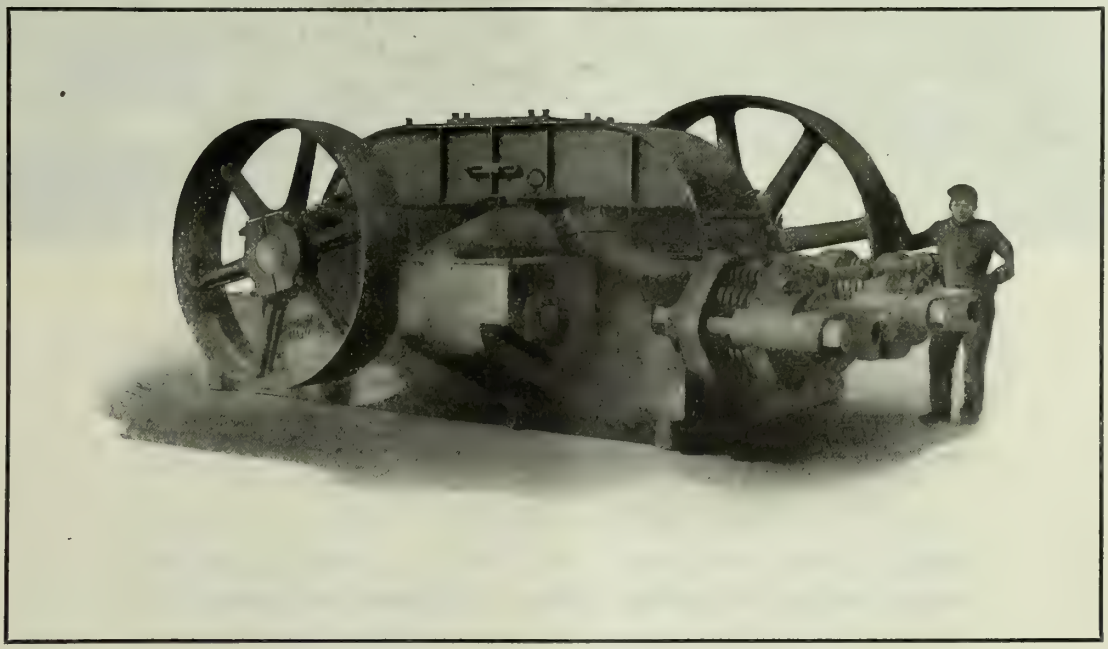

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Every piece of material which enters into their construction must first undergo a severe test and must conform to rigid specifications. This insures the use of proper materials for every part.

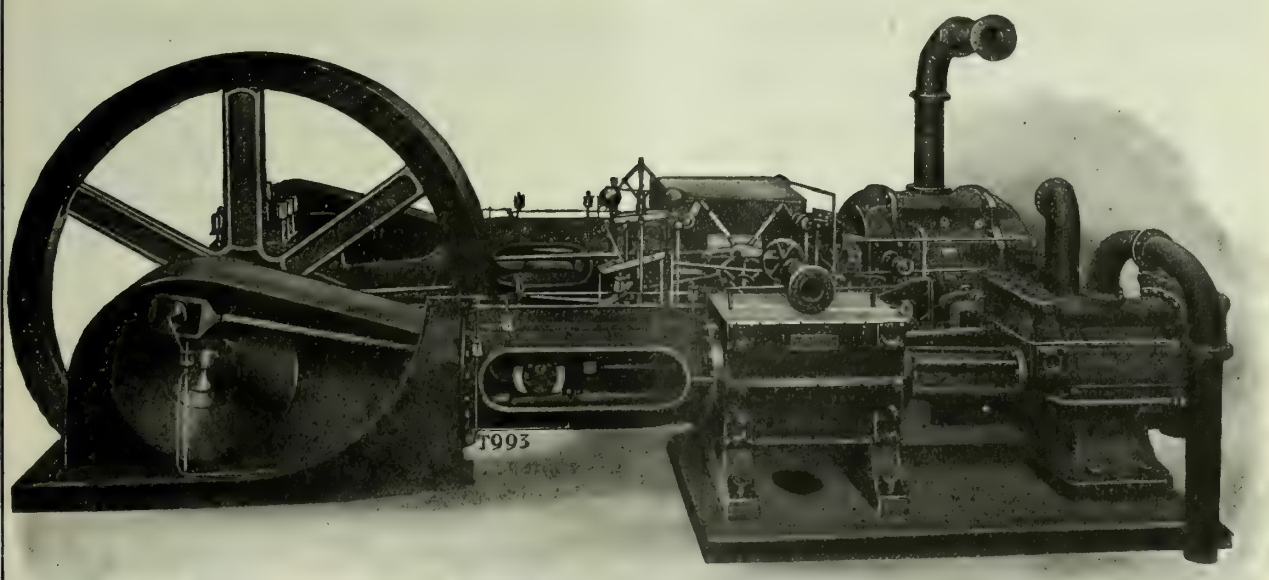
In buying a locomotive from us you get the benefit of the knowledge of engineers who make a study of locomotive requirements, the experience gained in building over 50,000 locomotives, and the guarantee of a $50,000,000 company.

AMERICAN LOCOMOTIVE COMPANY

30 CHURCH STREET, NEW YORK

McCormick Building, Chicago
Dominion Express Building, Montreal, Canada
N. B. Livermore & Co., Los Angeles—San Francisco—Seattle—Portland, Oregon

L. D. G. Heavy Duty Compressors



Cross Compound Two Stage Corliss Compressor Installed at Philadelphia, New York, Mare Island, Puget Sound and Pearl Harbor, P. I., Navy Yards.

¶ L. D. G. ***Heavy Duty*** Compressors are built with three paramount objects in view:

¶ FIRST:—***Perfection of Design,*** resulting in the compression of air with the lowest possible power cost.

¶ SECOND:—***Reliability*** and ***Low Maintenance Cost,*** secured by combining the most perfect designs with the best workmanship and materials possible to obtain.

¶ THIRD:—***Accessibility*** to all working parts and ***Freedom from Complicated Mechanism.***

¶ These features represent ***True Compressor Value.*** As the total operating cost will equal the first cost in from ***two to five years,*** the purchase of a compressor because of its low first cost is very poor economy.

Our Corliss Air Compressors are described in Bulletin L 523-32

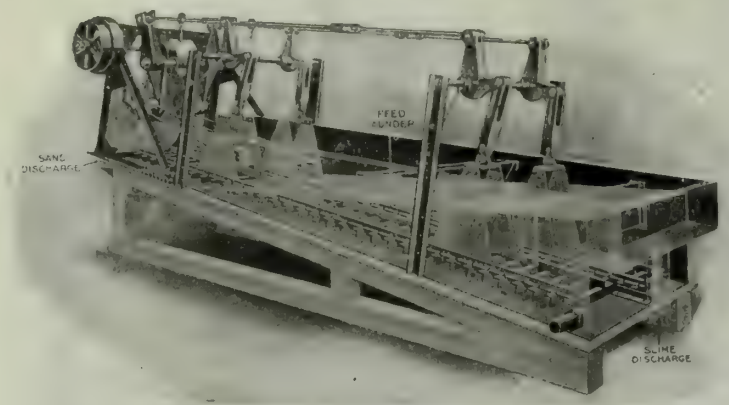
THE LAIDLAW-DUNN-GORDON CO.

WORKS: CINCINNATI, OHIO :: New York Office: 115 Broadway

L163.8

The Leading Mills Endorse Dorr Classifiers and Thickeners

Endorse them by the most convincing of all endorsements—by using them in their own work.



¶ For instance: The Santa Gertrudis is using 26 Dorr Machines. The Tonopah-Belmont are installing eight Classifiers and eight Thickeners. The Real Del Monte have, in all, 31 Dorr Machines in their numerous mills.

¶ In fact, Dorr Machinery is a part of the equipment of practically every up-to-date plant.

¶ Would it not pay you to investigate and see *why?* Write us—we will gladly go into details.

THE DORR CYANIDE MACHINERY COMPANY

733-734 First National Bank Building, Denver, Colo., U. S. A.

Cable Address: Dorr.
Codes: Bedford McNeill and Western Union.

Grothe & Carter, Mexico City, General Agents for Mexico

William Russell, 17 South Street, London, E. C., Special Agent

"EMPIRE" GOLD DREDGES

Show the largest returns on the investment represented, because, while **saving all the values**, they require the **minimum operating and up-keep expense**, leaving **larger profits** than any other dredge can show. This is "Empire" service.

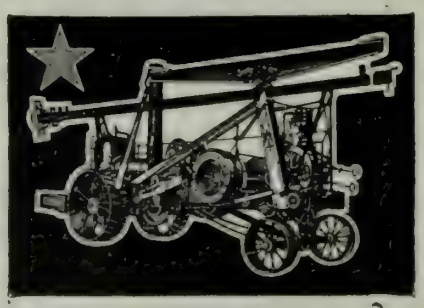
"EMPIRE" PROSPECTING DRILLS

Have never failed, under any conditions, to do more work in less time and at less cost, **with greater accuracy**, than any other prospecting drill.

New York Engineering Company

2 Rector St., NEW YORK

STAR PORTABLE DRILLING MACHINES



Star Drilling Machines are rapid drillers, and they do not consume all the profits for renewals and repairs.

There are fewer wearing parts than in any other drill. A strong steady pull and a quick positive drop are imparted to the drill rope.

The gear wheel on the bull wheel shaft for rapid pulling and running in of tools, the slanting Sampson post, the solid band wheel, the running board, and many other minor improvements, are details that you should know about.

The Star Drilling Machine Co.

450 PALMER ST.
AKRON, OHIO, U. S. A.
Branch Office: Los Angeles, Cal.

WE SPECIALIZE IN

PLACER DREDGE MINING EQUIPMENT

Some of Our Work in 1911

We designed and installed a dredge with special equipment for mining **Placer Tin in Alaska.**

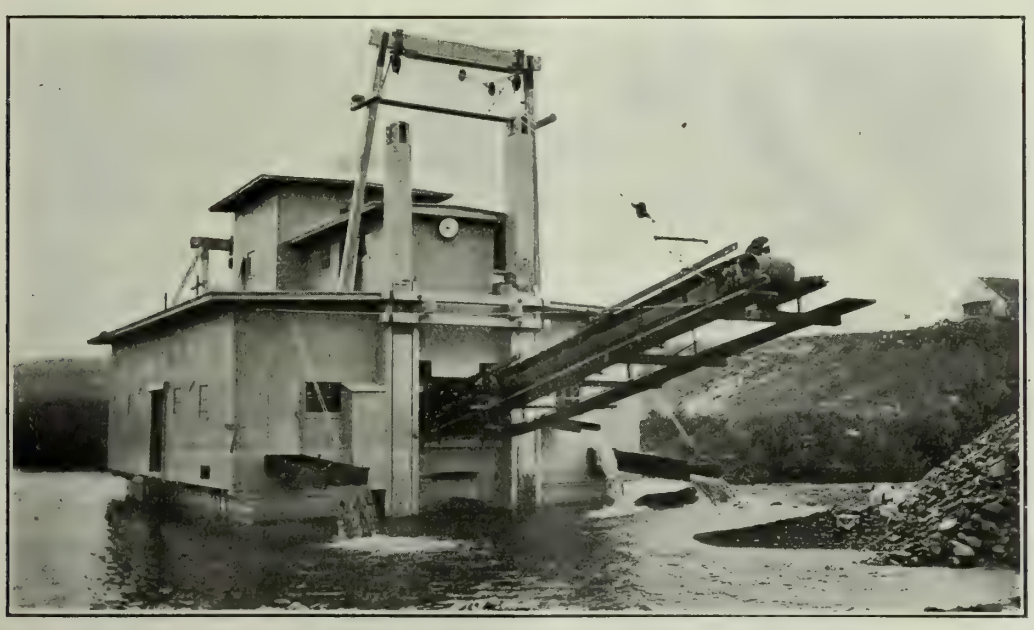
We dismantled a 7½ cu. ft. dredge, hauled the machinery 33 miles through the mountains of California, sawed out lumber on the ground, and had the rebuilt dredge in operation in 6½ months.

We built a 3 cu. ft. gold dredge near Nome, Alaska, in 31 days.

This Season we are building 5 Gold Dredges for Alaska

We are prepared to undertake the dismantling and rebuilding of dredges in any district.

3 Cu. Ft. Gold Dredge Driven by Distillate Engines, Operating near Nome, Alaska.



STERN VIEW OF ABOVE DREDGE

LET US SEND YOU OUR NEW CATALOGUE

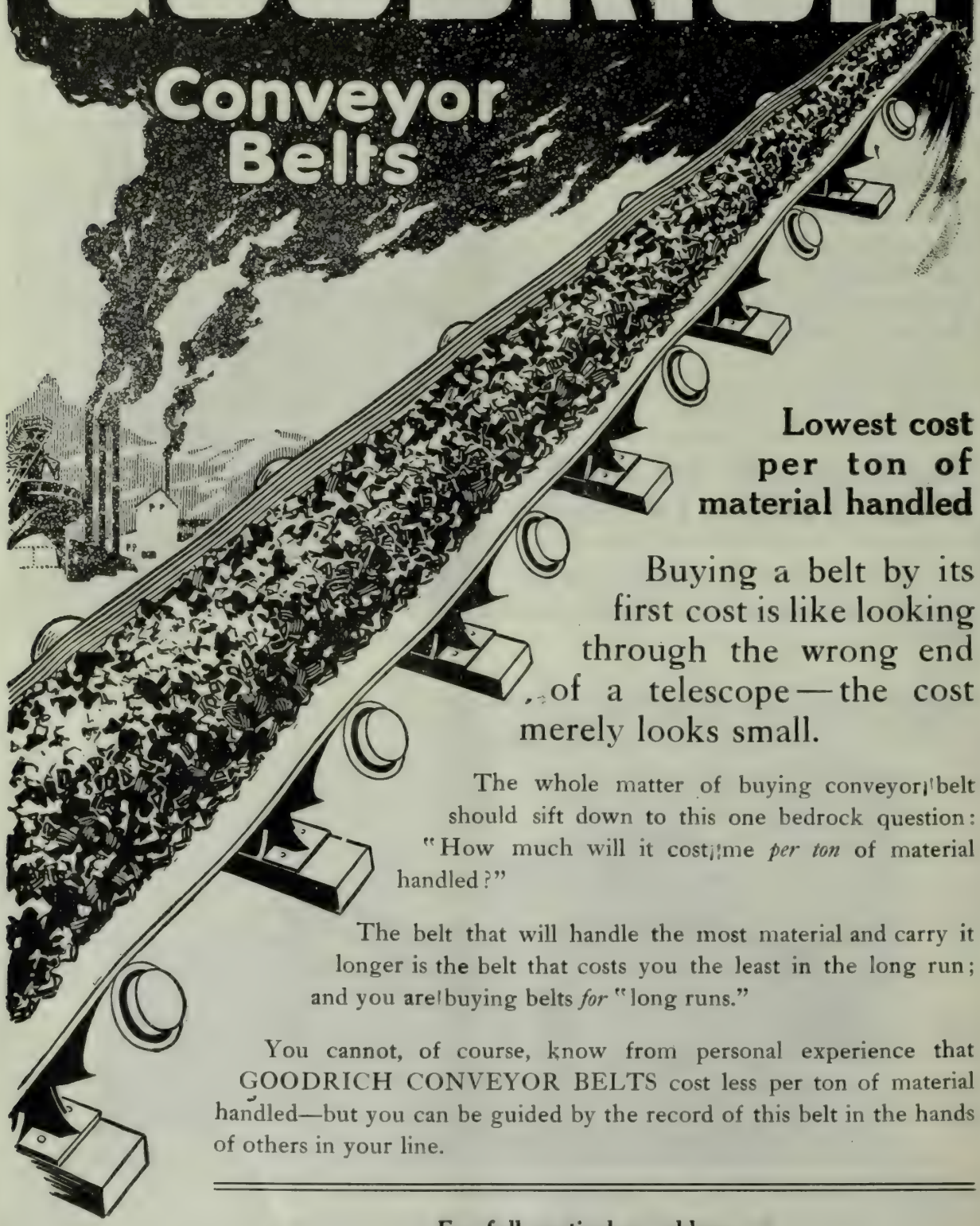
UNION CONSTRUCTION CO.

H. G. PEAKE — **604 Mission St. San Francisco, Cal.** — **W. W. JOHNSON**

Western Union Code — **Cable Address: Unconco**

GOODRICH

Conveyor Belts



Lowest cost per ton of material handled

Buying a belt by its first cost is like looking through the wrong end of a telescope—the cost merely looks small.

The whole matter of buying conveyor belt should sift down to this one bedrock question: "How much will it cost me *per ton* of material handled?"

The belt that will handle the most material and carry it longer is the belt that costs you the least in the long run; and you are buying belts *for* "long runs."

You cannot, of course, know from personal experience that GOODRICH CONVEYOR BELTS cost less per ton of material handled—but you can be guided by the record of this belt in the hands of others in your line.

For full particulars address—

The B. F. GOODRICH COMPANY

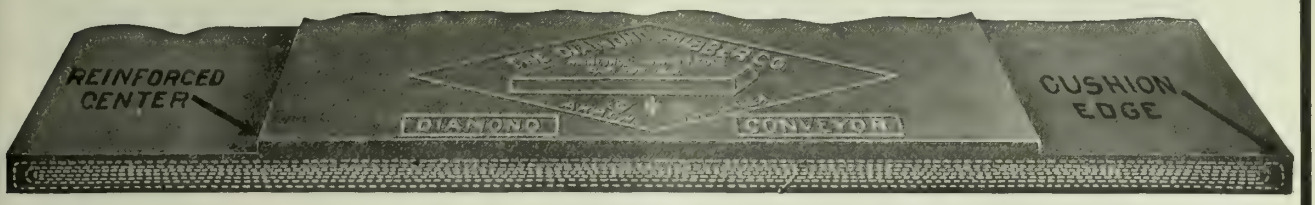
Akron, Ohio

LARGEST IN THE WORLD

TRADE MARK

TWO BIG FACTS

The Reinforced Center—The Cushion Edge



Diamond
Patent Conveyor Belt

Reinforced Center

Note the arrow pointing to the extra cover. This added center is where all the load is carried and abrasion and wear the greatest.

It more than doubles the wearing thickness of the belt.

The Reinforced Center can be made to cover the entire top surface if desired.

Cushion Edge

Note the arrow pointing to the Cushion Edge. It takes all the wear due to side rails and idlers, and the fabric is never reached.

When the edges of an ordinary belt wear slightly the fabric is exposed, moisture is admitted, the plies separate and the belt speedily ruined.

1,200,000 tons of material were conveyed by one of these belts in the gold fields of South Africa.

¶ More than 50% of all conveyor belts used in South Africa are Diamond Belts.

¶ We compete with the world's best belt builders in securing this business—and on an efficiency basis the Diamond Belt always wins.

¶ In the United States Diamond Belts are conveying annually billions of tons of material—slashing records by their wonderful feats of endurance.

¶ We have facts and figures to lay before you which knock mere claims into a cocked hat. The only thing of interest to you is the reduction of your conveying costs. We have tangible proof of exactly what we can do.

¶ Centralize your responsibility—put it up to us to cut your cost—our combination of knowing how to build a belt and having belt experts to assist you in selecting the right belt for the right place is the best guarantee in the world for getting most for your money.

¶ *Then Write Us To-day* for a sample of this Belt—get in touch with Diamond goods and Diamond service.

THE DIAMOND RUBBER CO.

AKRON, O.

DISTRIBUTING STATIONS IN ALL PRINCIPAL CITIES

THE RUGGLES AERIAL CARRIER
WILL DO EVERYTHING BUT TALK

This cut shows the Ruggles Aerial Carrier being used in the excavating of a canal. The material is being picked up and deposited on the sides. Later when the canal was completed and the water turned in, the same equipment was used to pick up the rock and load it into barges for transportation to a crushing plant.

THE use of this device reduces your aerial transportation system to the most simple form and allows the lowest possible cost of operation. With it there is no endless traction rope, and a single drum engine is ample for power purposes.

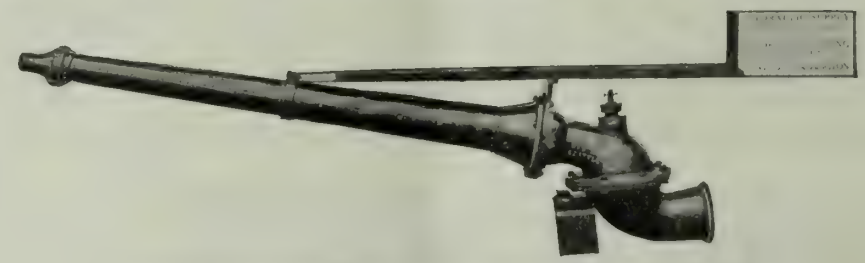
The Ruggles Aerial Carrier will lift a skip, or other load, from any distance to the cable, automatically unlock itself, move in either direction on the incline, automatically lock and either dump the skip in the air or lower a load to the ground. All these operations are controlled by the hoisting engineer through a single line from the hoisting drum and with no signal except that to start. The return trip is equally simple and automatic.

The brake on the carrier is independent and does not hold by gripping the cable, thereby reducing the wear on the latter to an absolute minimum.

SEND FOR CATALOGUE A.

RUGGLES MACHINE CO., POULTNEY, VERMONT

Hydraulic Mining Machinery



DOUBLE-JOINTED BALL-BEARING GIANTS
Showing Giant with Weighting Attachment

Riveted Iron and Steel Pipe — Gravel Elevators
Riffles — Gates — Giants — Water Lifts
Steel Sluices — Penstocks

These are the advantages we offer: Promptness in filling orders, careful packing to economize freight space and insure delivery in good condition, personal supervision of shipment and for our output, first class material made up by first class workmen.

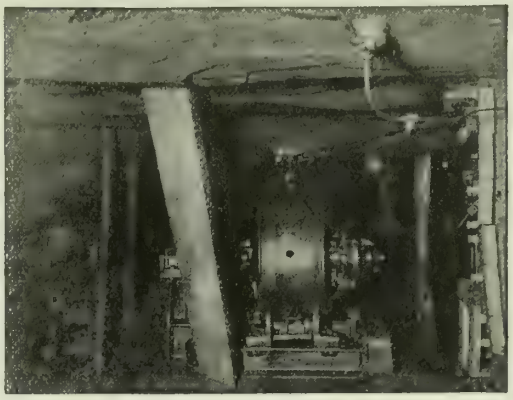
WRITE FOR CATALOGUE

HYDRAULIC SUPPLY MANUFACTURING CO.
SEATTLE, WASHINGTON

The Extensive Use of Westinghouse Motors For Mine Pump Service Proves Their Great Reliability

Only a thoroughly reliable motor can be used for driving mine pumps.

The pump must run day and night; the atmospheric conditions are very unfavorable; and the motor is often located in remote places where it can be inspected at infrequent intervals only.



Westinghouse Motor Driving Mine Pump

Hundreds of Westinghouse Motors have for years given thoroughly satisfactory service in mines.

Their reliability, proved beyond question, is the result of experienced design, careful construction, and rigid tests after completion.

Westinghouse motors can be supplied for every kind and size of pump. To insure satisfactory operation, specify Westinghouse motor when ordering your pump.

Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

SALES OFFICES IN 45 AMERICAN CITIES

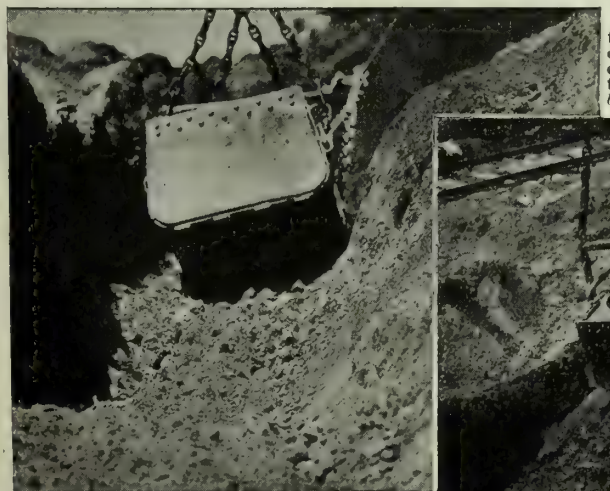


Illustration No. C-257

A Hayward Drag Scraper Bucket digging in "rotten rock." Note the angle at which it is digging and the pieces of rock in its wake, torn loose by the teeth before it settled to dig

Illustration No. C-256 (Lower View)

This is a companion picture to Illustration C-257. The same bucket after the operation, filled with a good 1½ cu. yds. of "rotten rock," a very difficult material to dig. This bucket handled it *without blasting.*

This 1½ cu. yd. HAYWARD DRAG SCRAPER BUCKET handles over 2 cubic yards of top soil each trip.

Further, it will dig this load in less than twice its own length.

It never balks nor hesitates, but takes loam or "rotten rock" with ease—digging it without blasting.

Every connection flexible—not a single rigid bail in its make-up. Nothing to break as it lands on side or stomach. There is less strain on the operating machine, because the Bucket may be picked up as soon as filled—without dragging it "home." This new

Hayward Drag Scraper Bucket

works perfectly at any angle. It requires but two men and less than three minutes' time to change from a hard to soft digging Bucket. Where other Buckets have cross bracing and hoods which prevent them from entering the material, the Hayward Drag Scraper has an open front so that in digging, large boulders and large rocks are easily handled.

Get the facts from us—say Pamphlet 582 on a postal.

THE HAYWARD COMPANY

50 CHURCH STREET NEW YORK

Manufacturers of Dredges, Skid Excavators, Orange Peel, Clam Shell Buckets for Pacer Mining—Loading Gravel—Mining Gold—Digging Canals and Ditches—Stripping Iron, and for Rehandling and Digging Purposes Generally.

STEEL MINE TIMBERS

used when driving new heading will result in a large decrease in the amount of excavating to be done, and when used to replace wooden sets in retimbering will give a considerable increase in the clearance on both sides and the top of the heading. They will also save their users many times their cost, not only in preventing loss of life, in providing protection against cave-ins and fires which may put the mine out of commission, but in every place where wood is liable to prove a means of destruction by falling under stress, decay or burning.

Carnegie Steel Company

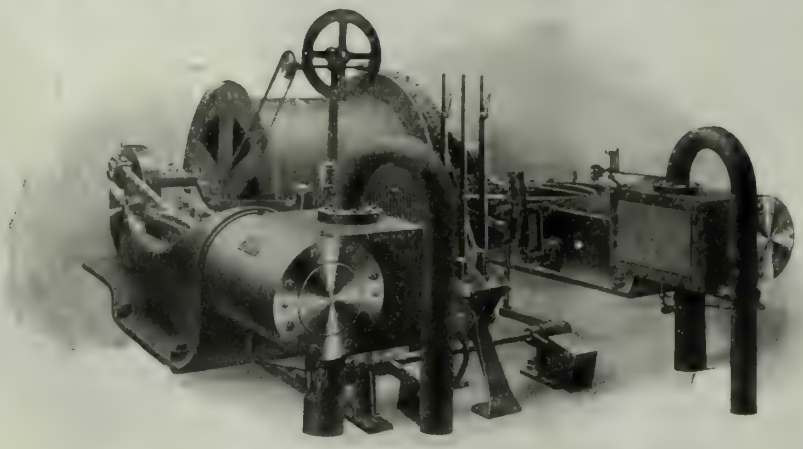
GENERAL OFFICES: PITTSBURGH, PA.

Catalog and Technical Pamphlet may be had on request.

THE WELLMAN-SEAVER-MORGAN CO.

WELLMAN-SEAVER-MORGAN ENGINEERING DIVISION — ENGINEERS AND MANUFACTURERS — WEBSTER, CAMP & LANE DIVISIONS

FIRST MOTION STEAM HOISTS



15″ x 20″ Double Cylinder
Balanced
Slide Valve Engines
with
Heavy Duty Beds
Cast Iron Drum
Band Brakes and Reverse

A neat and compact machine for rapid hoisting

NEW HOIST CATALOGUE JUST ISSUED. SEND FOR IT.

CLEVELAND, OHIO, U. S. A.

NEW YORK, Hudson Terminal. **DENVER, 611 Ideal Building.** **MEXICO, D. F., Apartado 1220.**

A NEW SULLIVAN DRIFTER

The Sullivan "Lightweight" Class "FF12" Rock Drill is a new one-man drifting drill, in which light weight, drilling speed, long life and labor economy are emphasized.

It is claimed for the "Lightweight" drill that it does the work of a 3-in. or 3⅛-in. machine. Requires one man instead of two, and uses from 20 to 25 per cent less air for the same work.

New Bulletin No. 1366F

Air Compressors **Diamond Drills**
Hammer Drills **Hoists**

Sullivan Machinery Co.

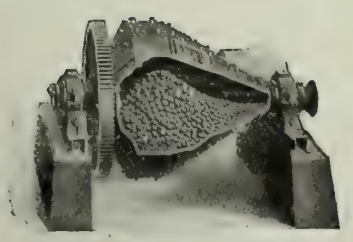
461 Market St., San Francisco

Birmingham, Ala. Joplin, Mo. Salt Lake
Boston Knoxville San Francisco
Butte, Mont. London, Eng. Seattle
Chicago Nelson, B. C. Spokane
Cobalt, Ont. New York St. Louis
Denver, Colo. Paris, France. Sydney, N. S. W.
El Paso Pittsburg

TWO YEARS AGO THE CALUMET & HECLA MINING COMPANY

Wrote "We find the Hardinge Conical Mill the most efficient grinding machine we have yet gotten hold of."

They now substantiate this statement, after two years of continuous use, by constructing a plant to contain



64

8 FT. HARDINGE REGRINDING MILLS

Hardinge Conical Mill Co.

Sales Agents for { UTAH, MONTANA, NEVADA, IDAHO }

The Mine & Smelter Supply Co., Salt Lake City, Utah.

50 Church Street, New York
(Denver Office, 601 Ideal Building)

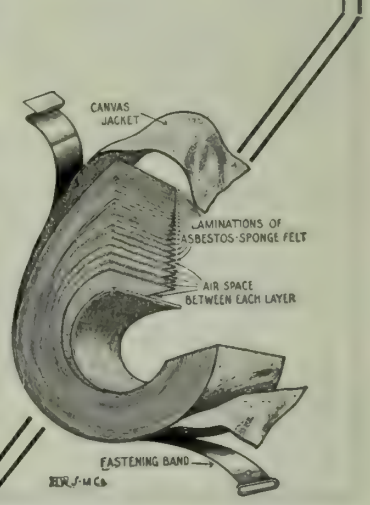
Won't Crack, Break or Lose its Insulating Value from Vibration or Rough Usage

The temperature of high pressure pipes soon dries out molded and ordinary pipe coverings. Then expansion and contraction of the pipes and vibration reduce the carbonate of lime (chalk) and other like materials with which these coverings are filled to a powder. This powder settles at the bottom of the canvas covering, leaving the top insufficiently covered, and gradually sifts through the canvas. Thus what little insulating properties they originally had are quickly lost.

J-M Asbesto-Sponge Felted Pipe Covering

retains its high insulating properties indefinitely. Pipes covered with it can even be walked upon without injury. This is because it is made of many layers of fine paper, composed of pure, long-fibred Asbestos and a small quantity of granulated sponge. It has been found in perfect condition after more than fifteen years' service on underground pipes.

Can be taken off pipes and replaced without injury.



Ask nearest Branch For Sample and Booklet

H. W. JOHNS-MANVILLE CO.

MANUFACTURERS OF ASBESTOS AND MAGNESIA PRODUCTS — ASBESTOS — ASBESTOS ROOFINGS, PACKINGS, ELECTRICAL SUPPLIES, ETC.

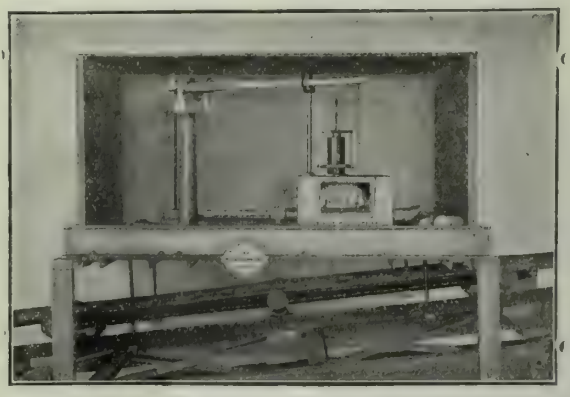
Baltimore	Cleveland	Indianapolis	Milwaukee	New York	Pittsburgh
Boston	Dallas	Kansas City	Minneapolis	Omaha	San Francisco
Buffalo	Detroit	Los Angeles	New Orleans	Philadelphia	Seattle
Chicago					St. Louis

For Canada:—THE CANADIAN H. W. JOHNS-MANVILLE CO., LIMITED 924

Toronto, Ont. Montreal, Que. Winnipeg, Man. Vancouver, B. C.

THE MERRICK CONVEYOR WEIGHTOMETER

An automotic weighing machine which weighs and records the load of any material in the act of that material passing over belt or bucket conveyor or other continuous conveyor systems.



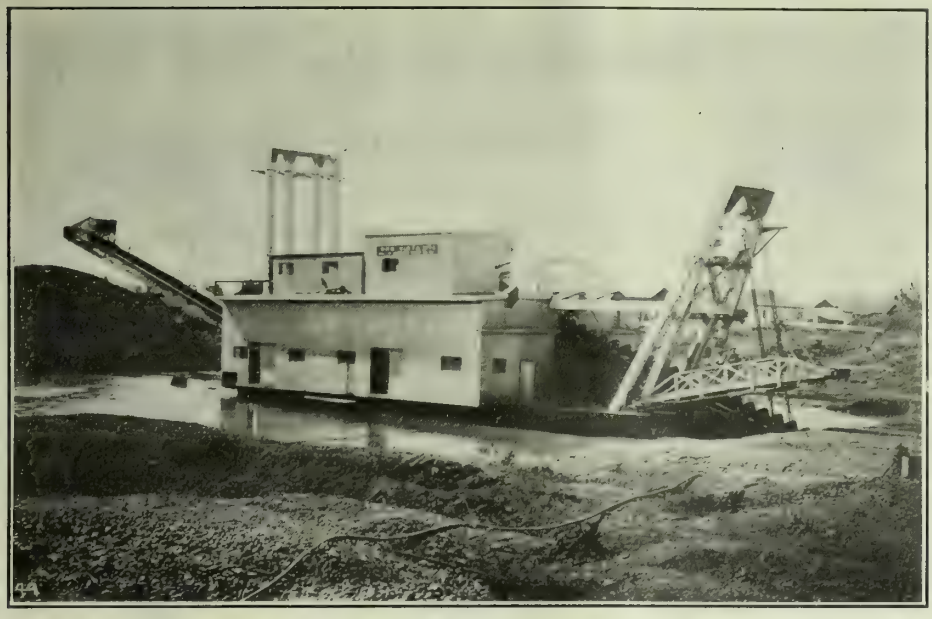
Although the MERRICK WEIGHTOMETER is not a direct producer, the operation of every mine, mill and smelter may be made less costly by economies which will be indicated as desirable by the accurate record of material handled, obtained by this apparatus.

Many users—every one a booster because of guarantees fulfilled and results gained.

WRITE FOR CATALOGUE.

Merrick Scale Manufacturing Company

PASSAIC, N. J.



	Cubic Yards		Running Time.
Oct., 1911,	70,000	—	86%
Nov., "	57,408	—	84%
Dec., "	79,600	—	83%
Jan., 1912,	65,384	—	80%
Feb., "	43,300*	—	78%
Mar., "	61,746	—	82%
Average,	62,906	—	82.1%

*NOTE.—During the month of February it was 22° F. below zero.

ACTUAL RESULTS ARE WHAT COUNT

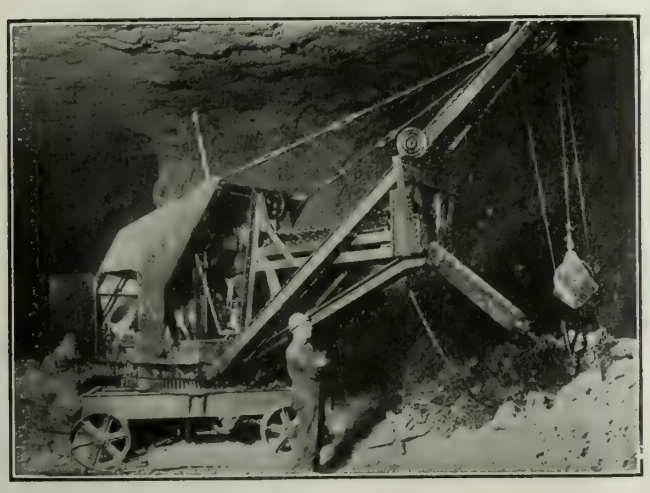
Read the above yardage and running time made by one of our 5-ft. open type Gold Dredges operating in Idaho.
The latest dredge built in the Oroville field was made by the

UNION IRON WORKS CO.

SAN FRANCISCO

Thew Shovels for Underground Mining

Because of its horizontal dipper crowding motion, the THEW shovel can be employed in underground work with overhead clearances as low as 10 feet by making use of a special design for boom. The full circle swing of the THEW shovel permits its convenient use under usual mining conditions. The machines may be mounted either upon car wheels or traction wheels and may be equipped for operation by compressed air or electricity.



Zinc Ore Mining at Joplin.

Thew Shovels

of the FULL CIRCLE SWING type are built in six standard sizes, ranging from 12 to 50 tons in weight, and from one-half yard to two yard dipper capacity.

Numerous modifications have been made to adapt the shovels to special conditions or to render the machine available for service of a miscellaneous nature.

AS TO QUALITY

we refer to any owner of any THEW shovel anywhere.

Shovels for All Classes of Mining Operations

Underground mining or surface work, open cuts, ditch construction or rehandling tailings.

WRITE FOR INFORMATION

THE THEW AUTOMATIC SHOVEL COMPANY, LORAIN, OHIO

Seldom on the Pay Roll
Always on the Job

Improved Wood Rock Drills

Day in, day out, always, ceaseless drilling—drilling—drilling. That's a Wood Rock Drill! Rarely needs repairing; requires little attention.

Never, like poor drills, continually at the cashier's window, spending more and still more money.

The master mind that planned the first Wood Drill twenty-one years ago, is still overseeing every detail of its manufacture now. If we weren't progressive we could well say "Here we rest our case"—but we're not the 'resting" kind.

Ours is the one drill that's "certain." The one drill you can depend upon. The one drill that carries a guarantee which means something; "We guarantee Wood Drills against any defects during the entire life of the drill. We guarantee Wood Drills to do more work, cost less for repairs, and stay on the job longer than any other drill on earth."

IS THAT BROAD ENOUGH?

Write for our Catalog to nearest Agent.

Wood Drill Works

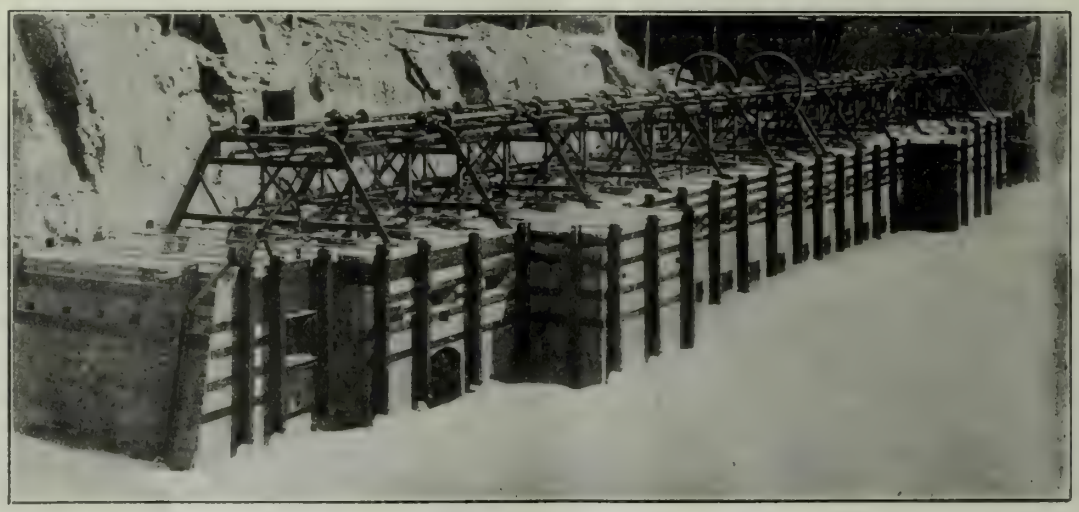
30 DALE AVENUE PATERSON, N. J.

AGENTS:

HAMMOND MFG. CO., Portland, Ore.

CANADIAN FAIRBANKS CO., Vancouver, B C.

THE EDWARDS ROASTER



Is being successfully adapted to every roasting problem—as evidenced by recent sales to:

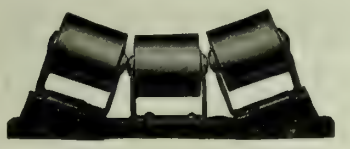
The Golden Cycle Mining Co. (9th machine), for roasting Sulpho-Telluride Ores.
The Goldfield Consolidated Mines, for roasting Concentrates.
Robt. Lanyon Zinc & Acid Co., for roasting Zinc Blende.
Primos Chemical Co., for roasting Vanadium Ores.

EXPLAIN YOUR CONDITIONS AND REQUIREMENTS TO

THE STEARNS-ROGER MFG. CO., Denver, Colo.

Manufacturers of Mining and Milling Machinery.

"S-A" Belt Conveyors for Bedding Concentrates



The new "S-A" Unit Carrier has features of advantage which should be familiar to all mining men.

It is the strongest carrier on the market, and yet is lighter in weight than any other carrier of corresponding size.

The light weight and strength is secured by the pressed steel construction with drum type pulleys, mounted with double supports.

Dust-proof ball bearings eliminate the attention required by other carriers.

The carrier is almost frictionless and saves the belt.

Adaptable to all operating conditions.

The "Labor Saver" gives Conveyor News

Tell us your name and the position you hold, and we'll send you this monthly magazine without charge. It's of interest to all mining men.

The application of modern methods in the handling of their ore has enabled the Cananea Consolidated Copper Company to place their low grade ore properties on a paying basis.

The latest conveying system installed has been applied to the bedding and reclaiming of concentrates. The concentrates are received in gondola cars, and in order that a uniform grade may be delivered to the furnaces, they are "bedded." A system of three "S-A" Belt Conveyors brings the concentrates from the gondola cars—the third conveyor on the bridge distributes over an automatic tripper on to the pile. A system of three other "S-A" Conveyors reclaims the ore and delivers to pockets above the furnaces.

Let our engineering board solve your conveying problems.

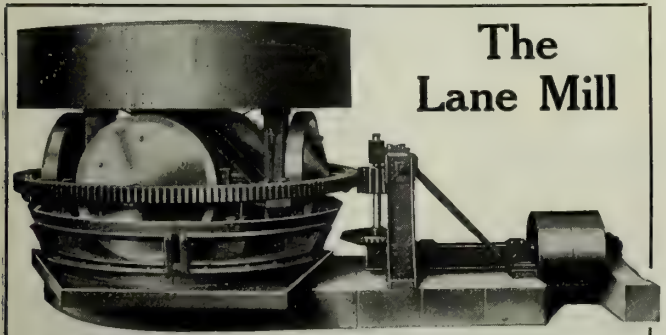
Stephens - Adamson Mfg. Co.

AURORA, ILLINOIS

New York Chicago Pittsburgh Portland St. Louis
Los Angeles San Francisco Birmingham

Conveying, Elevating and Hoisting Machinery. Robins Coal and Coke Crushers.
We carry a complete stock of Chains and Sprockets. Write for monthly bulletins.
ROBINS CONVEYING BELT COMPANY
Main Office: 13 Park Row, New York San Francisco: The Griffin Company
Chicago: Old Colony Building Spokane: United Iron Works

The Lane Mill



In several plants is saving 95 to 98% by amalgamation. The initial and operating costs are less than stamps.

Full details on request.

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Successors to Lane Slow Speed Chilian Mill Company,
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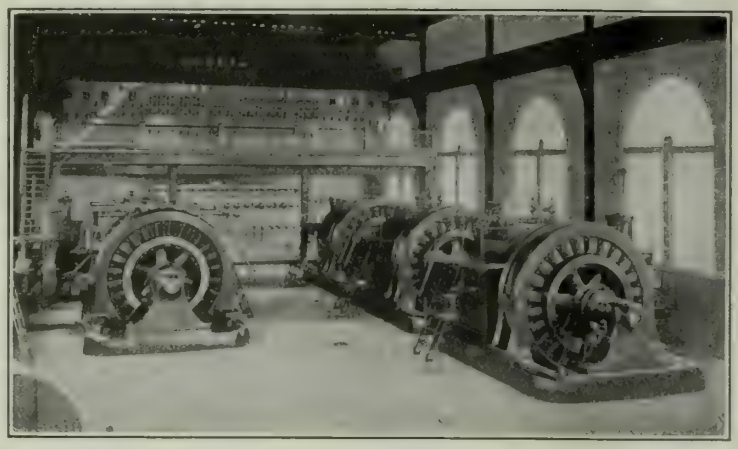
Coal Tipples, Elevator Buckets
Elevating Machinery
Mining Machinery
Phosphate Machinery
Steel and Belt Conveyors
Ore and Clay Dryers
Coal Handling Machinery
Shaking and Revolving Screens
Malleable and Drop Forged Chain
Gypsum Machinery

and are also exclusive manufacturers of

The Greene Self Dumping Car Haul



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These wheels are made to be direct connected to generator shaft and are used under all heads from 10 to 1,000 feet

Catalogue containing 70 pages on Hydraulic Machinery and Centrifugal Pumps.

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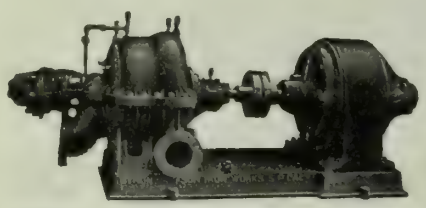

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Jackson Turbine Station Pumps

FOR HEAVY DUTY

Designed to work against any head. Made with bronze fittings for handling acid waters.

Split on center line for convenience in dismantling and inspection.

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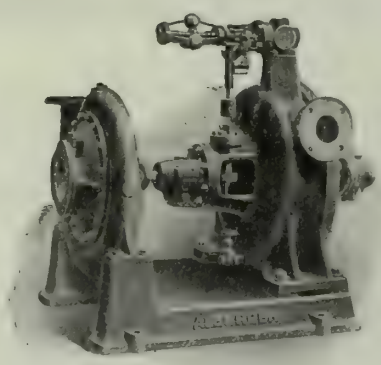

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ANY QUANTITY—
BUT ALWAYS
HIGH
EFFICIENCY

Alberger Pump Company

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When Looking for Pumps

for any service be sure to remember

Jeanesville Pumps

We build them in all sizes, both steam and centrifugal, and both have very desirable and distinctive features. Better have our two new catalogues J 36-32 and J 40-32

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J 144.1

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Mr. Rickard's book will help you to present your ideas in such a convincing way that every one will exclaim, "that man knows what he is talking about." Send for **A Guide to Technical Writing.** You will read it through at the first sitting. *Published and for sale by*

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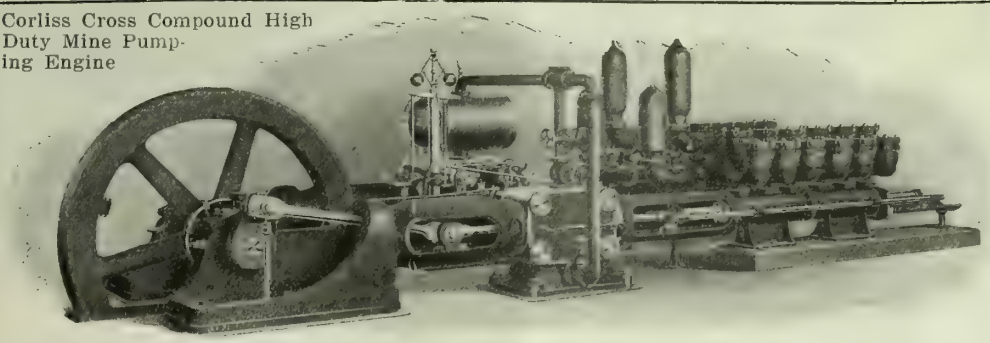
Built on a Solid Base

The Reputation of Prescott Mine Pumps

Why? Because the initiation of the business was not an accident of chance, nor a broadening out to embrace the mine pump field because it was attractive. **Read the Condensed History**

Corliss Cross Compound High Duty Mine Pumping Engine



From 1885 to 1894 Fred. M. Prescott dealt in mine machinery and supplies. Meantime mining practice was changing. The originally shallow mines grew deeper with attendant increase of water and fuel costs, creating the necessity of heavier and more efficient pumps. As builders of pumps Mr. Prescott represented could not see that their standard types were outgrown, he began to build them for local trade. Their immediate success developed a demand that forced him to devote himself to their manufacture. Subsequent history is familiar—the growth of the business until it included the building of the most successful pumps in a wide range of patterns to meet every sort of mine service. This is well attested by our *Catalogue P 22-32. It proves "Who builds the best Mine Pump? PRESCOTT."*

Works: Milwaukee, Wis.

New York Office: 115 Broadway.

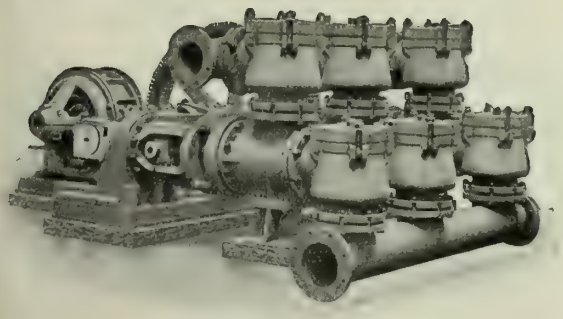
Fred.M.Prescott Steam Pump Co.

Branch Offices in all Principal Cities

P129.4

WOOD-LINED MINE PUMPS

FOR HANDLING ACID MINE WATER



The Deane of Holyoke

can meet any condition of pumping service

Bulletin D 43-32 illustrates and describes our mining pumps

THE DEANE STEAM PUMP CO.

WORKS: HOLYOKE, MASS. New York Office: 115 Broadway

Branch Offices in all Principal Cities D 199.2

No Other Pump Equals the Economy of the "American" Centrifugal as a Mine Pump

It combines the highest development of the centrifugal principle of pumping with greatest simplicity of construction.

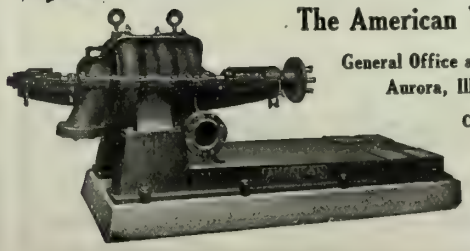
Flowlines are worked out to the easiest possible curves and interior of casing and impeller are machined true and accurately adjusted, preventing back-flow.

There are fewest number of parts, all passages are cast in the casing and all parts are easily accessible without disturbing the pipe connections.

Our sinker and mine station pumps have many advantages over old-style plunger pumps for these purposes.

American Centrifugals are made in over 50 regular styles, backed by longest experience and largest output.

They are described in General Centrifugal Pump Catalogue No. 117, the most complete ever issued. Write for it.



The American Well Works

General Office and Works
Aurora, Illinois

Chicago: First Nat' Bank Building
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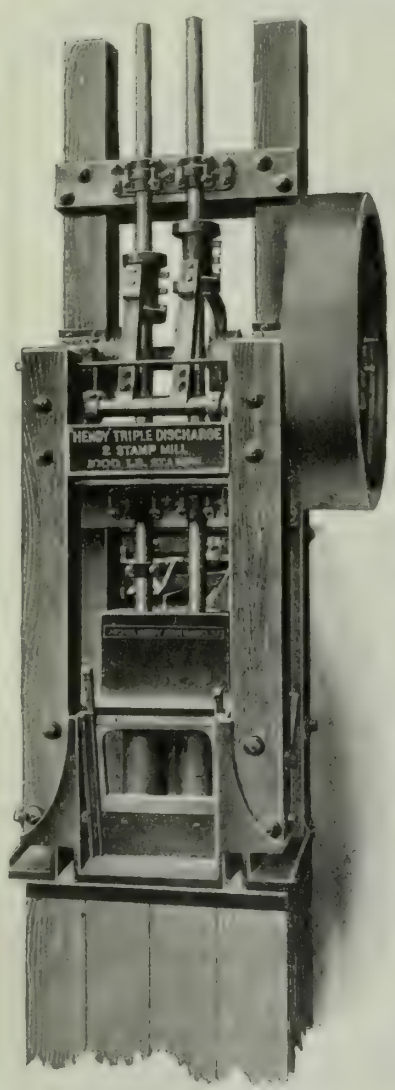
Hendy Mill Units

Usually, in the beginning, when the investment is small, it is necessary to employ machinery which does not require much outlay of capital.

Hendy mills are built as a system of units.

Hendy improved triple discharge two-stamp mills are the first of the units.



Their capacity is sufficient to warrant installation in a battery of two or three mortars for permanent work—all details are equivalent to our standard mills.

Once the mine proves good and you wish to begin operations on a large scale, this two-stamp mill simply forms the nucleus of your plant.

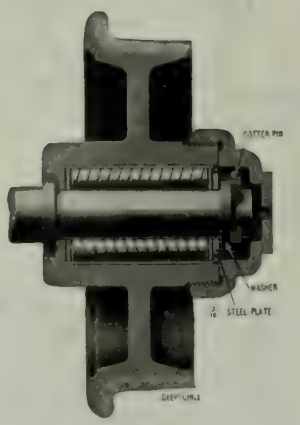
Many of our customers in different parts of the world have begun operations in this way—it's a good beginning.

Illustrations and complete information concerning this two-stamp mill, as well as the larger Hendy mill units, will be found in Bulletin 113—send for it.

Joshua Hendy Iron Works

(Sole Manufacturers)

San Francisco **California**



Twelve Progressive Wheel Manufacturers

have adopted the Hyatt Flexible Roller Bearing. Any of these twelve could make a solid roller bearing at a lower cost than the price of the Hyatt, but with their knowledge of the severe conditions under which mine cars operate, they selected the Hyatt Flexible Roller Bearing.

Bulletin 604E (new edition) illustrates and describes the various designs, one of which is sure to be exactly suited to your requirements. A postal brings it.

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NEWARK, NEW JERSEY

2002B

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if you know how
to handle
an aeroplane
and the
weather conditions
are right.

IF you wish to ***transport your goods safely and economically*** in all kinds of weather, it can be done with a

BLEICHERT AERIAL TRAMWAY

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Why?

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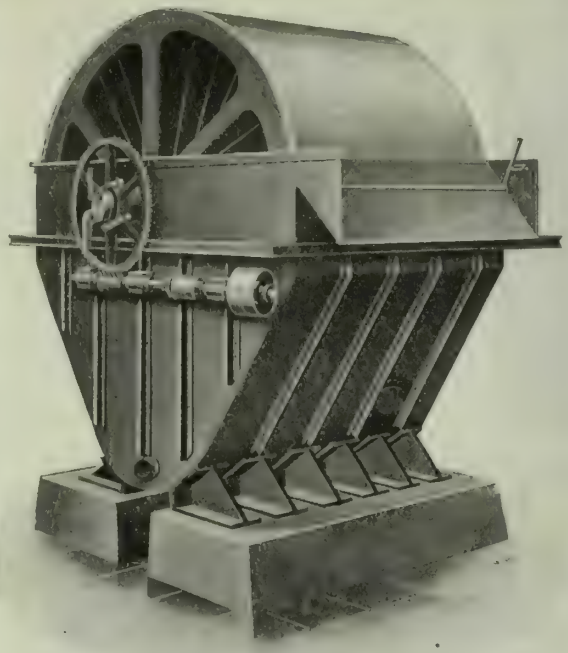
Wire Rope for every purpose



Shortage Of Water Need Not Interfere With The Cyanide Plant Where

The Oliver Filter

Is Installed

Many mines that dispose of filter tailing by sluicing are seriously handicapped this year by the prevailing water shortage. Where Oliver Filters are installed, it requires but few changes to discharge the tailing dry. This will reduce water consumption more than half, without affecting the filter efficiency or capacity. If you are facing water shortage, write, asking for details of our new atomized wash and the cost of changing from wet to dry discharge.

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Hooker & Lent Bldg., San Francisco, Cal.

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produce clear, bell-like tones that can be heard for miles.

They are made in a large number of varieties—**Single Bell** having but one tone; **Single Bell Chimes**, or **Three Separate Whistles on a Branch**, both styles producing three distinct tones, and **Variable Sound Whistles**, provided with pistons from which any tone desired can be obtained.

Owing to the correct proportions of **Lunkenheimer Whistles**, they are very economical, as a very small expenditure of steam or air is necessary to obtain satisfactory results.

They are exceptionally neat in design, are very strong and durable, and satisfaction is guaranteed.

Specify and insist upon securing genuine Lunkenheimer make. Do not accept substitutes—they are never as good as the genuine.

Your local dealer can furnish them; if not, write us.

Write for 1912 catalogue.

Single Bell Chime Whistle with Valve

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21

DRIVE YOUR TUNNELS QUICKLY and CHEAPLY

BY USING

DU PONT

EXPLOSIVES

The driving of tunnels in ore mines can be accomplished at a considerable saving of time and cost of labor by resorting to the following Brands:

Forcite, or Repauno Gelatin Dynamite

These explosives are noted for their rending power and the minimum fumes resulting from their detonation. If very hard rock is encountered, we recommend the loading of a few cartridges of Blasting Gelatin in the back of bore-holes with Gelatin Dynamite on top of them.

To be able to complete tunnels economically, you should use Du Pont Explosives exclusively. Just which one is best suited to the condition found in your mines may be learned by asking for High Explosives Catalog No. 119, or stating your problems to our Technical Division.

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If you heard of a drill that could be installed anywhere that an electric wire could be run, either above or below ground, at less than one-third the cost of pipe lines, wouldn't you be interested?

If you learned of a drill that would actually save 70% to 90% of what you are now paying for power and at the same time advance your work faster, easier and better than ever before, wouldn't you be anxious to learn the particulars about it?

If we claim the Fort Wayne Electric Rock Drill will do all this and offer to send you a Bulletin that explains the design, construction, and operation of the drill, don't you think it would be worth while writing for it?

FORT WAYNE ELECTRIC WORKS

Of General Electric Company

ROCK DRILL DEPARTMENT MADISON, WIS.

Factories: Fort Wayne, Ind., and Madison, Wis.

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Cut Your Drilling Costs

THE DOBBINS CORE DRILL

OCCUPIES MUCH LESS SPACE

IS MORE CONVENIENT FOR OPERATION

MUCH LESS SUBJECT TO BREAKAGE

HAS 25 TO 50% GREATER EFFICIENCY

THAN ANY CORE DRILL OF EQUAL RATED CAPACITY

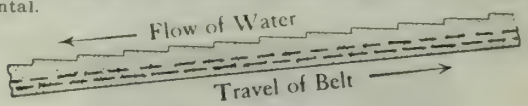
Let Us Send You Catalogue "M"

THE MANHATTAN DRILLING COMPANY

No. 25 Broad Street New York City, N. Y.

Goodyear "Step" Concentrator Belt

The surface of the Gates Improved Step Concentrator Belt is composed of a series of transverse steps, with 'treads' ¼ in. wide and 'risers' 1/32 in. high. When the belt is running on a concentrator the 'treads' are horizontal.



Full-sized Section

This design prevents the heavy particles of mineral from escaping down the belt by holding them on each step, until dense enough to discharge the sands, when, due to the combined motion of the machine and flow of water, they gradually travel toward the mineral discharge end of the machine.

With this belt it is almost impossible to overload a concentrator, because even if a few steps are overloaded, the lower part of the belt holds the minerals until separated. The efficiency of a machine equipped with this belt is therefore greatly increased, and produces cleaner concentrates.

Our patent edge is used on the Gates Improved Step Concentrator Belt. The edge will stand up in passing around drum, and will not crack.

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DREDGING SLEEVES, BELTING, HOSE, PACKING, ETC.

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of all the ROCK CRUSHING is being done with

McCully Gyratory Crushers

Could ANYTHING be MORE CONVINCING of Their MERITS?

Of course these are exceptionally large jobs.

That is just why we mention them. There are a great many different contractors involved and it is evident how many of them agree as to which is THE crusher. Moreover it is for such large jobs that the greatest care is taken to select the BEST crusher. Only the best is good enough.

On small jobs this is not so important. But—we could go on and give a long list of smaller jobs where our crushers are the ONLY ones used.

If you want to know WHY the McCully Crusher is preferred to all others, send for our bulletin PM-432.

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District Offices: New York, Chicago, El Paso, San Francisco

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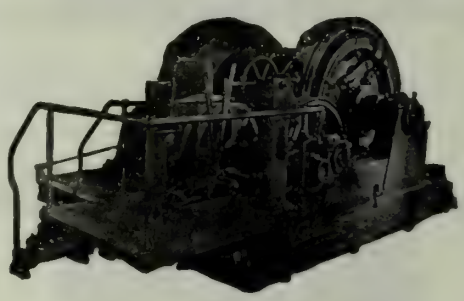

Vulcan Electric Hoists

The above illustrated hoist, now in operation at the mines of the Carbon Hill Coal Company, Carbonado, Wash., is one of many recently shipped to the Northwest, and if you are interested in good electric hoists it will pay you to see it in operation.

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VULCAN IRON WORKS

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GOODAL BROS., ASSAYING.

Helena, Montana, May 24, 1912.

DENVER FIRE CLAY CO., Denver, Colorado.

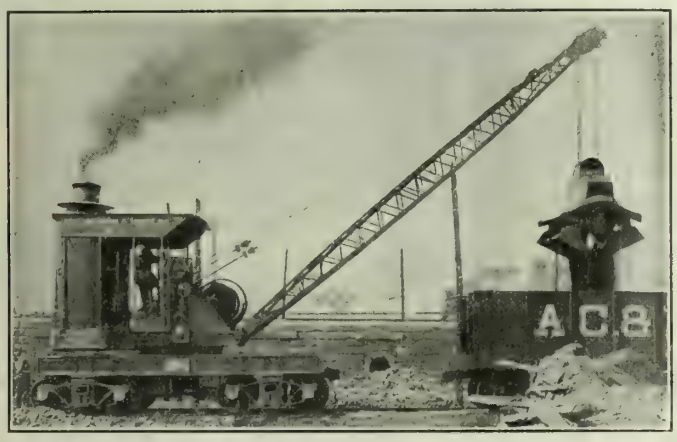
Gentlemen: We have been using your Case Burner 2″, and find it the most comfortable burner we have ever worked with. After a month's service the plugs are still tight and there is no leakage. It is so far ahead of the ———— burner that there is no comparison. The other burners we don't consider at all.

Sincerely yours, GOODALL BROS. (by Herbert Goodall.)

—— MADE BY ——

THE DENVER FIRE CLAY COMPANY

DENVER, COLORADO U. S. A. SALT LAKE CITY, UTAH



Have you ever considered using a locomotive crane at your mine or mill?

Being self-propelled and having complete rotation of the boom, it will handle all your ore and other material rapidly and at a low cost. The illustration shows a Brownhoist crane loading ore, 1½ to 3 tons at a load, with only one man, the operator, of the crane.

Our catalog shows this crane in use at mines and mills. Write for it.

THE BROWN HOISTING MACHINERY CO.
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would do well to inquire of those who have.

To break up boulders or large pieces of stone and for general cleaning up about a quarry, the **"BUSY BEE"** Hammer Drill is an indespensible tool. Over 200 feet of blast holes has frequently been drilled with one of these hammers in a day. Real economy in the quarry is attained where **"Busy Bee"** drills are used.

Full particulars are given in the **"Busy Bee"** Hammer Drill Bulletin. Send for it.

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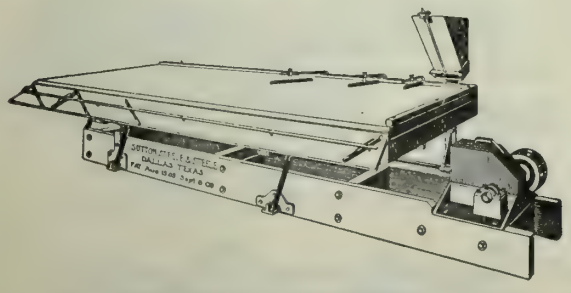
Rock Drills, Core Drills, Sheet Pile Hammers, Air Compressors 3



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S. S. & S.
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Capacity three times that of the best types of wet concentrating tables.

Especially adapted to the treatment of refractory ores having close specific gravities.

The S. S. & S. System of dust control eliminates all dust made in dry crushing.

COMPLETE TESTING WORKS FOR ORE TESTING

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THE CORRECT METHOD OF HANDLING MATTE

The 16 pans in this tapping car will hold 3,000 pounds of copper matte, yet they can be easily revolved with a bar and operated by one-man power. When a tap is being made the matte strikes in the successive pans and the entire mold is filled up by a series of layers of matte, which solidifies in thin layers, making it easy to crush for later operations.

It is possible to tape 3,000 pounds every 30 minutes. Dumping is accomplished by putting a bar under the back lug of pan and tipping it up slightly. The overbalance does the rest. Only a few minutes required for the entire car. Cakes are in simple form for handling. The first cost is low. It has been in use for years. It is durable, efficient and simple.

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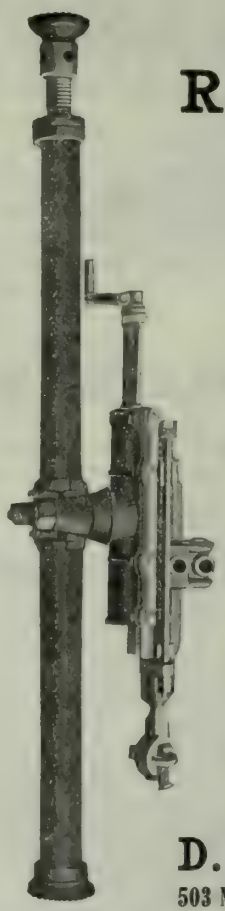

PACIFIC ROCK DRILL

MADE IN SEVEN SIZES

The distinguishing feature of this drill is the fact that the guide lugs on the cylinder and the corresponding seats on the shell are not in the same plane, thus absolutely preventing side play when the guides and seat become worn.

Send for our Circular 30 showing full details.

Low cost of up-keep.

Few wearing parts.

Light in weight.

Variable stroke.

Simple design.

D. D. Demarest Co.

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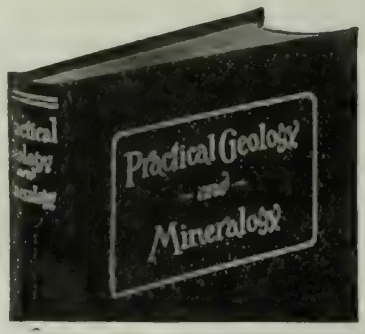

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A book written entirely to meet the wants of miner and prospector who has had no technical training. The salient facts of geology, mineralogy, petrology, and mineral deposits are given in plain and easily understood language. It is certainly the best book of its kind yet published, and we highly recommend it.

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Ropes of our PATENT FLATTENED STRAND construction are particularly fitted for mine hoisting and haulage.

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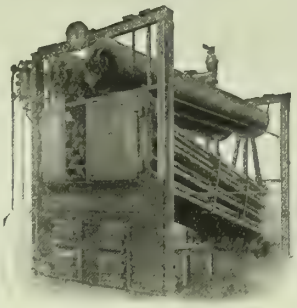
ROOT WATER TUBE BOILERS



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Needless to argue the superior economy of the water tube boiler over other types. Every engineer admits it—and profits by it where he can.

You can realize Water Tube Boiler economy at your mine—no matter how inaccessible your location—by installing the Root Water Tube Boiler.

For the Root Boiler is the only true **Sectional** Boiler on the market, breaking up into parts suitable for pack-animal transport **anywhere.**

With the high fuel costs prevalent in most mining districts, you **must** make the greatest possible amount of steam per pound of fuel burned.

With a Root Boiler, you will not only realize the highest fuel economy, but you will do so at the lowest cost for freight, transportation and erection.

ROOT SPIRAL RIVETED PIPE

ABENDROTH & ROOT
MANUFACTURING COMPANY
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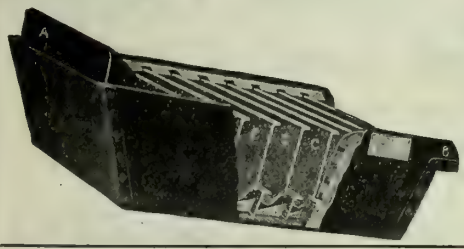
CHICAGO, Commercial Nat'l Bank Bldg. MEXICO, Mutual Bldg.

$150 per Day

Pierce Amalgamators

made a saving of little more than $150 per day in a 60-stamp Colorado mill during a period of 23 months.

Send for Catalogue No. 10.



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The British Columbia Mining and Engineering Record

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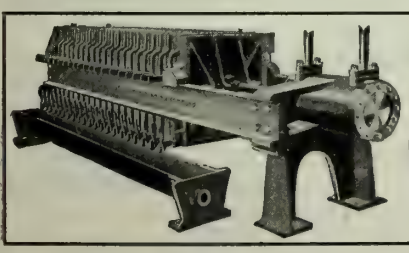

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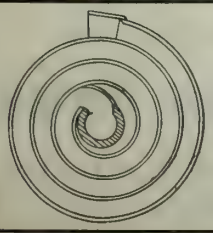

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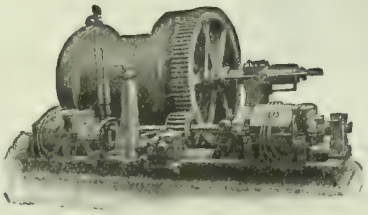

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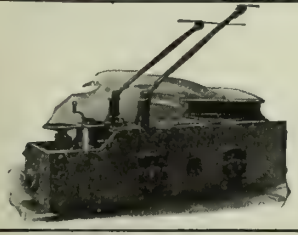

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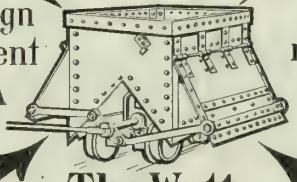

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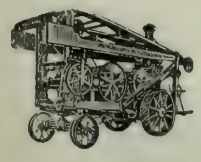

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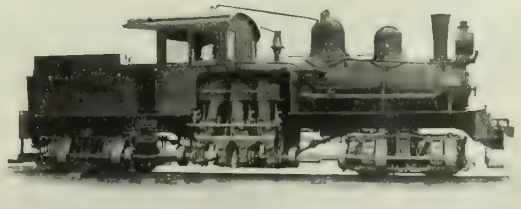

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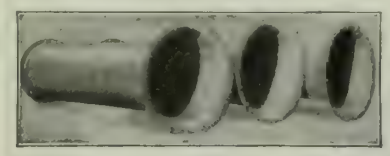

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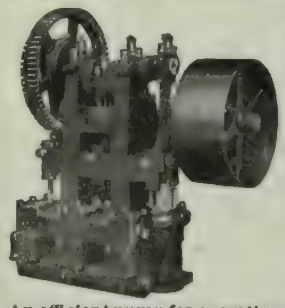

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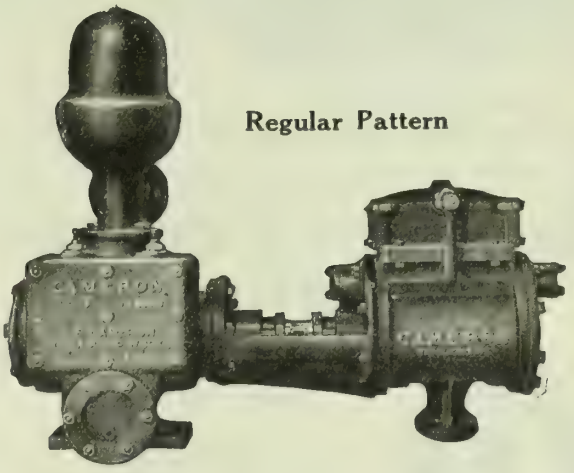

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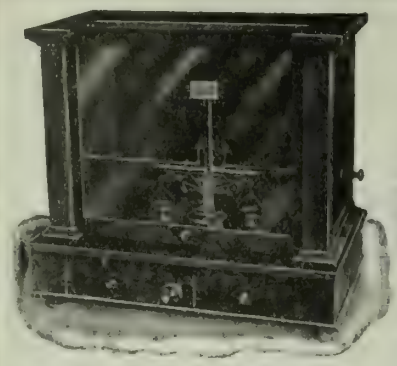

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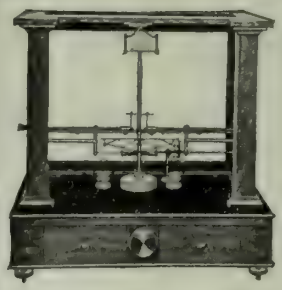

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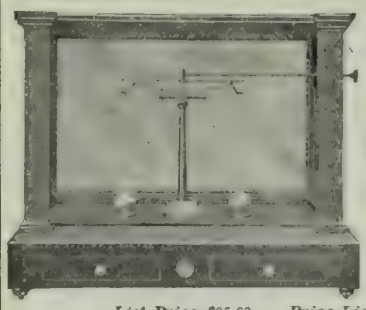

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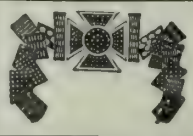

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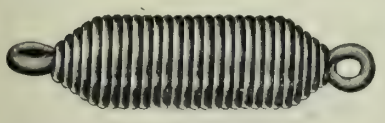

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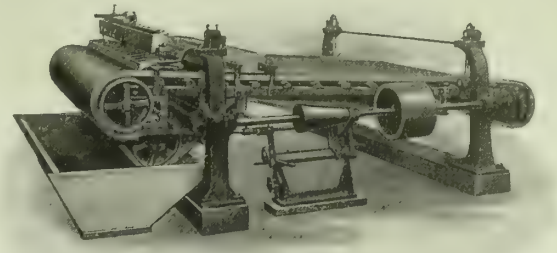

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AMUSEMENT APPARATUS—Douglass H. Cleghorn, Oakland, Cal. This invention relates to a new amusement apparatus, the object of which is to create a new sensation by carrying passengers in carriages on a circular track which has sudden dips and rises.

RAILWAY-RAIL CHAIR.—John W. Swales, Fruitvale, Cal. The object of this invention is to provide a means for securely holding railway rails in place upon the ties or sleepers upon which they are carried.

REVERSIBLE HYDRAULIC CLUTCH.—Peter English, San Francisco, Cal. It is the object of this invention to provide a means for transmitting motion from a driving shaft to the shaft to be driven, which will permit of the speed of the driven shaft being varied to any desired extent.

CURTAIN AND LIKE DISPLAY DEVICE.—Ferdinand Frank, San Francisco, Cal. This invention relates to an apparatus for displaying curtains and light goods which are usually carried in rolls or sheets, and which must be unrolled and exposed for display purposes.

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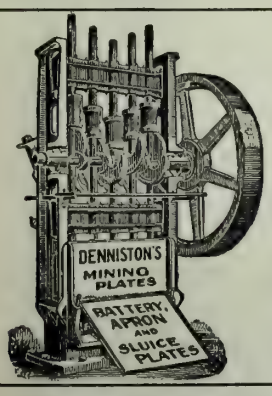

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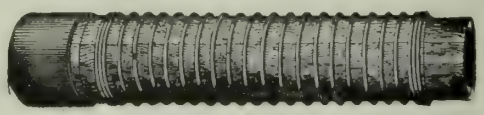

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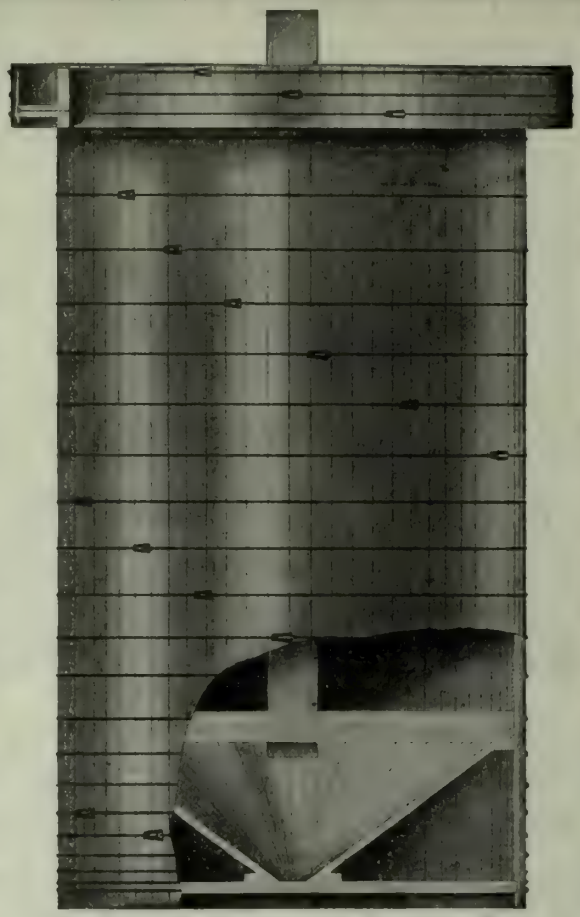

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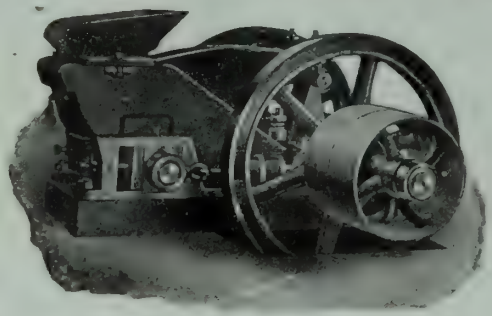

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EDITORIAL

VICTORIA, the pleasant and attractive capital of British Columbia, is to entertain the Western section of the Canadian Mining Institute, September 18.

ARIZONA recently enacted a law making a mining property, operated under a lease, option, or otherwise, responsible for all bills for labor involved in working the property. Similar bills have been enacted elsewhere, and certainly the laborer often needs better protection. The Supreme Court of Wyoming has, however, held that such a law is only constitutional when it applies to all classes of industry.

CEMENT-MAKERS did not have a good year in 1911, according to figures collected by Mr. E. F. Burchard, of the United States Geological Survey. While the total output of the United States was 79,547,958 barrels valued at $66,705,136, the actual increase, 1,500,000 barrels, was the smallest in 13 years. An interesting fact shown by the statistics is that California now ranks third in production and second in value of output.

SAN FRANCISCO engineers have long had the pleasant habit of lunching together frequently. This has now crystallized in the formation of an Engineers Club, which is to meet at luncheon at the Palace hotel on Tuesdays. Mr. C. W. Merrill has been chosen as first president of the club. Associated with him on the executive committee are Messrs. A. H. Babcock, M. H. Peck, A. M. Hunt, and H. Foster Bain. It is hoped to make the club an effective agency for promoting mutual acquaintance and a pleasant medium for the entertainment of visiting engineers.

ADVICES from Washington announce the serious illness of Mr. W. J. McGee, long prominently connected with the United States Geological Survey and the Bureau of Ethnology, and now soil expert in the Department of Agriculture. Mr. McGee's many friends will hope that the account of his poor health may prove exaggerated. A strong, self educated man of vigorous intellect and philosophical bent of mind, he has contributed notably to the progress of geology and related sciences, and at the same time his friendly interest and quick sympathy have stimulated many a young scientist to better work. Impatient as reformers usually are, he has given a good account of his talent.

EFFORT is being made to revivify the California Miners' Association, and a meeting of the executive committee has been called at the St. Francis hotel July 15. The Association was for years a powerful influence voicing the needs of mining industry of the state. It has a long and honorable record for good work, but in recent years has lain dormant, only a skeleton organization being maintained. The approach of the time of holding the Panama-Pacific Exposition and the desirability of assuring an adequate exhibit of Western minerals and mining methods leads the officers to believe that the general work of the Association should be resumed, and all those familiar with its history will wish them the fullest measure of success.

THE fiscal year at Washington closed with a surplus of $32,000,000, as against one of $45,682,000 in 1911. Except for the failure of Congress to pass usual appropriation bills there would have been a deficiency. It is interesting to note that customs yielded $310,000,000, internal revenue $292,000,000, and the corporation tax $27,000,000.

SMOKE problems are attracting large attention throughout the coal-burning territory, but nowhere is a more determined effort being made to overcome the nuisance than in Pittsburg, long known as the 'Smoky City.' With rare good sense, foundation for success is being laid in broad research. A fund has been placed at the disposal of the University of Pittsburg and a special staff has been organized to carry on the work. At present the investigation is being conducted by a force of twenty-five, of which seven are giving their entire attention to this task. Some of these men are studying the effect of smoke and soot on the atmosphere, on the weather, on plant life, on buildings, on the public health; some are investigating the economic damage done by smoke and soot; others are making a detailed study of the mechanical devices for preventing or abating smoke; and still others are inquiring into the chemistry and physics of smoke and soot, into the laws concerning the smoke nuisance, and into the history of the subject as a whole. Recognizing the interest in the smoke problem manifested by a large number of American cities, and in response to inquiries that have recently been made, it has just been announced that the members of this staff are prepared to lecture upon various phases of the problem upon request. Those interested should apply to Mr. R. C. Benner, who has general charge of the investigation.

COMMERCIAL attachés are utilized by European countries as a means of detecting trade opportunities before they have been utilized by rival nations, and an important part of the success attained by Germany in foreign trade is due to her successful use of such means. Recently the Associated Chambers of Commerce of that country have suggested that commercial attachés should be stationed at consulates, in order to be in closer touch with trade than is possible at the great capitals, where industry is apt to be subordinated to politics, and the suggestion is typical of the spirit of intelligently directed effort which characterizes development of German trade. Example is more stimulating than precept, and, by the initiative of Messrs. H. A. Wheeler and J. H. Fahey, the American Association of Commerce and Trade has been formed in Berlin to "provide a national clearing house for the development and consideration of business opinion and to secure united action upon questions affecting the commercial interests of the United States. Only questions of national importance shall be considered." The Association should be able to accomplish much, and it is to be hoped that the movement will receive the support it deserves. The great trade opportunities of the future lie in the Orient, not in Europe, and it is discouraging to contemplate the trade relations between the United States and Oriental countries. In contrast with Germany, where consuls are, in many instances, men possessed of expert knowledge concerning trade conditions, American consuls in the Far East are, though otherwise competent, frequently devoid of more than a vague general knowledge of industry and the conditions which govern it, and no attempt is even made to supply the deficiency by the appointment of commercial attachés, though even such small European countries as Sweden maintain commercial attachés at Peking and Tokyo. When American trade with the Far East is fostered by intelligent and well directed effort a better showing in completion with European countries may be expected.

EXTENSIVE preparations are being made for the twelfth session of the International Geological Congress which is to be held in Canada next year. Excursions have been arranged preceding and following the meeting to all parts of the Dominion, from Nova Scotia to British Columbia, and an attractive program is being arranged. The special topics proposed for discussion include: the coal resources of the world; differentiation of igneous magmas; the influence of depth on the character of metalliferous deposits; origin and extent of pre-Cambrian sedimentaries; subdivisions, correlation, and terminology of the pre-Cambrian; to what extent the Ice Age was broken by interglacial periods; the physical and faunal characteristics of the Paleozoic seas with reference to the value of the recurrence of seas in establishing geologic systems. The International Congress is a widely representative body of great usefulness. At the last session, in Stockholm, the various countries were represented as follows: Algeria, 3; Germany, 161; Argentina, 2; Australia, 2; Austro-Hungary, 64; Brazil, 1; Bulgaria, 2; Canada, 6; China, 1; Denmark, 22; Egypt, 3; Spain, 9; United States, 63; France, 53; Great Britain, 44; India, 1; Italy, 30; Japan, 6; Mexico, 7; New Zealand, 2; Holland, 13; Portugal, 4; Rumania, 9; Russian Empire, 56; Sweden, 134; and Switzerland, 16. It is anticipated that about 1000 persons will take part in the Canadian meeting. Two previous sessions have been held in America, one at Washington in 1891 and another in Mexico in 1906. Both meetings were notably successful and it is anticipated that that to be held next year will surpass them. A copy of the preliminary circular and program, in French or English, may be obtained upon application to Mr. R. W. Brock, general secretary, Victorian Museum, Ottawa, Canada.

PATENT law is again thrown into controversy by the decision of the Massachusetts Supreme Court in the case involving the United Shoe Machinery Company. It was here held that although the question of whether the company is "an illegal combination in restraint of trade and has monopolized trade and commerce between the several states," must be decided ultimately by the United States Supreme Court, "no word or phrase in the Sherman anti-trust act reveals an intent to exempt the owners of patents from its sweeping provisions against monopolistic combination. The conclusion seems to follow that the comprehensive condemnation of the act against every person who monopolizes interstate commerce by combination with the others includes holders of patents as well as others." The company involved was one formed to perfect and maintain a monopoly by use of patents. There have been many similar cases, such as the reputed fact that it is impossible to purchase machinery for use in a steam laundry except the purchaser agrees to maintain a certain standard schedule of retail prices. It was fear of the extension of such a policy rather than any desire to rob inventors of just reward for their skill, that led to the popular outcry against the recent decision of the United States Supreme Court. If a clear line can be drawn between proper and improper use of patent monopoly, and the contention of the Massachusetts court sustained, there is no valid reason for objecting to the doctrine laid down by the Supreme Court. It is one thing to maintain that the maker of a manifolding machine may take his royalty in the form of a legitimate profit on a required ink, and another to insist that no one shall buy a mangle unless he agrees to charge three cents for each collar laundried. Patents are sound in principle, and in any legitimate operation of the patent law the patentee needs, just now, more protection than the public; but patents should not be used to make legal what would otherwise be an illegal monopoly.

DRILLING contests are regularly a feature of Fourth of July celebrations throughout the West, and even across the Pacific the custom has spread. At Tonopah this year Page and Pickens established a new record by drilling $45^{7}/_{16}$ inches in Rocklin granite in 15 minutes, striking an average of 66 blows to the minute. Lundquist and Dahlen, of Victor, Colorado, drilled $41^{7}/_{16}$ inches, and Porter and Goddard, of Oatman, Arizona, $38^{7}/_{16}$. At Lowell, Arizona, a shoveling contest was held, the task being to shovel two tons of ore over a partition three feet high. The prize of $100 was won by Henry Arnes, who completed the task in 8 minutes. His nearest competitor, Frank Travers, was 26 seconds slower.

Lead Mining in Missouri

Statistics of metal mining in Missouri in 1911, compiled by Mr. J. P. Dunlop of the United States Geological Survey and summarized on another page, invite comment. The total value of the state's production of lead, zinc, copper, and silver in 1911 is placed at $30,171,311; a very considerable sum. It is interesting to note that toward this total, silver contributed $26,430 and copper $80,051, and that production of both is increasing. Missouri mines now yield 49,867 ounces of silver and 640,411 pounds of copper, which fact will come as a surprise to those who think of Missouri as only a lead-zinc state. It is true that the most important contributions to the world's metal production now being made by Missouri are in the form of zinc and lead. In zinc the state has long ranked first, and shows no signs of impending loss of standing. In lead Missouri has held first place since 1907 when Idaho was passed in the race. Missouri lead mines have been known since the earliest settlement of the Mississippi Valley, but with the development of the silver-lead deposits of the Rocky Mountain regions attention was diverted from them and it was thought that their importance had ceased. This proved to be an error. When the price of silver dropped one-half, a new period of development began in the lead fields of the Mississippi Valley, and they now occupy their old place of first rank.

The greater part of the lead output of Missouri comes from the southeastern district. In 1911 the crude ore mined there equalled 3,974,712 tons and in the central and southeastern districts together, 219,145 tons of concentrate was produced. Since the output of the central Missouri district is relatively insignificant, this means that the five big companies operating in the Flat River district furnish nearly half the lead produced in the United States. The lead content of the crude ore in this district is 3.7 per cent. From this is made a concentrate containing 67.3 per cent lead and worth $46.94 per ton. The yield of concentrate from the crude ore equals 5.5 per cent. These are Mr. Dunlop's figures and are based upon returns from all the companies. One concern is, however, known to work ores averaging about 3 per cent lead and worth, accordingly, about $2.40 per ton in the ground. Even at this there is a profit since the saving is about 85 per cent and the operating cost, roughly, $1 per ton. Some of the Missouri companies have had a long struggle but all are now making money. While they do not distribute stockholders reports it is known that one cleared about $750,000 last year, another $500,000, and that others did proportionately as well. Though the plants are large they are simple and the investment charge, other than for land, is not unusual, taking into account the fact that each company, except the Doe Run which is affiliated with the St. Joseph, owns its smelter and markets its own metal.

It is interesting to compare these figures with those of the Bunker Hill & Sullivan Mining & Concentrating Company, operating in the Coeur d'Alene district of Idaho. This great company has mined to the close of 1911, 4,883,468 tons of ore having a gross value of $47,581,988 and has made an operating profit of $19,009,363, paying dividends to the amount of $12,701,850. Roughly the ore is worth, gross, $10 per ton; it costs $6.75 per ton, including freight and treatment; and the profit has been a trifle over $3.25. The recoverable value of the ore in 1911 averaged $7.55, of which $1.49 was due to the silver content. The ore is much more complex than in Missouri, milling costs more, and the tailing losses are higher. The gross value per ton of Coeur d'Alene shipping ore and concentrate was greater than that of a ton of Flat River concentrate, the figures being $50.14 and $46.94 respectively, the difference being due to the silver content. Operating costs at the Bunker Hill & Sullivan mine are $2.03 per ton; about twice as large as in the best Missouri practice. The ore, however, is richer; containing 9.59 per cent of lead and 3.81 ounces of silver as against 3 to 3.7 per cent lead and no silver at Flat River. Freight and treatment charges are much higher in the case of the Idaho ores than in that of those from Missouri. Another striking difference is in the character and form of the orebodies in the two districts. In Idaho the lead is found, in the form of galena mixed with other sulphides and carbonate of iron, metasomatically replacing quartzite along fault fissures. In Missouri the galena, with only slight admixture of other sulphides, occurs impregnating nearly horizontal beds of dolomite of great thickness and extent. The galena shows a marked preference for certain layers and for beds of peculiar physical condition and chemical composition, and its distribution is, in detail, extremely irregular. In Idaho it is possible, and customary, to develop and carry large ore reserves; that of the Bunker Hill & Sullivan company is now estimated at 3,521,050 tons. In Missouri, in a large way, there are no reserves and a steady output is maintained by keeping open a considerable area of 'face.' The conclusion should not be drawn that the companies operate 'from hand to mouth'. In fact they have in each case excellent assurance of long continued production, but this is not in the form of proved ore reserves. Since 1867 the diamond-drill has been commonly and largely used in this district. It was in truth the application of the drill that made possible all the modern development. It is not customary to figure in tonnage the proved or probable reserve found by drilling, for the reason that experience has shown that individual holes are extremely deceptive. Conditions are not comparable with those in copper mining where great confidence has come to be felt not only in the general but the specific results of drilling. In Missouri the character of the rock, especially the content of organic matter, is often as significant as the actual amount of lead present. Drilling here is of the greatest service in showing the general trend of the orebodies but not their actual content. One of the most capable and successful engineeers who has worked in the district came, in time, to rely much less on the drill than on constant study of the face of the mine, calmly confident that the ore was continuous over large areas in some direction and could be followed underground. The orebodies are large and stopes are acres in extent; the ore is simple and the conditions for working excellent; fuel supplies, and labor are near at hand; and there is a ready market for the output. All these factors have enabled the Missouri companies, with a leaner ore and no silver, to gain upon their capable and energetic competitors in the West, and no one even superficially acquainted with the district can doubt that the lead industry that began when the Spanish first hunted metal for making bullets, will continue for many years to contribute to the national wealth.

Veta Colorada Mill and Cyanidation Plant—II

By Bernard MacDonald

(Continued from page 4.)

Comments and Criticism

In the first part of this paper* I gave an outline of the flow-sheet or travel of the ore pulp and solution in treatment through the mill of the Veta Colorada M. & S. Co., at Parral, Mexico. I propose now to submit comments and criticism of the millsite, machinery, and practice.

The Millsite.—The selection of a site for the erection of a milling plant is of fundamental importance, and the greatest care, considering all the factors bearing favorably or adversely on the economy of future operations, should be intelligently and carefully exercised before making the final location. The same is equally true and of only relatively less importance with respect to the sites of all appurtenant buildings such as power-house, machine-shop, precipitation-house, warehouse, and assay office. Before the grade stakes are finally set, the designing engineer should have a clear comprehension of all the factors commercially affecting future operations, and from them work out a favorable balance for the site to be chosen. The selection of a site that is ideally perfect is impracticable, even in the most favorable localities, but existing conditions should be so weighed and balanced that the best site possible shall be chosen. The preliminary investigation and study necessary for this purpose is not always given by the designing engineer. It frequently happens that the site is arbitrarily selected by those who have little or no experience in mill construction or operation, and the engineer is left to do the best he can with the site so selected. Be this as it may, the fact remains that serious errors in the site of the mill or the accessory buildings exact their toll from the beginning of operations.

These reflections have been inspired from observations covering milling plants in general and not alone from the site selected for the Veta Colorada mill, although the site of that plant was not the best that could have been selected. The site for this mill was chosen too far down the hillside (a mistake frequently made), whereas, with a few minor disadvantages, completely overshadowed by general improvement in facilities for construction and operation, the mill might have been placed from 50 to 100 ft. higher. Such a site would have saved considerable expense in grading and retaining walls for the mill benches and in the disposal of the tailing of the ore treated, and the plant would have been more accessible for construction and operation.

In the design of the plant the old idea of placing the precipitation-room at the lower end of the mill was adopted. The result of this, coupled with the necessity of securing flow grades on the hillsides for the several benches of the plant, caused it to be stretched out so that it occupied a length of over 500 ft. from the crusher-bin to the precipitation-house. Notwithstanding this length, the site for the precipitation-house, and the sump tank and pump-house adjoining measuring 80 by 150 ft., had to be blasted out of the solid rock to an average depth of 12 ft., and, to provide floor drainage, a small tunnel had to be run from the bottom of this grade to a nearby creek. The precipitation-house, as designed and built, was 75 by 100 ft., just twice the size required, and at the place selected it was the most distant of all of the mill buildings from the offices and living quarters of the American employees, which made its supervision and protection more difficult.

In completing the plant, I seriously considered abandoning the use of this building for precipitation and the erecting of a new one on the patio at the head of the mill, where it would have had all the advantages of being close to the company's offices and the living quarters of the American employees, but as the house had already been substantially built of masonry, floored with cement, and the sump tank and return pump erected, the expense deterred me from doing so. Had the mill been placed higher on the hillside, the steeper contour would have provided for closer building of the several plant units, saved hundreds of feet of piping, and thousands of dollars in grading, besides affording better accessibility for supervision and more economical conditions for operation.

Power Plant.—The placing of this plant, and the design of its machinery could have been improved. It was built close to the mill, to which fuel had to be hauled from the railroad terminal, and the boilers supplied with mine-water carrying deleterious solids in suspension, while, with a 7-mile transmission line, it could have been built at the junction of two railroads where fuel would have been cheaper and plenty of clear water for the boilers available. And, for some reason hard to explain, the electric generators and the mill motors were designed for a 25-cycle current, a design at variance with common commercial practice. A 60-cycle electric plant was in existence at the time, designed for the sale of current to users in the district, and, at the present time, a 15,000-hp., 60-cycle, hydro-electric plant is bringing in its lines to the district to dispose of its power to the mines and mills. This power cannot be used in this plant without the intervention of 'frequency changer' and a corresponding consumption of power.

The Rock-Breakers.—As already stated, these are of the 'Australian type', which in operation close their jaws and crush the rock on the down-throw of the pitman, instead of on the up-motion as in the ordinary type. This antipodean type may work satisfactorily in Australia, but as designed for this plant it did not do so. The force exerted in crushing the rock on the down-thrust of the pitman reacted upwardly on the bearing boxes of the fly-wheels, loosening and frequently breaking the stud-bolts that held down the caps. The keeping of the toggles in adjustment was also much more difficult than with the ordinary type of rock-breaker.

Mortar Foundations.—These were built of concrete in separate blocks for 20 stamps at some time before work was suspended in 1907. I found these blocks cracked horizontally from end to end, the cracks being 6 to 12 in. apart, so that, at places, the top layers could be easily lifted by driving a gad in the cracks. I puzzled over this problem for some months pending the arrival of the mortars from the factory, and finally reached the conclusion that these cracks were due to one or more of the following causes: (1) the concrete was laid in layers and each layer allowed to dry before the next one above was laid down, the junction of the two contiguous layers constituting a line of weakness along which the unequal shrinkage of the dry and wet concrete was manifested in the cracks; (2) the sand in the different layers of concrete differed in character and quantity; (3) the frequent but erroneous practice of putting a thin leveling layer of neat cement on top of the block, instead of laying the block a trifle high and bringing it to proper level with a chipping tool. It was evident that the foundation blocks would crumble under blows at the stamps unless something was done to make the layers cohesive, for even the vibration of the blow of a sledge at one end of a block could be plainly felt at the other. To dig out the foundations and put in new ones, it was estimated, would have cost $5000. This

*See *Mining and Scientific Press*, July 6, 1912.

would have been safe, but that portion of the mill building was roofed and sided with corrugated iron and would have had to be stripped, as blasting would have been necessary in order to get out the deeper sections of the blocks. I finally concluded to have the blocks drilled with vertical holes to the depth of 30 inches, 30 holes under each two mortars and the shoes of the battery posts, and dropped into each hole a piece of ⅞-in. octagon drill steel 30 inches long, around which was poured melted sulphur until the hole was filled level with the top of the block. After this there was no vibration felt under the blows of the sledge-hammer, and the rubber pads were put on and the mortars bolted down. On two of the blocks the top leveling layer of concrete ranging from ¼ to 1½ in. crumbled off. From these I removed the rubber pads and wedged up the mortars to the level and tamped the space between them and the concrete solid with 'rust joint.' The result was satisfactory, as none of the foundation blocks showed any signs of weakness under operation.

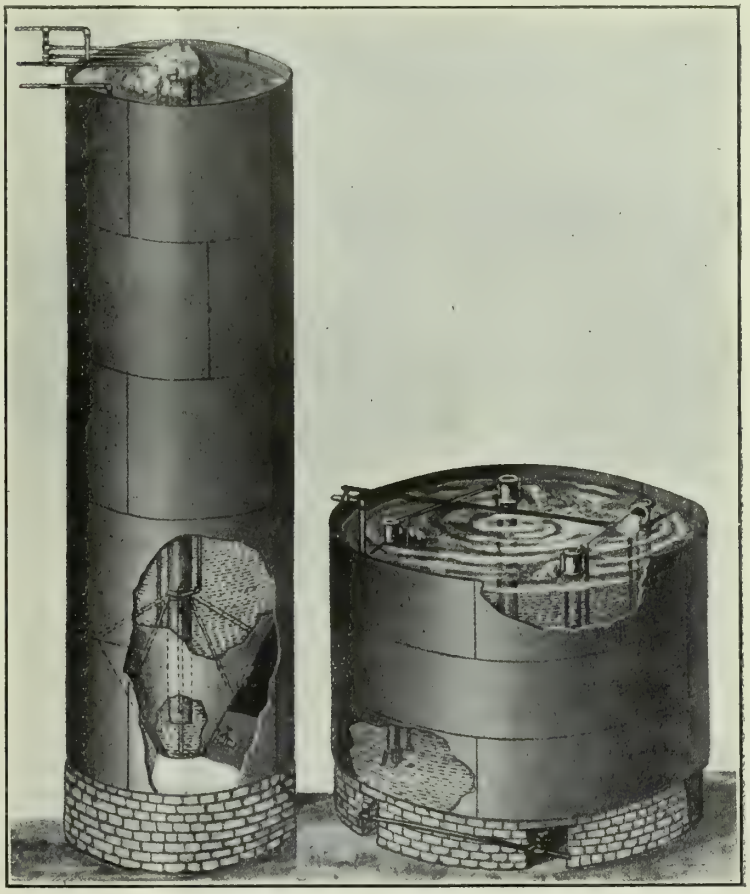
Concentration.—The mill is equipped with 24 concentrating tables, which were put into service when operations began. Owing to the fact that the dump ore to be treated was the ferruginous oxidized low-grade material discarded from the ore previously mined from the upper levels, and that most of the other ore treated in the mill was of the same character, it was not practicable to make a clean grade of concentrate that could be profitably shipped to the smelters. After tests showed that better commercial results could be obtained from cyaniding the pulp without concentration, the tables were left idle and the pulp treated entirely by cyanidation. The concentrators remain in place ready to be started if complex sulphide ore is found in the deeper levels.

Tube-mills.—These measure 5 by 14 ft. and were originally designed to be driven by 30-hp. motors, but before starting I substituted 40-hp. motors, and even these had barely enough power to start the loaded mill from rest without reverse swinging. The spur and pinion gearing by which the motors operated the mill, proved not to have sufficient strength for the strains of operation, and after a couple of months' use three of these broke and were replaced by belt pulleys. The motors, when connected by belts, started the tube-mills with greater ease than when previously connected by spur-gearing.

It will be interesting to millmen to know of a little device by which I improved the grinding capacity of the tube-mills and lightened their running load. The discharge openings of the tube-mills were of 7-in. diameter and the pebble charge came up to the bottom of these openings, or 3½ in. below the longitudinal centre of the mill when at rest. I reasoned that if the discharge opening was smaller, so the mill could be loaded with pebbles until the longitudinal centre line of the mill was reached, this load would be easier started and better grinding would be done. To test this idea, I had a wooden plug 8 in. long turned on the lathe to the exact fit of the discharge opening and a 1½-in. hole bored through the centre line of the 8-in. dimension. This plug was driven snugly into the discharge opening and the mill filled with pebbles an inch or so above the centre. The result was very gratifying, the mill was easier to turn over from rest and to run than with the lower charge of pebbles, and the grinding was better. Since this time I have recommended this in other mills, where it showed similar favorable results.

Agitation Tanks.—As stated at the beginning of these notes, the plant, as originally designed, provided for the dual treatment of the pulp as sand and slime. For the agitation of the slime, tanks 25 ft. in diameter by 12 ft. high equipped with stirring arms were provided in the original design and in 1907 two standard Pachuca tanks 25 ft. in diameter by 45 ft. high were purchased. Most of the material for these tanks had reached the site, but none of them was erected.

For some years previous I had been developing and experimenting with a system of pneumatic agitation with the object of overcoming the defects of the Pachuca tank system, namely: (1) The uneconomical shape of the tank, having small diameter and great height, which provided small holding capacity per pound of steel employed in the construction; (2) the high consumption of compressed air for the work done, and the trouble and expense for operating the rubber sleeve air nozzle; (3) the vertical



PACHUCA TANK. PARRAL TANK.

settlement of the pulp immediately around the central lift-pipe and the consequent imperfect mixture of the solid and solution constituents of the pulp charge around the side of the tank.

By experiments based on scientific principles, I had developed a system which worked out satisfactorily in a small way and promised to eliminate the defects above mentioned, and now the opportunity of applying it on a large commercial scale was presented. But what were to be the dimensions of the first 'Parral tanks' to make the best compromise of the various conditions existing at this plant? The factors to be equated in the compromise were: (1) my former ideal of an agitation tank to be of such dimensions as would give the greatest holding capacity per pound of steel used in its construction; (2) the height of the two standard Pachuca tanks, to be units in the series, the steel plate for which was in stock; (3) a large quantity of steel plate shaped for the original agitation tanks 25 by 12 ft. which was in stock; (4) arrangement of tanks suitable for either the individual or continuous processes of treatment as would prove best under experiment; (5) the original design to make the plant's capacity 500 tons per day to be carried out so far

as the machinery and material in stock would permit.

The compromised design and dimensions of the agitation tanks under these conditions resulted in a battery of tanks consisting of the two Pachucas, each 15 ft. in diameter by 45 ft. high, and five Parral tanks, each 25 ft. in diameter by 42 ft. high. The Pachucas had a holding capacity of 83 metric tons each and the Parrals 250 metric tons each; the pulp consisting of two parts by weight of solution to one of the dry solids. With the exception of one of the Pachuca tanks, which was set apart as a storage tank for the wash-water required for the filter-presses, these tanks were 'piped' top and bottom so as to be operated by either the individual or continuous agitation systems as might be demonstrated by test to be preferable. The Pachuca tank was equipped in the usual way with the central transfer pipe, 16 ft. diameter, provided with the 1½-in. pipe with rubber sleeve nozzle for the introduction of compressed air as furnished by the manufacturers, and the Parral tanks were equipped with four 12-in. transfer pipes, each of which was provided with a 1-in. compressed-air pipe equipped with a ball-valve nozzle. Operation was commenced and continued one month by the continuous process of agitation treatment and then changed to the individual process. So far as the extraction went, there was no difference shown by either process over the other, but on account of its greater economy and simplicity of operation, the continuous process was adopted after the tests.

The Pachuca and Parral Systems.—The Pachuca tank here gave as favorable results as usual, and, in comparison with the Parral tanks,

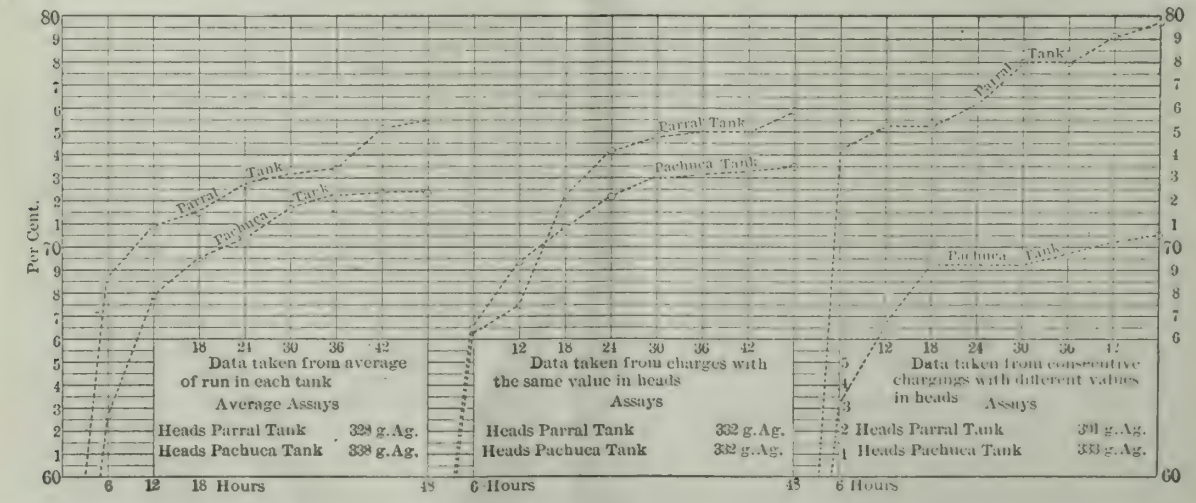
> "I could have been happy with either,
> Were the other dear charmer away."

However, in this case, there was a decided difference between the charmers. So far as it was possible to determine the amount of air consumed in the tanks operating side by side, treating pulp of the same specific gravity, by the degree of valve openings on the compressed-air supply pipes of the same diameters, there was no greater consumption of air in agitating the Parral tank holding 250 tons than in agitating the Pachuca holding only 83 tons. Besides, the rubber sleeve nozzle in the Pachuca tank gave considerable trouble in starting up agitation after the compressed air was shut off for any reason, while, in the Parral tanks under the same condition, the ball-valve nozzles would start up agitation promptly without trouble. After the month's run, when the change was made from the continuous to the individual system of agitation, the rubber sleeve was found to be frazzled and to have lost its elasticity. At this time the 1-in. air-nozzle ball-valve was attached to the end of the 1½-in. pipe in the Pachuca tank, and afterward there was no more trouble in starting and the agitation was equally active, with appreciably less valve opening. The following letter from D. S. Colland, assistant to C. W. Van Law, director for the Compania de Real del Monte y Pachuca, will be interesting as corroborative evidence on this point. It relates to experience at Pachuca in February 1912:

"Just a word regarding the installation of ball-valves in our Pachuca tanks. Before the receipt of your letter, accompanied by the 1-in. valve, we had already tried out the ¾-in. that you had left here. As you know, the valves we have always used are the rubber sleeves outside of 1½-in. air pipe. This pipe was reduced at the bottom of the tank for the ¾-in. valve and all the air turned on at the 1½-in. valve at the top. This resulted in the rising of the pulp in centre column but 2 in., the air bubbles simply forcing their way through the thick slime. Upon receipt of the 1-in. valve it was connected in the same manner and it worked excellently. The 1½-in. air valve at top of tank is opened about three-quarters of one turn for all the rubber sleeve valves, and the ball-valve has been operating now nearly a week, giving entire satisfaction. On last Friday the power was interrupted several minutes. The four tanks operated with rubber valves had to be opened full to start them, while the valve on the tank equipped with ball was not touched. As soon as the air-pressure came on, this tank began agitating exactly as before interruption. The slime during the test has been approximately 1.7 to 1."

The Parral system of agitation, like the Pachuca, is effected by the continuous transfer of the pulp from the bottom to the top of the tank by air-lift, but the details of the method of operation by the two systems are entirely different. In the Pachuca, which is fitted with a cone-bottom, the agitation of the pulp is effected by its continuous transfer from the bottom to the top of the tank, through a pipe 16 inches in diameter fixed centrally in the tank with its intake near the apex of the cone at the bottom and the delivery end at or near the top of the pulp charge. The compressed air is delivered to the intake end of the transfer pipe through a 1½-in. pipe capped at the end and perforated on the sides for a length of 6 to 8 in. back from the cap. To prevent the pulp from entering the perforations, a tight-fitting rubber sleeve is drawn over the end and clamped above the perforated section. When the compressed air is turned on, the rubber sleeve expands against the hydrostatic pressure surrounding it, and the air passes out under it and, entering and ascending through the transfer pipes, carries the pulp from the bottom and discharges it at the top of the tank. The mechanical defects which I found in the Pachuca tank and system of agitation will come under the following heads:

1. The tall narrow shape of the tank with its comparatively small holding capacity per pound of steel and its high cost of construction.


Per Cent.
Parral Tank
Pachuca Tank
Data taken from average of run in each tank
Average Assays
Heads Parral Tank 328 g.Ag.
Heads Pachuca Tank 338 g.Ag.
Data taken from charges with the same value in heads
Assays
Heads Parral Tank 332 g.Ag.
Heads Pachuca Tank 332 g.Ag.
Data taken from consecutive chargings with different values in heads
Assays
Heads Parral Tank 391 g.Ag.
Heads Pachuca Tank 333 g.Ag.
Hours

EXTRACTION-CURVES PLOTTED FROM RECORDS OF OPERATIONS IN PACHUCA AND PARRAL TANKS. SAMPLES TAKEN EVERY SIX HOURS AND ASSAYED.

2. The cost of elevating the charge to tall tanks during operation, barring plants erected on exceptionally steep millsites.

3. The imperfections of the means employed for admitting the compressed air to the lift-pipe, and excluding the pulp from choking the air-pipe during times when the air is shut off.

4. The excessive amount of power necessary to generate the high pressure and volume of air required to effect the agitation in a central lift-pipe of large diameter.

5. The imperfect mixture of the solid and liquid constituents of the pulp in the tank during agitation.

6. The difficulty of starting agitation when compressed air has been shut off and the solids in the pulp settled in the cone at the bottom of the tank.

In the Parral tank system these defects have been eliminated by the use of a plurality of transfer pipes of comparatively small diameter, the number of these pipes being in proportion to the diameter of the tank, which may be economically proportioned to its height so as to give the greatest holding capacity per pound of steel or material used in the construction. The accompanying illustration and table of comparison will indicate some of the advantageous features in construction of the Parral type of tank.

COMPARISON TABLE OF CORRESPONDING ITEMS IN STANDARD PARRAL AND PACHUCA TANKS

Points of Comparison.	Parral.	Pachuca.
Height in feet	15	45
Diameter in feet	25	15
Horizontal area in square feet	490.8	176.7
Effective holding height in feet	14	39
Holding capacity in cu. ft.	7671.2	6891.3
Holding capacity in metric tons of solids:		
Pulp ratio: solution 2, solids 1	92.8	83.3
" 1½ " 1	139.4	125.3
" 1 " 1	155.3	139.5
Weight of steel plate and all construction:		
Material in pounds	14,650	33,000
Lb. steel per ton of 2.1 pulp	157	400
Lb. air-pressure required for agitation	8 to 10	30 to 50

I have selected the dimensions 25 by 15 ft. as the standard size for the Parral tank for the following reasons:

1. A tank of these dimensions makes a convenient unit for most plants, as it holds from 90 to 100 metric tons of dry pulp of a specific gravity usually suitable in most ores for treatment.

2. The high holding capacity per pound of material in its construction.

3. Its comparatively low height, which makes charging possible by gravity flow in most hillside plants, and permits agitation by compressed air of 8 to 10 lb. pressure per square inch.

However, the system by which agitation is effected may be installed in and will work well in tanks of any diameter and any height. In the plant of the Veta Colorada M. & S. Co. the tanks were 25 ft. in diameter and the height was built up to 42 ft. to correspond with the Pachuca tanks included in the battery, as the walks on top and sampling platform could be more conveniently arranged in connection with a uniform height. All the trouble and expense due to the short life of the rubber sleeve as a nozzle on the compressed-air pipe and the high consumption of air required to operate it (the total hydrostatic pressure of the tank charge on this sleeve being 850 lb.) in the Pachuca tank is obviated by the air-nozzle ball-valve of the Parral tank. This valve is balanced in the hydrostatic head of the pulp charge except about 50 lb. due to the seat area. These valves have been in continuous operation for 16 months without renewals or showing any sign of loss of efficiency, so their life limit cannot be fixed. With these valves, agitation has been started and brought to normal running in 15 minutes after the air had been shut off and agitation suspended for 24 hours, by simply turning on the air.

The imperfect mixture of the pulp charge of the Pachuca tank due to the vertical settlement of the pulp immediately around the central transfer pipe, is prevented in the Parral system by creating a rotary flow in the tank charge whereby the whole mass revolves round and round from top to bottom within the tank, and the solids are thus carried spirally in suspension, and therefore the distance of their travel from top to bottom of tank is many times greater than if allowed to settle vertically. The rotary flow is created by the force of the horizontal discharge from the several transfer pipes in the same direction with respect to the side of the tank on the surface of the charge.

The surprising facts in connection with the rotary flow in the tanks are that it is generated by so small a force

COMMENCEMENT OF PULP TRANSFER IN PARRAL TANK.

as the spouting from the discharge of the transfer pipes and that when generated on the surface of the charge it will extend to the bottom of the tank with sufficient activity to prevent the settlement of the pulp in dead accumulations on the bottom such as takes place in tanks 42 ft. high. An analogy, showing the mobility of water under slight force and the persistence of flow when once created in it, is seen in the great ocean currents which, generated by the trade winds, revolve continuously between the shores of continents thousands of miles apart. The Gulf stream is generated by the easterly trade winds blowing on the surface of the Caribbean sea which drive these waters westward before them till they make their escape back again into the Atlantic ocean between Florida and Cuba, where, as is generally known, the flow of the current is 6 ft. per second and its strength such as to sweep the sea-bottom, here 600 ft. below the surface, as clean as a floor and force the current in a rotary path across the Atlantic ocean to Europe and back again. Whether this analogy is correct or not, the fact remains that the rotary flow created at the surface of the charge in a Parral tank maintains a continuous revolution in the entire mass

within the tank which keeps the solid and solution constituents of the pulp in proper proportional mixture, in every part of the tank at all times during treatment, while the spouting of the pulp at the surface of the charge gives the aeration required for the chemical reactions.

Extraction.—That the extraction is better in the Parral tank as compared with the Pachuca is shown by the diagram on p. 42, which is self-explanatory. The data from which the curves are traced were taken from the log records of the results obtained when both tank systems were being operated by the individual process.

Chemical Constituents of Solution:

KCN	15%
Protective alkalinity	850 gm.
Lead	3 gm.

Physical Condition of Pulp:

Dilution	2 to 1
Specific gravity	1.26

Screen sizes: +200, 15 to 20%; −200, 75 to 80%.

Extraction:

Prior to tank treatment, 10 to 20%.
By tank treatment, as per chart.
Total extraction, as per chart +10 to 20%.

In explanation of the percentage column of the above chart, it may be said that more than 62% of the metal was extracted during the first six hours' agitation.

The low extraction shown in the curves was due to the character of the dump ores being treated. The dump as it was built up was mixed with accumulation of rotten timbers from the mine workings and the ashes and charcoal from the steam plant near the shaft. It contained, besides, the mud and oxidized matter from the ore-washer which was on the dump and used for washing the mine ore preparatory to hand sorting.

The Kelly Filters.—These did satisfactory work on the slime, which was very clayey. The filter test made on the slime of an average sample of the ore before the filters were ordered, showed that under 40 lb. air-pressure it was only possible to build a cake ⅜ in. thick in 20 minutes. In regular operation, after the presses were erected, there was no difficulty experienced in building a cake 1 in. thick in the same time and drying it to 15% moisture under 30 lb. air-pressure for 3 minutes. Had water not been available for flushing the discharged cake to the dump, it would have been dry enough at 15% moisture for disposal by belt-conveyor. Having filter capacity to spare, one of the filter-presses was very successfully used as a clarifier for the decanted solution from the Dorr thickening tanks on its way to the zinc-boxes for precipitation. This solution flowed through the leaves of the press by gravity under a head of 25 ft. and came out perfectly clear. About a ¼-in. cake built up of the fine matter suspended in the solution would deposit on the leaves each 24 hours. This had to be discharged, as nearly all flow stopped when a ⅜-in. cake would form on the leaves.

Dividends

The Colorado M. Co. paid a dividend of 3c. per share on June 25.

The Daly West has declared a dividend of 30c. per share, payable July 10. This makes a total paid to date of $6,552,000.

The Bunker Hill & Sullivan M. & C. Co. paid dividend No. 178 of $65,400 on July 3. This makes the total amount of dividends paid $13,584,750.

The Wettlaufer Mining Co. has declared a quarterly dividend of 2½%, with an extra dividend of 2½%, payable July 20. This brings the total dividend disbursement to 30% of the capital.

The Colorado Fuel & Iron Co. has declared a dividend of 2½% on its preferred stock. This is the first dividend paid since 1908 on the preferred shares, on which 8% per annum is guaranteed.

Mining in France

PARIS CORRESPONDENCE

A statement has been issued by M. Péchadre, who was delegated by the budget committee of the French Chamber to draw up a report respecting French public works. The chapter devoted to mining wealth contains a good deal of interesting information concerning the present mining situation in France. He describes the mining industry as one of the most prosperous of the nation. There are 1483 concessions covering an area of 1,200,000 hectares (one hectare equals 2.471 acres), all which concessions, it is said, are being actively exploited.

The annual output of the minerals in France is estimated at 945,000,000 francs value. This includes quarries, but does not refer to Algeria, which is included in many statements, at times leading to confusion in respect to France proper. The number of workmen engaged in mining is 350,000.

The number of coal and lignite concessions is 641, of which 298 are being exploited. The principal centres for the production of coal are the well known Nord and Pas de Calais, which furnish between them about 67% of the total coal production of France. There are other coal centres of local importance, such as the Loire, the Gard, Saône-et-Loire, L'Aveyron et le Tarn, and finally there are the Bouches-du-Rhône and the Puy-de-Dôme et l'Allier. The production of coal in France is increasing. Nevertheless, the country is unable or is not equipped to produce the quantity necessary for its consumption, and it is obliged to import coal from England and sometimes from Germany and Belgium; to the latter countries it returns the compliment by exporting fuel to districts convenient to its source of supply.

Of the ironfields of France the principal centres are the Meurthe-et-Moselle, where over 50 mines are worked. Then follow Normandy and Anjou, where considerable iron deposits have been discovered; and, finally, in the Pyrenees high-grade iron ore is produced and is used for special purposes. It may be mentioned in connection with the Normandy deposits that the Germans realize their importance and have established large plants there to supply the lack of iron ore in Germany, and when these are well advanced France will become a large exporter of iron ore. As to other minerals, except gold and one or two others, the situation is not so satisfactory. France has some 90 mines of various minerals such as iron pyrite, manganese, antimony, copper, lead, zinc, and silver, which produce a value of about 20,000,000 francs of mineral of various kinds. Most of them yield but small profits, except the zinc and iron pyrite, which, on the contrary, have paid well.

Gold-mining is improving. A number of companies were formed with success at Lucette (Mayenne), Bellière (Maine-et-Loire), and Chatelet (Creuse). Encouraged by the results, many prospectors continued the search in districts such as Aurieras and St. Sulpice-Laurière, where numerous veins have been discovered, and concessions are being applied for from the Ministry of Public Works. There are 41 concessions for salt mines and brine wells, where about 250,000 tons of refined salt, 115,000 tons of crude salt, and 490,000 tons of salt in solution is produced, the last named for the production of soda.

There are now 190 applications before the Ministry of Public Works for mining concessions, 20 of which are for coal, 70 for iron, 38 for gold, 20 for salt, and 42 sundries. The statement appears at a time when the mining laws of France require revision; in favor of the miner on the one hand, while the Government appears desirous of getting more revenue out of them, on the other. While the matter of revision remains unsettled, little may be said; but enough is known outside the report to confirm a *couleur de rose* view of the coal and iron situation, particularly of the latter, in the east near the German frontier and in the north in Normandy; the revival of the gold industry also promises well.

Churn-Drilling in Shaft-Sinking

By Tom McCormac

Churn-drilling has long been practised, and is a most common method of drilling any soft rock, particularly in surface work. In these latter days of the almost universal use of compressed air and machines for drilling purposes, churn-drilling has not been used with the frequency that is justified by the results which can be obtained from its use. In hard rock the method cannot compete with the power-driven drill, but in shaft work most excellent results have been obtained in the softer rocks. Chief among the advantages of churn-drilling is the fact that in any ordinary shaft drilling can be started within ten minutes after the broken rock from the previous round has been cleaned up. The hole drilled, furthermore, is large, and, when loaded, the powder lies well toward the bottom, where it can do the best work. And not least of the advantages of the drill is the fact that anyone can operate it.

In sinking through any soft rock the churn-drill will compare most favorably with the air-driven piston drill. In speed of drilling it is even the faster in some cases, since no time is consumed in the unproductive work of 'setting up' and 'tearing down.' It has the further advantage of requiring no expense for power. While no particular skill is required in its operation, still the hard work involved in its use makes a careful selection of the drilling crew imperative. A good active workman will accomplish twice as much drilling as will a man only a little less energetic; while in the hands of poor men, churn-drilling would probably fail entirely. Churn-drills may be had in a great variety, ranging from the elaborate outfit used in testing placer ground to the simple bar of steel sharpened at each end.

I am indebted to W. H. Storms[1] for several of the ideas which I used successfully in sinking a two-compartment shaft through a firm but soft shale; but I was first induced to try the drills by Martin Empey, an able miner at Ely, Nevada. In this shaft it was the usual routine for four men to drill 10 holes from four to five feet deep, and blast in four hours. No piston drill could compete with the churn-drill in this class of rock. I used the common ⅞-in. drill steel sharpened on each end and in 7 and 9-ft. lengths. Should deeper holes be desired, I would advise the purchase of bits fitted for 1-in. pipe and which can be obtained from any dealer in mining machinery; these can be attached to pipe of any convenient length. The shape of the bit is of more importance than in hand drilling, and it should be carefully made, rather strongly forged, exactly gauged, and tempered very low. A churn-drill is not intended for hard rock, and a low temper—almost a blue—will give the best results.

Usually a hole was started with a hammer and drill, although there were times when the rock was soft enough to auger a short distance, and at other times an old 'gun' or 'bootleg' would be cleared out and made to serve as a short hole in which to start churning. Until a hole reaches a depth of a foot or 18 in., the drilling goes rather slowly; after that it goes surprisingly fast. Up to a depth of three feet the hole can be cleaned if necessary with an ordinary machine 'spoon', but a deeper hole can be more quickly cleaned with the device described by Mr. Storms—a bar of ⅜-in. iron with an eye welded in the end through which can be drawn an old rope yarn or a piece of rag. This, dropped into the bottom of the hole, is withdrawn and wrung out, and the operation repeated until the hole is dry. Should there be too much water, it can be removed by using a piece of ¼-in. pipe bent over at the top and using one hand at the top for the valve, or it can be removed by using the sand-pump. A simple form of the latter is a pipe having the bottom drawn to a small opening which is closed with a steel ball, held from being thrown out of the pipe by a pin a short distance above. Plenty of old sacks for 'mop rags' are needed, and a couple of tin cans, without bottoms, will occasionally be found useful for casing the top of a large hole.

One of the most frequent causes of trouble in drilling with the churn-drill is the encountering of caving or raveling ground. In such case the supply of drilling water must be kept as low as possible, in the hope that the thick mud will plaster the sides of the holes. If a drill should break, it can usually be loosened in the hole and fished out with the scraper, or it can sometimes be made to adhere to a chunk of mud or clay on the end of the loading stick or scraper. The bar magnet, suggested for this work, would, I am afraid, prove to be far too interesting a plaything to be permitted in a shaft.

[1] 'Timbering and Mining,' p. 141.

Copper Producers' Association Report

The Copper Producers' Association statement, July 8, shows a decrease during the preceding month in accumulation in this country of 5,280,639 lb. The details are as follows:

	Pounds.
Stock of marketable copper of all kinds on hand at all points in the United States, June 1, 1912	49,615,643
Production of marketable copper in the United States from all domestic and foreign sources during June	122,315,240
Deliveries for consumption, June	66,146,229
Deliveries for export, June	61,449,650
Stock of marketable copper of all kinds on hand and at all points in the United States, July 1.	44,335,004

The changes in surplus since July 1, 1911, have been as follows, in pounds.

	Increase.	Decrease.
July, 1911	.....	19,695,306
August	.....	4,297,357
September	7,453,355	.....
October	.....	5,897,214
November	.....	23,212,454
December	.....	22,330,493
January, 1912	.....	22,173,252
February	.....	3,301,944
March	.....	572,431
April	2,927,829	.....
May	.....	15,450,386
June	.....	5,280,639

Gypsum mined in 1911 amounted to 2,323,970 short tons, valued at $6,462,035, as stated by E. F. Burchard in an advance chapter on gypsum from 'Mineral Resources for 1911,' published by the U. S. Geological Survey. This was a slight decrease from the figures for 1910—1.05% in production and 0.94% in value—but while the industry was not especially active, certain changes, such as the replacement of old mills by a smaller number of larger modern mills and the establishment of mixing plants in commercial centres, should result, according to Mr. Burchard, in the saving of freight charges on finished plasters and enable the products to be sold to the consumer at low rates. Gypsum was produced in 17 states and in Alaska from 78 mills. The imports for 1911 were considerably reduced.

Mineral deposits of importance in Turkey are those of emery, chromite, copper, and marble. Great supplies of marble in matchless varieties of color are found on the coast of the Sea of Marmora and elsewhere, most of them unworked. Eski Shehr practically supplies the entire world with meerschaum. The work of mining is still pursued in the most primitive fashion with picks and knives. The output goes almost entirely to Vienna, the average annual value being about $300,000. Why American dealers should buy meerschaum in Vienna instead of at the production point is not apparent. Turkey has many hot and mineral springs, the most famous being those at Brusa and Tiberias, which only await foreign capital to gain renown among the health resorts of the world.

El Porvenir Mine in the District of Mallama

By F. P. Gamba

In almost all the mines in the southern part of Colombia the ore is genetically related to volcanic action. In the case of the El Porvenir mine, it is connected with the most important volcano ever existing in South Colombia, the Gualcala. This volcano, at present extinct, was active until a recent geological epoch. The last lava flow from Gualcala was an augite andesite, which I have called propylite in my Spanish writings on the subject. Afterward the volcano ejected only breccia and mud. To this breccia I ascribe the origin of the ore deposits, and for that reason I call such material madre (mother of the formation). During its last convulsions, the Gualcala vomited only tuff.

MAP OF COLOMBIA.

My experience in the mines of this territory permits the following general conclusions:

(*a*) The metalliferous deposits of the region had a common origin.

(*b*) The ore-bearing formation is the breccia ejected from the volcanoes.

The mineral-carrying waters of these muddy eruptions percolated through the mass of the breccia to impregnate the subjacent rock, filling at the same time the crevices, fissures, joint places, and cleavage cracks, so as to form the *mantos*, stringers, and networks of ore characteristic of the mineral formation here.

(*c*) The actual orebodies have been formed by reconcentration under the influence of surface waters.

El Porvenir mine is one of the most appropriate, in which to study the genesis of the deposits which characterize the Narino department, and for this reason I have selected it for a brief description, in which to summarize the principal features of the petrology (and economic conditions) of the locality.

Situation and General Relations

El Porvenir mine is one of a group of concessions owned by a native company named Compañia Minera de Mallàma, and it is the only one which has been much explored. The group consists of 30 pertenencias of 600 by 240 metres each. El Porvenir is near the peak Gualcalá and beside the crater on the west or Pacific slope of the cordillera which trends north-south.

It is a noteworthy fact that all the big craters here open to the west, and therefore the most important outflow of lava was in that direction.

The altitude of the workings is 3400 metres (11,100 ft.); mean temperature, 7°C.; the climate very healthful.

The distance to Guabo, a village on the highroad to Barbacoas, is three and a half kilometres. The distance from Guabo to Barbacoas is 110 km., a three-days journey on muleback. Barbacoas is the river post on the Patia river, and is one day's steamer travel from Tumaco, the seaport. The distance to Tuquerres, the local centre for provisions, is 50 km. Excellent native labor is available, the peons making good miners and millmen. The wages, reduced to American currency, are as follows: Peons, 16 to 20c., with board costing 26c.; carpenters and blacksmiths, 66c., with board costing 36c.; millmen, monthly, $9.60, with board at the same rate as the carpenters. The miners prefer contract work. They are hard workers, intelligent, and particularly courageous. When contracting they earn an average of 60c., and then demand the same board as the millmen.

Timber for underground use is cheap—$1.60[1] per cubic metre; squared or sawn timber costs $32 for the same measure. The explosive employed here, and in almost all the mining enterprises in southern Colombia, is 'rackarock.' Its advantages in transportation, freedom from import duty, make it preferable in a country like this. The cost of freight is: Tumaco to Barbacoas, 40c. per *bulto*[2]; Barbacoas to Guabo, $1.60 per *bulto*; Guabo to Porvenir, 32c. per *bulto*. For heavy pieces the cost is very high. The currency is silver at 250% exchange rate against United States currency.

Ore Deposits

The ore is found along the contact between two eruptives; monzonite (locally called *granito*) and propylite (an amphibole augite andesite called *peña verde*). The ore is not confined to one of the two eruptives, but extends into both rocks. The monzonite (with all the transitions from true syenite to granite) forms the basement of the metalliferous belt that runs south for more than 150 km. along the western slope of the cordillera. It appears in all the mines of the mining districts of Mallàma and Samaniego. The propylite is an eruptive characteristic of the Gualcala zone and peculiar to the mining district of Mallàma. Covering the monzonite and propylite is a thick bed of volcanic breccia formed by cemented fragments of propylite and on this are layers of tuff. The ore deposit is in a system of east-west parallel veins and veinlets, which at the same time is more or less parallel with the line of contact, having, therefore, some stringers in the propylite which lies south of the contact, and others in the monzonite which lies north of the contact. Occasionally, as the veins pass from one rock into the other, they are on the contact itself. Some of the stringers or narrow veins are very irregular in strike, and form lenticular masses deposited in the joint planes. Outside of this, as the rocks are broken by cleavage into parallelopipeds, all fine cracks have been penetrated by the solutions, and the rock itself, principally the monzonite, has been impregnated and metasomatically replaced by ore. The individual lenses of ore are from 0.10 to 1.60 m. thick and very

[1] All values reduced to U. S. currency.

[2] The *bulto* (bundle) weighs 100 to 130 pounds.

variable. They are separated by layers of metamorphosed country rock, averaging a half metre in thickness. The lode is known to be nearly 100 m. thick and is exposed by superficial cuts for 1200 metres.

The main fault runs north-south, cutting the lode, and at the intersection is an open pit connected with underground workings. The inspection of the walls in the open-cut shows clearly the manner in which the orebody was formed by the descending waters that percolated through the bed of breccia. At the same time, all stages of the process of metamorphism of the country rock into ore may be seen.

The most abundant mineral, and the last to be deposited, is mispickel. It is followed in order of quantitative importance by pyrite, blende, chalcopyrite, and galena. The accessory minerals are tellurides (whose existence is known by the H_2SO_4 reaction), sulphides of silver, native silver, and gold.

In the gangue may be distinguished stringers of quartz, solid sulphides, and altered country rock.

The ore contains some free gold, too fine to be distinguished with the magnifier. All the minerals mentioned are accompanied by gold and silver, but the richest ore is pyrite. The average value of the ore is nearly $30; for the pyrite it is $150 to $238. The altered country rock assays $9 per ton.

The workable ores can be classified as follows: (*a*) sulphides, 5% of the whole, with an average value of $200; (*b*) quartz and metamorphosed rock, 10% of the whole, with value of $20; (*c*) impregnated rock and saprolite, 85% of the whole and value of $9. The ratio of the gold to silver by weight is 1:6.

At present El Porvenir mine is only a promising prospect. Early this year a 3-stamp Krupp mill was erected, the stamps weighing 550 lb. They drop 7½ in., 75 times per minute. Though the ore generally shows no colors in the pan, it pays well in the mill. The plates are 1 by 3 m. in size. The capacity of the mill is from 4 to 5 metric tons per day. When running on rich ore and pyrite the yield of amalgam is 400 to 1000 gm. per 24 hours. From the poorest ore the yield is 40 to 80 gm. The amalgam, by reason of the climate, is hard. It must be cleaned carefully with hot water, for it encloses large quantities of sulphides; its product in bullion is 22% of 700 fineness. The mill is driven by a 18-in. Pelton motor with 40-m. head and water consumption of 7 litres per second. Below the plates is a mercury trap, followed by two wooden spitzkasten. The rich sand is carefully collected for future treatment. The slime is run to the creek.

The additional plant now in erection included a common reverberatory furnace for dead roasting, with capacity of 2 metric tons per 24 hours, and a cyanide plant for percolation treatment of the roasted material. All of this equipment is home-made of wood. My experience with the roasted sand is that a recovery of 95% can be made in 36 hours. The plant is erected practically at the mine to avoid the transportation of the ore which, in a country like Colombia, is the most difficult and expensive part of mining. The ore, from the open-cut, costs in the mill, all expenses included, $0.30 per metric ton. The milling adds $0.68. From underground the ore costs $2.50 per ton delivered in the mill. As a rule the sulphides are sorted out by hand and carried to special dumps to be treated afterward or shipped to the establishment of the Gualcala Mines Co., which is near by. If the road to Barbacoas was made suitable for freight wagons the rich pyrite could be shipped to the United States at good profit; unfortunately the freight cost at present is prohibitive.

Worked as a low-grade mine El Porvenir could be made a big producer. The financial condition of the owners oblige them to work on small scale, practising coarse concentration and throwing into the waste all ore lower than $10 in value. Practically 85% of the whole is not now treated. Similar conditions exist in the case of many mines in the vicinity where the same kind of concentration is practised. An enormous amount is thrown away, but the owners obtain nice profits.

In the course of the next six months the present plant will be enlarged to 9 stamps, ordering two batteries more from the same maker; the Krupp machinery has given the highest satisfaction, the design being such as to make it easily transported, and the erection of the steel frame being rapid and easy. The development of the mining industry in this part of the Republic will be slow if things continue as they are at present. Few people, and those with only limited capital, are interested in mining. To put things all right, and to bring the country up industrially to the level warranted by its mineral resources, it is of the utmost importance that people and capital come into the country from outside.

The only large foreign mining concern existing at present here is the Gaulcala Mines Co., an American enterprise. This company owns a great area of mineral land and has just erected a modern cyanidation plant in this same mining district. The ore is similar to those described, but the orebodies are quite different. They take the form of fissure veins rather than that of an impregnation as is the case of the El Porvenir mine.

Gold Deposits of Gibbonsville, Idaho

By Francis Church Lincoln

Gibbonsville is situated on Dahlonega creek, just above its junction with the North Fork of the Salmon river, in Lemhi county, Idaho. Until recently the nearest railroad point was Divide, Montana, 86 miles distant on the Oregon Short Line, and all freight and mail came from there by way of Wisdom in the Big Hole basin, and thence across the continental divide into Idaho. The new Pittsburg & Gilmore railroad now has a terminus at Salmon, Idaho, 36 miles from Gibbonsville, and mail comes by this shorter route, although, on account of excessive freight rates, some freight still comes by way of Divide and Wisdom. The Gibbonsville region, comprised in the Dahlonega mining district, has produced a large quantity of gold from both placers and lodes, but unfortunately only fragmentary records of its history and production are available. The property upon which the greatest amount of work has been done is that of the American Development, Mining & Reduction Co. This ground is credited with a production of $1,500,000. The mine has changed hands several times, spent five years in the hands of a receiver, and lost a 30-stamp chlorination mill by fire. It is now equipped with a new 30-stamp cyanide plant, and, although work is at present suspended, timber has been ordered for a new 500-ft. shaft, so its activities may be expected to commence this summer.

Several other mines in the district have made notable productions. Among these may be mentioned the Clara Morris group belonging to the Largey estate of Butte, and the McCarthy, both north of the A. D. M. & R. mine; the Corn Beef group, belonging to the O'Rourke estate of Butte, and the Anderson group, to the west; and the Twin Brother group belonging to Henry Seligman, of New York, to the south. Not one of these properties, however, has approached the production of the A. D. M. & R. They have all been lying idle for a number of years, but the coming of the railroad to Salmon has stimulated mining in Lemhi county, and this stimulation has begun to be felt at Gibbonsville. As a result, O. P. Zortman secured a lease on the Twin Brother group last summer and began to develop that property; Messrs. Edwards and Roberts purchased the Anderson group; work has commenced on the McCarthy; and the Butte claim-holders are considering the further development of their properties. No placer properties are in operation at present. Guy Stapleton, of Butte, has many of these under option, and last summer made an unsuccessful attempt to drill the North Fork.

The hills in the vicinity of Gibbonsville are well wooded with spruce and yellow pine, and ranching is profitable wherever the creek bottoms attain sufficient width. The altitude of the town is 5400 ft. by aneroid barometer. From the creek bottoms the hills rise steeply for about a thousand

feet. To the northward, the mountains of the continental divide make a great semi-circular sweep with an eight mile radius about Gibbonsville as a centre, and across the divide lies Montana. At Gibbonsville, Dahlonega creek flowing west is augmented by Anderson creek flowing south, and turns southward, entering the North Fork of the Salmon river just below the Twin Brother group at the southern end of the mineral district.

The principal country rock is slate. This has been briefly described by W. H. Weed.[1] The slate includes quartzose, feldspathic, and micaceous facies, and its structure varies from thinly to thickly laminated. The strata have a general north-south strike, and dip steeply to the east. No fossils were observed. The beds are probably of Algonkian age, and possibly referable to the Prichard slate of the Coeur d'Alene, in which the gold veins of that district occur.[2] The only other sedimentary rock in the region is a quartzite over a hundred feet in thickness which is exposed on the west side of Dahlonega creek in the northern part of the district, and has been taken up by Mr. Hughes as a lode claim. This quartzite is interesting because it contains gold. I obtained an assay of 40c. per ton in gold and was credibly informed that assays of $1, $2, and in one instance even as high as $8, had been obtained by disinterested parties. As there are no marked signs of secondary mineralization, the quartzite may represent an ancient placer.

At one point in the high placer west of Anderson creek, a small patch of decomposed granitic rock outcrops in the slate. It is an eroded knob of earlier age than the slate, and probably is Archean granite. A great dike of basic rock extends down Anderson creek to its junction with Dahlonega creek and then follows Dahlonega creek to its junction with the North Fork, down which it extends for an undetermined distance. This dike is narrow on upper Anderson creek, widening gradually to a thousand feet at Gibbonsville. The rock of which it is composed consists of large white crystals of feldspar with a dark background of ferromagnesian minerals free from olivine. Another dike of gabbro occurs west of the North Fork near its junction with Dahlonega creek, and a third dike of like character forms the crest of the continental divide on the trail from May creek, Montana, to Gibbonsville. These dikes appear to be similar to the diabase dikes and sills of the upper St. Joe river basin, south of the Coeur d'Alene district,[3] and may be approximately contemporaneous with them. Several small pegmatite dikes were observed in the gabbro where exposed in the bedrock of the Anderson creek high placer.

Numerous north-south faults occur. Within the slate these are marked by narrow clay seams and have caused but slight displacements, but at the slate-gabbro contact east of Anderson creek there is a brecciated fault-plane which indicates a much greater movement, and the Twin Brother adit discloses not only this contact fault, but also a number of parallel, brecciated fault planes within the basic dike. These facts taken in conjunction with the occurrence of granite and quartzite on the west side of the Anderson creek dike only, point to a very considerable upthrow of the major portion of the dike and of the region to the west of it.

The Gibbonsville gold ore occurs in fissure veins in the slate. These veins are said, on good authority, to extend into the gabbro in some instances, and fissure veins which probably belong to the same system certainly do occur in the Anderson creek dike, but as yet no ore has been mined from veins in the igneous rock. The ore-bearing veins were probably formed by hot ascending waters circulating in fissures produced subsequent to the consolidation of the gabbro. It is possible that the gold was derived by the leaching of the auriferous quartzite previously described. The productive belt in the neighborhood of Gibbonsville has a length of about two miles in a general north-south direction, and a width of about half a mile. The veins within this belt all appear to belong to the same system. They have a general east-west strike, cutting across the stratification of the slate. Their dips are steep, and in all cases save one are toward the north. They are narrow but fairly persistent, and in some instances can be traced for the length of several claims. Post-mineral faulting on a small scale is extremely prevalent. The faults are generally pivotal in character. The greatest displacement observed was 25 ft. The ore-shoots vary in width from a few inches to a few feet, and are rarely over 2 ft. wide, although in one instance a width of 12 ft. is said to have been attained. They are frequently several hundred feet in drift length. The barren intervals between shoots are of variable length. So far as known, all the ore-shoots pitch toward the east, the direction of the dip of the slate.

The ore in the narrow fissure veins of Gibbonsville is high grade, ranging in value from $20 to $200 per ton. Some rich ore occurred in the shallow oxidized zone. The gold was free there, but the sulphide ore below is base. The principal ore minerals are quartz, auriferous pyrite, and chalcopyrite. The vein filling varies from nearly solid pyrite with a slight admixture of quartz and chalcopyrite to almost solid quartz with a few scattered cubes of pyrite and specks of chalcopyrite. East of the Anderson creek dike the copper content rarely exceeds 0.5%, but west of the dike it is much higher. Examination with the naked eye shows that the pyrite retains its own crystal outlines when imbedded in the quartz, and that the quartz keeps its shape when in chalcopyrite, but that the chalcopyrite only shows crystal faces when it occurs on the interior of vugs. The order of formation was therefore (1) pyrite, (2) quartz, and (3) chalcopyrite.

These later-formed particles of chalcopyrite may be the result of secondary concentration by cold descending waters. In this case, the percentage of copper is the measure of secondary concentration, and, if the erosion has not been too rapid, also proportional to the amount of erosion. Thus the high copper content of the veins west of Anderson creek is explicable on the ground that there has been a greater amount of erosion in that locality. This conclusion is borne out by the structure, which has been shown to indicate an up-throw of that section. A slight secondary silver enrichment in the upper portions of the orebodies is suggested by the fact that in 1896 MacDonald[4] reported 99% gold and 1% silver by value in the ore, while last summer my assays of samples which probably came from greater depths than MacDonald's, showed only traces of silver. Native gold has been occasionally observed in small specks in the oxide ore, but in the sulphide ore the gold occurs disseminated in the pyrites. The iron pyrite is rich, the copper pyrite is poor, and the quartz practically barren. The relative gold content of these minerals is shown by the following assays of fairly pure material selected from a single sample.

Mineral.	Oz. Gold per Ton.
Pyrite	2.68
Chalcopyrite	0.18
Quartz	0.01

Placer deposits occur in both terrace and creek gravels. One terrace occurs west of Anderson creek near its junction with Dahlonega, and another west of North Fork near its junction with Dahlonega creek. These terraces were formed by the present streams at an earlier stage in their history. The placer gold is very pure, having a value of $18 per ounce. It is nearly all coarse, small nuggets of from $3 to $10 being common[5], and occurs in worn particles which are usually free from quartz. It is evident that this gold cannot have been derived from the local lodes, since particles of the lode gold are fine, while particles of the placer gold are not only coarse, but also show by their abraded surfaces that they have come from a distance. Placer gold of the same character is found across the continental divide in Montana on Hughes creek, a tributary of the Bitter Root river and on May and Pioneer creeks, branches of Trail creek, a tributary of the

[1] U. S. Geol. Surv. Prof. Paper 27 (1904), p. 90.
[2] Ransome and Calkins. U. S. Geol. Surv. Prof. Paper 62 (1908), pp. 29 and 141.
[3] J. T. Pardee. U. S. Geol. Surv. Bull. 470 (1911), p. 47.
[4] *Eng. & Min. Jour.* 62 (1896), p. 319.
[5] D. Maguire. *Mines and Minerals* 19 (1899), p. 277.

Big Hole river. The placer gold in all these localities appears to have been derived by reconcentration from an ancient river bed, probably of Neocene age.

The conditions are, on the whole, favorable to mining. Owing to lower elevation, the climate is much less rigorous than that of the adjoining parts of Montana. The slate drills and breaks easily. Little timbering is required, and when supports are necessary, a good quality of timber can be obtained within the district. There are a number of small water-powers which can be developed at small cost. One of these is now being used by the A. D. M. & R. mine to run its air-compressor, and another to run its mill. The only adverse conditions are the narrowness of the veins and the high freight rates. The usual method of mining is to strip the hanging wall of a vein and bar down the ore.

In the early days of the camp the free-milling surface ores were treated by amalgamation in arrastres and stamp-mills. As the ores became more basic it was found necessary to employ chlorination, and MacDonald has described the plant erected by the A. D. M. & R. company for this purpose. That mill was burned and the new one erected by the same company employs cyanidation. The ore is crushed by stamps through 45-mesh screen and the free gold removed by amalgamation on plates. The pulp is then concentrated and the concentrate cyanided. A series of tests that I made showed that there is no free gold in the deeper ores, and that in order to obtain an extraction of 90% by cyanidation it will be necessary to slime them.

Regeneration of Cyanide Solution

By W. D. Williamson

In 1899 while treating cupriferous tailing in North Queensland, the excessive cyanide consumption, due to the presence of copper carbonates, made profitable treatment exceedingly difficult. Solutions rapidly fouled, precipitation was very unsatisfactory, and extraction decreased until the only alternative was to discard the fouled solution and make up fresh solution. Changes of solution were very frequent and involved considerable expense and loss of time. This trouble was finally overcome by preliminary leaching with sulphuric acid, about 12 lb. of acid being used per ton of tailing treated. Later, when sulphide ore had to be treated, sulphuric acid leaching was useless.

Experiments made on solutions, which had become charged with copper, demonstrated the fact that a very considerable saving of the combined cyanide could be effected by the addition of sulphuric acid to the solution, in sufficient quantity to precipitate all the copper as $Cu_2(CN)_2$—namely:

$$Cu_2(CN)_2 2KCN + H_2SO_4 = Cu_2(CN)_2 + K_2SO_4 + 2HCN$$

The insoluble $Cu_2(CN)_2$ was separated by filtration, and the clear filtrate containing the HCN neutralized with a slight excess of alkali.

The experiments were sufficiently encouraging to induce me to continue the method on a working scale. As solutions became overcharged with dissolved copper, sulphuric acid was added to the sumps in sufficient quantity to complete the above reaction. The precipitated $Cu_2(CN)_2$ was settled, and the clear supernatant liquor was drawn off and neutralized in a separate sump, and was then used as a fresh clean cyanide solution. The settled $Cu_2(CN)_2$ was collected and saved for shipment to smelter. The possible recovery of the cyanogen in combination with the copper as $Cu_2(CN)_2$ still gave me material for experiment.

Heating with acid I consider impracticable, as it would involve distillation of the liberated HCN, and probably excessive loss of cyanogen, owing to the decomposition of the cyanogen radical in the presence of heat and strong mineral acids. Eventually I found that an almost complete recovery of the cyanogen in $Cu_2(CN)_2$ could be obtained by suspending the $Cu_2(CN)_2$ in water, and passing sulphuretted hydrogen when the following reaction takes place:

$$Cu_2(CN)_2 + H_2S = Cu_2S + 2HCN$$

The insoluble Cu_2S was separated by filtration and the clear filtrate containing the HCN neutralized with alkali.

Finally, I combined the two operations by adding to the cupriferous cyanide solution sufficient Na_2S, to precipitate all the copper present, afterward adding the requisite amount of sulphuric acid to complete the following reaction:

$$2KCN.Cu_2(CN)_2 + Na_2S + 2H_2SO_4 = Cu_2S + 4HCN + Na_2SO_4 + K_2SO_4$$

The precipitated Cu_2S carries down with it the precious metals contained in the solution and is collected, dried, and shipped to smelter. The clear liquor is decanted or filtered, and sufficient alkali added to combine with the free HCN liberated by the previous treatment.

This process, which theoretically should recover all the cyanogen in combination in cupriferous cyanide solutions, has never been used to my knowledge on a working scale, but in laboratory experiments as high as 90% of the combined cyanogen has been regenerated and made available as a clean copper-free cyanide solution.

Commenting on this method, Andrew F. Crosse said: "Some years ago I was engaged in investigations in the cyanide treatment of cupriferous ore near Pilgrim's Rest. During my experiments I found that the solutions were always highly charged with copper, and I was unaware that anyone else had the idea of treating cupriferous cyanide solutions with sulphuric acid. I made many experiments. It was difficult at first to find out exactly the right amount of acid required. Then I made a long series of experiments to find out how much gold and how much silver was precipitated. I never obtained 100% of gold by precipitation; I used to get, if I remember rightly, 88 to 97%. I think that nearly all the silver was precipitated, but not quite all the copper. It was a very nice precipitate to handle; it would settle very easily. I treated over a ton of solution in this way. I then regenerated the hydrocyanic acid solution, after decantation, by means of caustic soda.

"The second part of Mr. Williamson's paper is certainly an improvement on what I did. I simply took the precipitate, dried it, calcined it, and melted it, and I got a little bar containing about 95% of copper, 1% of gold, and 2% of silver; but I certainly think that where sulphuric acid can be obtained fairly cheaply, and where a certain amount of cyanide is decomposed by copper in the ore, the method is worth considering. Supposing some gold does remain in solution, the solution is simply passed through the zinc-box after regenerating with caustic soda.—*Journal* Chem., Met. & Min. Soc. of South Africa.

The high and increasing prices of tin during recent years has naturally led to attempts to find and open up new tin districts, particularly in the United States and in British Africa. But the totals contributed by these new sources are hardly yet appreciable; the production in Nigeria, for example, in the first four months of this year probably did not reach 350 tons of metal—quite an encouraging output, of course, but not calculated to affect the price on the London market. The American production so far has been negligible. For all practical purposes the world's supply of tin is still provided by a very few older localities. It is remarkable, indeed, how few and circumscribed these areas are; a southern province of China, the Straits Settlements, two small Dutch islands in the Malay Archipelago, the eastern coast of Australia, Tasmania, Bolivia, and Cornwall—these were all, though now there must be added South Africa, which last year provided about 2000 tons.

The New Chucuitambo Gold Mines, near Cerro de Pasco, Peru, produced 29 kg. of gold during March, and it is expected that the cyanide plant will soon further increase the production.

Dry Concentration of Placer Gold

By F. J. H. Merrill

The recovery of gold by dry concentration from placer gravel, and from various ores, is a subject which has received much attention in arid regions, where water is too scarce or too expensive to be used in the ordinary processes. Inventive minds have for years been occupied with dry concentration in all its phases, and many machines have been devised to separate the precious metal from the associated rock fragments. Several have been built which effect a satisfactory separation on trial runs with selected material, but comparatively few have been made which, in continuous use, give good results on material varying in coarseness and in gold content, and some machines, otherwise good, are lacking in durability.

The fundamental principle of concentration, with either air or water, is to partly overcome gravity in the particles under treatment by an upward flow of the fluid used, and, through what is known as 'hindered settling,' to effect a classification of the fragments by the differences in their specific gravities and thus facilitate the separation of the gold from the valueless material mingled with it. The physical differences between air and water render their action in concentration somewhat different. The cohesion between the mineral fragments and the medium used is less with air than with water. This permits a more rapid settling of the fine particles, but in dry concentration it is observed that small particles frequently adhere to larger ones, probably through some electric influence. Particles of great difference in specific gravity differ in speed less in air than in water, and the effect of the greater density of water can be counterbalanced in using air, by giving it greater velocity, for, in jigging, air permits more pulsations per minute than water.

As there are several distinct types of concentrators using water, so are there several using air. In most of these an air current is used having a velocity greater than the free-settling velocity of the lighter material, consequently most of this is blown out of and away from the machine, leaving behind the gold, the other minerals of high gravity and the coarser particles of minerals of medium gravity.

The most elementary form is the *batea* or wooden pan. In using this the air-blast is supplied by the lungs and the implement is manipulated with rotary and other motions which gather the heavy material toward the centre, while distributing the lighter material toward the margin whence it is blown away. The air-blast is varied in force according to the material to be removed and, toward the last, the residue of valueless material is separated from the gold by clever manipulation and blown out of the *batea*.

Next in order is the common Mexican 'dry washer,' a most efficient machine, said to have been introduced by Hungarians about 1850, and extensively used in northern Mexico. This consists mainly of a tray about 1½ by 3 ft., with muslin bottom and 5 cross-riffles resting, at an inclination of about 15°, on a frame, beneath which is a canvas bellows. The latter forces through the muslin an intermittent blast of air which drives away most of the fine light material. The gravel is fed through a hopper upon the upper end of the tray and is moved slowly down the slope by the jar of the bellows stroke. As the operation proceeds the gold lodges on the riffles, chiefly behind the two uppermost, and the material of lower specific gravity flows on over the riffles and gradually passes out of the machine at the lower end. The slope of the latter is increased, when necessary, by blocking up the rear legs, and an inclination of 25° is frequently used.

A machine of this class is usually operated by two men. The common mode of procedure among Sonora *gambucinos* is for the men to spend the morning in mining. One digs out the gravel, while the other turns the windlass if a shaft is used, or carries out the gravel with a wheelbarrow if working in an adit. As the pay-dirt is taken out, it is spread in the sun to dry, all boulders and stones of appreciable size being removed. After a nooning, the two treat the dirt in the machine. One turns the wheel operating the bellows, adapting the force of the blast to the material, while the other feeds dirt into the hopper, carefully watching its progress over the riffles. When the latter appears to be as well loaded as may be consistent with safety, the bellows is stopped, the tray is removed, after loosening the wedges which hold it in place, and the concentrate is transferred from the tray to a *batea*, where further concentration and cleaning of the gold is done. This machine is thoroughly efficient in the hands of skilled workmen, who are not difficult to obtain. The loss of gold in the tailing is small. The chief loss is in gold so fine that it is blown away with the quartz dust, but the amount of this is usually not great. When built of substantial size, with a tray about 2 by 4 ft., or 2½ by 5 ft., these machines are quite efficient, and, with local labor, entirely satisfactory for limited operations.

The chief advance in the development of this type of machine is an air-jig, put on the market some eight years ago by Steele, Sutton & Steele, of Dallas, Texas. In this the stationary tray is replaced by a revolving table or belt about 3 ft. wide, with riffles about 8 in. apart and screened with muslin. This is inclined about 30°, the slope being adjustable. The operation of this machine is identical with that of the Mexican 'dry washer,' except that the operation is continuous, and as the fine is driven away by the intermittent bellows blast which passes through the muslin, the riffled belt raises the concentrate to the top of the machine and, passing over, dumps it into a box at the rear. In an extended trial of four of these air-jigs, on placer gravel in Sonora, Mexico, I found them very efficient in recovering the gold. A serious difficulty, however, was a lack of durability and a tendency to get out of adjustment, which made it necessary at frequent intervals to stop work for repairs. If this machine were perfected, as it undoubtedly can be, it would be most valuable.

The Curtis machine, made in Denver, Colorado, uses a continuous blast of air from a fan. As usually constructed, each unit consists of a trough-like box, semicircular in vertical section and covered by a perforated plate, somewhat less than an inch thick. The perforations are semicircular in cross-section, and about an inch in diameter. They are partly closed beneath by wire gauze, which allows the air-blast to pass but retains the concentrate. The boxes, which are usually set in pairs on a frame, have a gentle inclination and receive lateral agitation from a cam. The pay-dirt is fed upon the upper end of the plate and, as it passes down the slope, the fine material is blown away and the concentrate is caught in the holes or recesses which serve as riffles, the tailing escaping at the end. To clean up, the machine is stopped and the plate is rotated on a longitudinal axis, dumping the concentrate into the trough below, from which it is removed. The machine has made good recoveries on some material, but requires closer sizing than one-eighth inch.

Another type is the Shumway concentrator, made in Los Angeles. This consists of a shallow wooden box, covered with thin canvas through which a continuous air-blast is forced by a fan. Over the canvas, wire netting of about half-inch mesh is laid. By means of cams the box, which is slightly inclined, is agitated laterally and the dirt fed upon the canvas, at the top of the incline, passes down the slope, leaving the concentrate in the meshes of the wire, while the tailing falls to the ground. To recover the concentrate, the operation of this machine must be suspended and the table tilted for cleaning up. It has done good

work under favorable conditions, but it also requires finer sizing than one-eighth inch. For a time it was used in the Little Florence mill at Goldfield, Nevada.

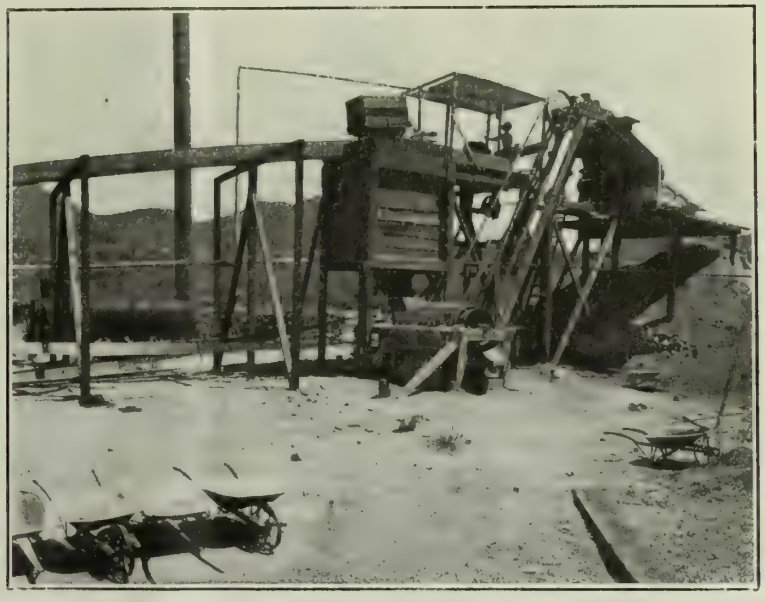
The Jardine concentrator, made in San Francisco, is the result of a diligent effort to construct a durable machine which is continuous in operation and does not stop for cleaning up. The air-blast comes from a fan, but is made intermittent by a rotary valve. The shallow box which serves as an air-chamber is interrupted across its length by riffles of parallel metal plates with intervening slits which guide the concentrate down into cylinders in which worm conveyors rotate, conducting the gold and heavier materials to a trough at one side. Between the riffles, the surface of the table is formed of a cotton-cloth screen, through which the air-blast passes. Lateral agitation is provided and, as the dirt passes down the sloping table, the fine light material is blown away. The concentrate caught by the riffles is delivered into the trough at the side, and the tailing passes away at the end of the table. A machine of much efficiency has recently been devised by A. H. Stebbins, of Los Angeles. This, in general form and action, resembles closely a Wilfley table. The surface and the riffles are formed from sheet metal, the latter being about 1 in. apart. Air is introduced beneath the table in a continuous blast from a fan, and reaches the bed of dirt through minute perforations in the metal surface of the table. These perforations, which are as close together as possible, are rectangular and about ¼ in. long and $^{1}/_{40}$ to $^{1}/_{64}$ in. wide. The longer axes of these slits stand at about 45° to the direction of the riffles. The form of the slit gives the air-jet an inclination of about 10° above the surface of the table, and the air-sheet formed by these jets flows with the dirt in its descent along the slope. It is stated by the inventor that material as coarse as ½ in. can be treated on this machine, which apparently is destined to be quite successful.

The total number of machines devised for this work can probably be reckoned by hundreds. Most of them have been short-lived. Those mentioned above are a few of the most promising which have come to my attention. To successfully solve the problems of the dry concentration of placer gravel, the machine employed must meet several conditions, and, on the other hand, certain conditions are necessary in the material to permit any machine to work successfully. The concentrator must be capable of working effectively on material of all sizes up to ⅛ in. This mesh has been determined for many localities in Sonora, as one which will allow most of the coarse gold to pass through with the fine. Should there be much coarse gold present in the gravel, the screen must be made proportionately coarser, and the concentrator must work on coarser material. Primarily the pay-dirt treated must be dry. Average uncemented placer gravel as it occurs, even in the dry climate of Sonora, is usually too moist, when mined, for immediate treatment. The *gambucinos*, working on a small scale, dry their dirt by spreading it in the sun. To do this on a large scale would invite theft. In many cases it is necessary to provide mechanical drying, but this involves no serious difficulty in labor or expense. Cemented gravel usually carries less water than that which is uncemented, but it requires crushing and screening to bring it into the required condition for treatment. The heat generated in the pulverizer serves to remove the small amount of moisture present.

The gold in the cemented placer gravels does not occur within the pebbles, boulders, and rock fragments, but on their surfaces, being practically all included in the calcareous cement which unites them. The first step in treatment must, therefore, be the separation of the barren rock fragments from the gold-bearing cement and the pulverizing of the latter. This is done with great efficiency by the Quenner pulverizer, which consists of a revolving trommel or barrel of steel staves with a shaft rotating independently within and carrying chain hammers. These hammers effectively break up the calcareous cement and leave the cobble-stones and pebbles with nearly clean surfaces, to be ejected at one end of the barrel, while the pulverized cement escapes through the quarter-inch spaces between the staves. Thus in many localities the material subjected to dry concentration for the recovery of the gold is only about one-half of the total mined. Credit for the invention of this machine is claimed by Joseph Lusignan, a French Canadian living in Nogales, Arizona, and a man of much mechanical ingenuity and skill, but Mitts Quenner, a Sonora miner, exploited the machine commercially and profited by his business shrewdness.

Concentration with air introduces a detail which does

DRY CONCENTRATION PLANT, BOLUDO.



DRY CONCENTRATION PLANT NEAR LLANO, SONORA.

not have to be considered in using water, as a cloud of fine dust rises from the dry concentrator, which is very irritating to the eyes and lungs. The best way to dispose of this is to cover the table with a hood, which catches the dust and delivers it to an exhaust fan. As most of the fine dust is blown out of the dirt near the upper end of the table, it is unnecessary for the hood to cover the whole of the latter. Sufficient of the lower end may be left uncovered to give a view of the action of the machine.

During the past four years I have attentively studied various methods of dry concentration in work carried on under my own supervision and in operations conducted by others, and my observations convince me of the commercial practicability of this treatment. Thus far, the Mexican 'dry washer' is the only machine which has been successfully used in treating dry placer gravel on a commercial scale in Sonora. Several other machines of small capacity have been used in individual enterprises with some success, but up to the present time no one has made a continuous demonstration in practical operation of any of the newer types of dry concentrator, yet undoubtedly some one of them will soon be perfected and will prove efficient. A machine made by J. M. Wishart, of Pasadena, is being used on the border of the Mojave desert near Victorville, but I have not yet seen it. It is not probable that, in concentration, air will compete with water where the latter may be freely obtained, but dry concentration is necessary for the recovery of millions of dollars in gold lying in the Tertiary and Quaternary gravels of the arid areas of Sonora, Arizona, New Mexico, California, and Nevada. At but few points do these placer deposits occur in sufficient extent to justify the expense of erecting plants for pumping water long distances, but, in a hundred or more of them, there is sufficient gold to justify an expenditure of from $5000 to $15,000 for equipment. Most of these, with careful management, will give ample return, while a few will yield substantial fortunes.

Short-Circuiting in Anode Tanks

By A. R. Ledoux

Some years ago the head of one of the most important electrolytic refineries in the United States was puzzled to discover the cause of certain short-circuits. He noticed that an accretion started at the anode and grew always from one side of the anode toward the cathode until it had completed a short-circuit. The works ran north and south, and this short-circuiting was always from the west toward the east. The manager came very near making a statement before a scientific society that the revolution of the earth must have something to do with this short-circuiting, as it always was in the direction from the west toward the east; but one day he broke off one of these fingers which ran across, and found, at the point where it began, a little splinter of wood. He broke off others and found the same thing; and, to make a long story short, the reason was just this: The anodes, which were heavy, were brought into the factory, unloaded from a car and dumped by the men on a block of wood alongside of the tank. They did it always the same way; the corner of the anode always struck the wood at a certain inclination, and little splinters of the wood were broken off and adhered to the bottom of the anode. When the anode was put into the tank (always in the one way), that splinter served as a starting point for a short-circuit, and that was the simple solution of something that had been bothering them for more than a year. When they substituted a rubber mat for a wooden block, the trouble ceased.—*Bulletin of the A. I. M. E.*

Copper ore and pyrite valued at $2,010,000 was produced in Norway in 1911. Nearly all of this was exported and the chief value was in pyrite, the copper being valued at $470,000. Some 4000 people are engaged in mining this ore.

The Cuyuna Iron Range

By Kirby Thomas

More than 2000 drill-holes have been sunk in the Cuyuna iron district of Minnesota in the past five years to find and explore the bodies of iron ore which were hypothetically located by Cuyler Adams from assumptions based on certain disturbances of the magnetic needle in the region. The whole area is covered with a glacial mantle from 50 to 100 ft. thick, and there are no rock outcrops to give any indication of the formation of ore within many miles of the orebodies now being disclosed. It is true that about 1890, R. D. Irving suggested that the iron-bearing formation should be found in the approximate region of the Cuyuna district, basing his suggestion on the obvious relation between the Keewenawan eruptive beds forming the vast Lake Superior synclinal trough and the older and underlying sedimentary beds in which several of the Lake Superior iron formations occurred, and later C. R. Van Hise and C. K. Leith, of the U. S. Geological Survey, more definitely accepted the hypothesis and mapped a projection of the iron-bearing formation approximately in the line of the later discovered Cuyuna deposits. It now develops that these hypotheses were only correct as applied generally, for the Cuyuna deposits seem to be rather related to the Crystal Falls, Michigan, area geologically, than direct extension of the Mesabi formation or correlating with the Penokee-Gogebic formation, a matter of academic interest. The purpose here is to present the method and results of the exploration after once the orebody was found and the factors in the interpretation of the large amount of data made available from drilling and lesser amount from the underground work.

The first drill-holes were sunk on the lines of maximum magnetic attraction, which had been platted with fair exactness. The results were disappointing, for the cores showed only lean schist with magnetite. With a knowledge of the general geology of the Lake Superior deposits, this information was significant, if not definite. Other drill-holes were sunk to the south at right angles to the line of the maximum attraction, and ore was found. This ore was hematite, and hence did not itself affect the magnetic needle, but the facts from these first drill-holes furnished the key to a new and important iron district, and added many millions of tons to the discovered ore reserves of the Lake Superior region. Further drilling disclosed that the ore was not in flat blanket-like bodies as on the Mesabi, but was in beds dipping from 60 to 70° to the southeast with the general rock formations of the area, and, in fact, forming part of the rock formations structurally. It was then further determined that the ore in depth changed to iron carbonate, mostly, representing the unaltered iron formation member of the geologic series, and that the orebodies were not continuous along the strike, but were lenses or interrupted parts of the beds coming to the erosion surface. Other approximately parallel lenses or beds were disclosed by more drilling on both sides of the magnetic schist member. Evidences of a pitch or hade of the orebodies was also present, indicating a complex folding to form the trough and saddle-shaped orebodies characteristic of the synclinal and synclinorial ore structures. Another range, so called, to the north was later found by drilling on the magnetic indications, and this was found to include several parallel beds. The whole disclosure so far indicates a broad system of folding of iron formation and the genesis of iron orebodies from the iron-bearing members at physically favorable places. It was also determined that eruptive dikes and bosses intercepted the sedimentary iron formations in places, and it was anticipated that these eruptive formations would have a bearing on the orebodies. All this was worked out before any shaft was sunk to give visible confirmation of the theories based on the drill data.

Most of the drill-holes were sunk vertically, but later, when it was determined that the orebodies had a regular

pitch to the southeast, angle holes to cut the beds at right angles were driven, with the result of checking the data from the vertical holes and giving a basis for the calculation of tonnage and definition of the limits of the orebodies.

Now half a dozen shafts have been sunk to the ore, and the district is a reality, but its discovery was due to a mere theory and its first proof wisely placed drill-holes. The work of exploration was in the hands of men familiar with the general iron formation of the region and with drilling, and competent geologic talent was always at hand to guide and to interpret the facts. The district has been proved for more than 35 miles along the formation, and an iron district potentially as important as any one of the others in the Lake Superior region has been found.

Alumina as a Drying Agent

By F. M. G. Johnson

In the course of an investigation on phosphonium compounds a drying agent was necessary which would successfully dry both PH_3 and HI or HBr, since P_2O_5 proved useless for this purpose. Satisfactory results were obtained by employing Al_2O_3 prepared by igniting the hydroxide at a low temperature. A test of the efficiency of this substance to take up moisture was made by passing air saturated with water vapor at room temperature, about 18°, through a tube containing about 7 gm. of the oxide, and then through a second tube filled with P_2O_5. The air was led through at the rate of about 2 or 3 bubbles per second. Both tubes were weighed from time to time. The somewhat remarkable result obtained was that the P_2O_5 tube showed no perceptible gain until the Al_2O_3 had increased about 18% in weight, corresponding to the formation of the hydrate $Al_2O_3.H_2O$. The reaction is generally represented by the equation

$$Al_2O_3 + H_2O \leftrightarrows 2AlO(OH)$$

The formation of the hydrate is accompanied by evolution of heat, hence increased temperature causes its dissociation into Al_2O_3 and H_2O. It is thus seen that 1 gm. of Al_2O_3 can practically completely absorb all moisture from approximately 10 litres of air saturated with water vapor at 18°. G. P. Baxter and R. D. Warren investigated the drying properties of $CaBr_2$, $ZnBr_2$, and $ZnCl_2$, and their results show that compared with Al_2O_3 these substances are much inferior as desiccating agents. Al_2O_3 is also more effective than H_2SO_4. A tube filled with Al_2O_3 can be used for an indefinite period, if from time to time it is heated with a smoky flame while air, previously led through H_2SO_4, is passed through it. To replace the usual P_2O_5 tube used in connection with mercury pumps it appears particularly suitable, since the tube used need never be renewed. A small tube of P_2O_5 following the Al_2O_3 would serve to indicate when the Al_2O_3 needed reheating. Its uses in many investigations are obvious.—*Journal Amer. Chem. Society.*

Production of manganese ores in 1911, according to E. F. Burchard, of the U. S. Geological Survey, was 2457 long tons, valued at $24,586, a slight increase over the figures for 1910. The ore was mined in California and Virginia. The importation of manganese ores continues to greatly exceed the domestic production, and will probably continue to do so as long as the principal sources of foreign supply are abundant and cheaply worked, and ocean freights are low. In 1911 the imports were 176,852 long tons, valued at $1,186,791, a decrease of 65,496 tons as compared with the importations for 1910. This decrease in the demand for manganese is attributed to the depression in the iron and steel industry.

Tin production of Bolivia in 1911 amounted to 24,000 tons, as compared with 22,855 tons in 1910 and 21,340 tons in 1909.

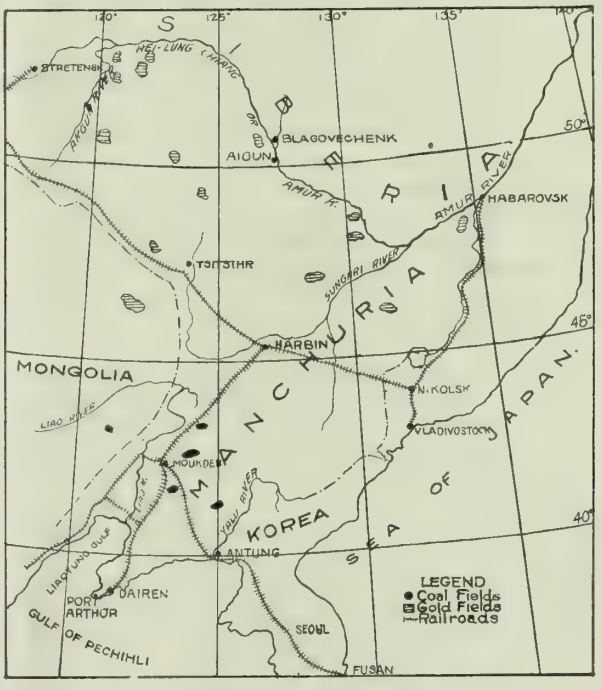
Coal deposits have been discovered in Neuquen territory, Argentina, by a Government expedition.

The Coal Supply of Manchuria

By Edward di Villa

The only coal mines of importance at present worked in Manchuria are the Fushun mines. These mines rank among the largest in China, with an average output of about 4000 tons per day. From October 1908 to August 1911 the exports from this mine amounted to 349,577 tons, of which Japan received 17,844 tons, Korea 101,276, China 210,332, Europe 4251, the South Seas 15,811, and America 3 tons. The coal seam is 130 ft. thick. The mine is situated close to Mukden, and a glance at the map of Manchuria will show that this mine can command the market of practically the whole of South Manchuria. The output of the mine is to be raised to 2,000,000 tons per year. The area of Manchuria is 400,000 square miles, and the population is about 13 millions, of which 6 millions are under Japanese influence.

Manchuria may be roughly divided at present into three



COALFIELDS OF MANCHURIA.

parts. The northwest is under Russian influence, and wood is the principal fuel used, even on the Chinese Eastern railway. The southern terminus of the Russian railway is at Kuanchengtze. From Kuanchengtze south 436 miles to Dairen the railroad is operated by the Japanese, and coal from the Fushun mines is used. The eastern part is still somewhat Chinese. The natives chiefly burn dry corn stalks and other refuse vegetation. A line is now in course of construction from Changchun to Kirin. This is a joint Chinese and Japanese undertaking, and coal is the fuel used. Unfortunately for the Chinese, the only place from which they can purchase their coal is from the Fushun mines, which are entirely Japanese. In case of any trouble between the Chinese and Japanese, the coal supply of the railway would naturally be stopped. In order to remedy this sad lack of foresight on the part of the Chinese Government at Peking, I spent three months in Manchuria examining the geological conditions in the vicinity of the new railway line. The length of the line is 84 miles, the ground is undulating, with a small range of hills to be crossed about half way. Five suitable places were discovered where coal-mining might at present be profitably started.

Among these, the most advantageously situated is one in a district called Huo-shih-shan, about 30 miles east of Changchun and one mile from the line of the Kirin-

Changchun railway. The land surface between the mine site and the railway line is nearly level, and is such that a branch line two miles long could be constructed with maximum gradients of 1%. The gradients on the K. C. R. are 1%. Some seams of coal outcrop in a small range of hills having a due east and west trend. The natives have worked the coal to a small extent, confining their operations to the surface. The hand specimens obtained are semi-anthracitic, tending toward bituminous varieties, contain some occluded gases, and are inclined to be shattered.

The first seam of coal is overlain by a corse-grained grit. This grit is very interesting, as it is similar to the grits overlying the Carboniferous formations of the northern coalfields of England. Another grit, similar to the above, is finer grained. The upper grit is composed of practically pure quartz, with a few glistening scales of muscovite mica, and in a matrix of kaolin, the quantity of kaolin exceeding that of the quartz. The lower grit has a larger percentage of kaolin, about 65 to 70. The quartz is angular and sharp, and viewed under the microscope is full of fluid cavities. In the upper grit, needles of tourmaline are of frequent occurrence. This grit is probably a decomposition product of granite. The quartz crystals show no sign of abrasion. The sizes of the crystals vary from 1/15 inch in the upper grits to 1/125 inch in the lower grits. These grits are not very hard, and in places they contain some very thin seams of coal of light grayish color. The thickness of the upper grit is 30 to 40 ft.; under this occurs a seam of coal 5 ft. in thickness. Next follows the finer grit, which has very fine clay partings and is 2 ft. thick; then comes a seam of coal 7 ft. thick. I have no doubt that there is more coal underneath, as there is no marked change in the character of the rock underlying the last seam of coal mentioned.

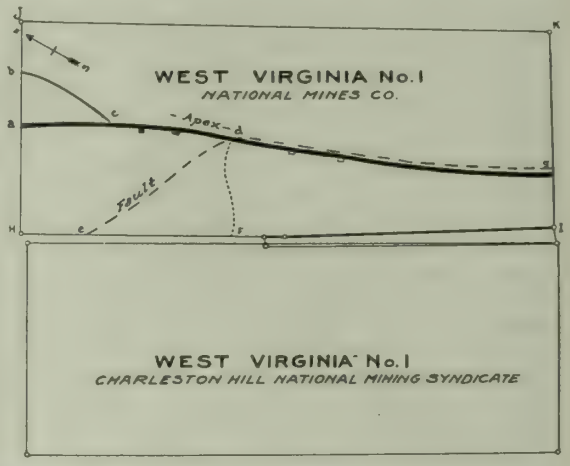
I was able to trace the seams of coal for several miles, but did not manage to collect any fossils, as these do not interest the natives. I promised to reward them for any fossils they would bring me. The district around is very poor and land very cheap. Labor would cost about ₱0.50 per day average. Water is not abundant in the district; there are, however, two small creeks nearby. In the villages wells nearby the depth to water is 30 to 40 ft. Timber is abundant. There would be an excellent market for coal in the neighborhood for the railway and up to Harbin. The selling price in Kirin and Changchun would be about $5 small coin (say $2) per ton of 2240 lb. I was unable to remain in this district as long as I should have liked, as I had to return to Tientsin on the outbreak of the revolution in November 1911. Under proper management these mines could be profitably worked, and with no small advantages to the railway.

Electric Pig Iron Production at Trollhattan

The electric furnace for the production of pig iron, at Trollhättan in Sweden, has been in operation for eighteen months, and the results of operations during a 215-day continuous run have recently been made public by J. A. Leffler and E. Nystrom. The iron ore used averaged 61% Fe for the run and was fed to the furnace at the rate of 24.5 tons per day, together with 6 tons of charcoal (containing 73% carbon) and 1.8 tons of unburned limestone (54.3% CaO). The daily production of pig iron was 15 tons, the power consumption per ton of pig iron being 1482 kw., and the electrode consumption 12 lb. per ton of pig. The average composition of the pig iron for the period was: C, 3.046%; Si, 0.725; Mn, 0.477; S, 0.0126; P, 0.02%. The e.m.f. on the furnace was 73.6 volts, and the current 11,423 amperes. The output of iron per kilowatt-year was 3.94 tons. The gases are drawn off at the top of the furnace and forced in again at the tuyere level, thus carrying the heat up the shaft to effect reduction; one-third of the heat generated is thus transferred. Many problems of operation still remain to be solved.

Litigation at National

We present below a sketch of the ground at National, Nevada, now in dispute between the National Mines Co. and the Charleston Hill National Mining Syndicate. The first named company is the owner of the West Virginia No. 1 claim, from which extremely rich ore has been mined in the past two years. The company claims the apex of a vein bifurcated at the north, as shown, but continuing to the end of the claim as indicated. On the other hand, the Charleston Hill Syndicate claims a fault line as indicated from *e* to *g*, and that the apex is from *a* to *d* on the surface and from *d* to *f* underneath the fault plane. According to this contention, the southern two-thirds of the 'apex' of the vein is really the apex of a fault later in time than the fissure in which the National vein is found. It is also



claimed that the fault cuts and dislocates the National vein. The two fissures are extensively developed by underground workings, and the fact that the drifts run without break from the recognized National vein into and along the fault claimed, is admitted. It is also true that the valuable ore has been found in the workings north from the intersection of the vein and the fault. It was at first maintained by the experts for the National company that there was no fault, but in later testimony doubt was thrown on this and emphasis placed upon the period of mineralization, which was held to be contemporeanous in the 'vein' and the 'fault,' making the whole one continuous vein. The case is still in process of trial. The experts for the National Mines Co. include Messrs. H. V. Winchell, A. N. Winchell, H. L. Hollis, W. H. Wiley, and others, while for the Charleston Hill Syndicate the principal experts are Messrs. Albert Burch and A. C. Lawson.

MASSIVE, finely granular rhodonite occurs at many localities in California, and some of them have yielded gem and ornamental material. The different deposits yield a similar product, the chief difference being in richness of color. Black manganese oxides are associated with much of the rhodonite, filling seams and cracks, and make pretty contrasts with the pink. Probably the best gem material so far found has come from the Wheeler prospect, about nine miles north of Happy Camp, in Siskiyou county, but good material has been found near Taylorsville, in Plumas county, and other localities. These rhodonite deposits are associated with sedimentary rocks and occur along belts of manganese-stained slates and quartzites.

FURNACES at the plant of the Han-Yeh-Ping Iron & Coal Co. at Hankow, China, are now in operation again and it is expected that full operations will be resumed this month.

NITRATE exports from Chile for the past four months of 1912 paid taxes amounting to $9,830,130, as compared with $8,471,650 in 1910.

Discussion

Readers of the MINING AND SCIENTIFIC PRESS are invited to use this department for the discussion of technical and other matters pertaining to mining and metallurgy. The Editor welcomes the expression of views contrary to his own, believing that careful criticism is more valuable than casual compliment. Insertion of any contribution is determined by its probable interest to the readers of this journal.

Smelting and Refining Zinc-Box Precipitate

The Editor:

Sir—In your issue of March 2, M. W. von Bernewitz has an interesting article on the treatment of matte and sulphur refining, but I am by no means convinced that the method of smelting the matte with cyanide and borax is the most convenient or best. Lately I have not had any matte to handle, having come to the same conclusion as Mr. von Bernewitz, that it is a nuisance and that its formation is best avoided, but, some time since, I did a good deal of sulphur refining, of which the following are typical examples: Crude bullion from cyanide clean-up, weight 171.7 oz. Assay value: gold, 518.5, equivalent to 89.03 oz.; silver, 264.2, equivalent to 45.37 oz.; base, 217.2, equivalent to 37.30 oz. This bullion was now melted, keeping the heat as low as possible, in a 30 'salamander' crucible, and 15% of its weight of sulphur added, stirring with a salamander rod. The large crucible was used to give plenty of surface and to avoid loss through spitting. The use of a small clay crucible inverted over the sulphur, described by Mr. von Bernewitz had been previously tried and abandoned, as it was thought the action was too violent and that some gold was lost by spitting.

The resulting bullion weighed 92 oz., assaying: gold, 813.9, equivalent to 74.878 oz.; silver, 139, equivalent to 12.788 oz.; base, 47, equivalent to 4.324 oz. The resulting matte, weighing 93.8 oz., was smelted in a hot fire with iron, no other addition being made except a little borax. The resulting bullion weighed 49.4 oz., assaying: gold, 301.4, equivalent to 14.8 oz.; silver, 548.2, equivalent to 26.9 oz.; base, 150.3, equivalent to 7.7 oz. The resulting matte weighed 51.8 oz., assaying: gold, 16.45, equivalent to 0.52 dwt.; silver, 10%, equivalent to 5.18 oz.; copper, 35%, equivalent to 18.13 oz. The matte was not treated further, but shipped to the smelter with the slag. It will be seen that the bullion assays do not agree exactly, owing to the difficulty of getting a fair average sample of the low-grade bullion by boring; it should have been sampled by dip samples.

The net result of the sulphur refining was to reduce the base metal from 37.3 to 12 oz. and to lock up 5½ oz. silver and ½ dwt. gold in the matte. The following is a summary of this and of two other lots of bullion treated in a similar manner:

	Bullion, oz.	Au, %	Ag, %	Base, %	Au, %	Ag, %	Base, %	S added. oz.	S added. %
Crude bullion	171.50	51.85	26.42	21.72	89.03	45.37	37.30	24	15
After first S treatment	92.00	81.39	13.90	4.70	74.87	12.78	4.35	..	..
Bullion from matte	49.40	30.14	54.82	15.03	14.80	26.90	7.70	..	..
Residual matte contains	....	0.05	10.00	Cu 35.00	0.026	5.18	Cu 18.13	..	..
Crude bullion	238.00	46.13	35.32	18.34	109.90	84.50	43.60	24	10
After first S treatment	183.75	59.89	31.82	8.28	110.04	58.47	15.24	24	13
After second S treatment	150.75	70.49	25.68	3.82	106.26	38.73	5.76	7	5
After third S treatment	141.50	73.54	23.94	2.51	104.06	33.78	3.56	..	..
Bullion from matte	51.30	13.24	72.68	14.07	6.79	37.22	7.29	..	..
Residual matte contains	....	0.027	13.70	Cu 33.50	0.025	12.35	Cu 30.15	..	..
Crude bullion	105.00	49.10	39.70	11.20	51.56	41.69	11.75	16	15
After first S treatment	65.50	71.22	25.60	3.17	46.65	16.77	2.07	..	..
Bullion from matte	27.25	17.96	72.08	9.95	4.89	19.64	2.71	..	..
Residual matte contains	....	0.05	12.18	....	0.021	5.28	....	..	..

This shows that the 'iron' method of treating matte is effective in recovering gold, but the resulting bullion is too base, requiring further refining, and a notable quantity of silver is locked up in the matte. It seems to be more effective than the cyanide method and is certainly easier, no pulverizing of the matte being required, and cheaper, no cyanide and but a very little borax being needed.

Not being satisfied with the sulphur treatment, I thought that if the precipitate were slightly roasted before acid treatment, in order to oxidize and render more soluble the base metals, a residue would be left containing little base metal, and smelting charge would be reduced. This was found to be the case, with the additional advantage that there was no foaming, as no hydrogen was evolved, less acid was required, as part of the zinc was volatilized, and any white precipitate was decomposed by the roast and rendered more soluble. On the other hand, there was the possibility of loss of precious metals in roasting. I was skeptical as to there being any serious losses, but to determine the matter to my own satisfaction, I made the following experiments. A difficulty in carrying out work of this class arises from sampling, it being almost impossible to get accurate samples of such rich stuff; however, all reasonable precautions were taken and six determinations were made to reduce the chance of error as far as possible.

After roasting or treating with acid, the samples of precipitate were fluxed as follows: precipitate, 100 parts; litharge, 50 parts; borax, 50 parts; soda, 25 parts. The slag was then cleaned by smelting with more litharge and iron, and the lead bullion cupelled, and assayed. The precipitate experimented on was from the treatment of an old slime dump and was essentially low grade.

EXPERIMENTS ON SHORT ZINC

			Au, gm.	Ag, gm.
1*a*	500 gm. ppt. after roasting yielded		11.84	10.51
1*b*	" " " acid treatment		12.14	11.06
2*a*	" " " roasting		7.77	7.26
2b	" " " acid treatment		9.69	8.22
3*a*	" " " roasting		6.92	5.95
3*b*	" " " acid treatment		8.43	7.02

Average loss by roasting: gold, 12.3%; silver, 9.9%.

The apparently smaller loss of silver was probably due to some being dissolved by the sulphuric acid.

EXPERIMENTS ON FINE PRECIPITATE

			Au, gm.	Ag, gm.
4*a*	500 gm. after roasting yielded		15.10	13.02
4*b*	" " acid treatment		13.97	14.59
5*a*	" " roasting		10.84	10.52
5*b*	" " acid treatment		11.08	10.53
6*a*	1000 gm. " roasting		40.02	37.94
6*b*	" " treatment with lead acetate to replace zinc and smelted without either acid treatment or roasting		43.14	42.50

Average loss of gold by roasting, 3.3%; silver, 8.8%.

Here the loss of gold by roasting is much reduced, but the silver loss is relatively higher, probably owing to No. 6*b* not being acid treated. In the six parcels treated, five gave higher results without roasting, and in the case of the sixth (No. 4*a*) the combined weight of gold and silver was higher in the non-roasted portion, and it is

possible that an error occurred in assaying the bullion, parting may have been imperfect. Roasting was effected in an iron pan over a fire; possibly with a more perfect roasting arrangement the losses would be materially reduced.

It seems probable that nearly all the advantages of roasting before acid treatment could be obtained by subjecting the damp precipitate to treatment in a chamber with warm air saturated with moisture and a little acid vapor (acetic acid would probably be suitable), somewhat on the lines of the old Dutch process of white lead manufacture. All the metallic zinc and copper would be readily oxidized and rendered soluble in dilute sulphuric acid, but it is doubtful whether the expense of this preliminary treatment would in many cases be justified.

The dried precipitate, after acid treatment, is in a finely divided state, and is specially suitable for smelting with an oxidizing flux. My present practice is to smelt with MnO_2, borax, sand, and fluorspar, obtaining a bullion that averages about 3% base metal. The silver is to a considerable extent carried into the slag, but that is locally no disadvantage, as the mint allows only 1s. 9d. per ounce for fine silver, while the combined bank and mint charges are 1s. 2d. per ounce, and as the slag has in any case to be shipped to the smelter, it is more profitable that it should have a high silver content. MnO_2 acts more energetically than nitre, and does not boil up so much, nor does it seem so corrosive on crucibles. Bessemerizing by air was first tried and patented by Manton, of Menzies, but the corrosion both of the air-pipes and of the crucibles was excessive, and until Rose published his classic paper on this method, no really conclusive work had been done to prove that there was no appreciable loss of precious metals.

H. R. Edmands.

Menzies, Western Australia, May 10.

Mine-Owners' Liability for Accidents

The Editor:

Sir—Among managers of plants there seems to be a widespread impression that if the mine manager adopts the compensation system he does not relieve himself from the possibility of a damage suit undertaken by the workman through a contingency lawyer. It may be well to point out the facts in regard to this, as there seems to be a good deal of misunderstanding about it.

The concluding paragraph of section 3 of the Roseberry law reads in part as follows: "And where such conditions of compensation exist for any personal injury or death, the right to the recovery of such compensation pursuant to the provisions of this act, and acts amendatory thereof, shall be the exclusive remedy against the employer for such injury or death, except that when the injury was caused by the personal gross negligence or wilful personal misconduct of the employer, or by reason of his violation of any statute designed for the protection of employees from bodily injury, the employee may, at his option, either claim compensation under this act, or maintain an action for damages therefor." Through the pernicious activity of insurance solicitors the most that can be made of the phrases "personal gross negligence" and "wilful personal misconduct" has been made of them to frighten employers from accepting the compensation provisions of the Roseberry act, lest by doing so they undertake to carry their own insurance under the protection of the limited liability which those provisions afford.

Nearly all laws relating to this subject, in nearly all countries, retain these exceptions for the punishment of that relatively small number of employers who do take less care of their men than they do of their mules, and who need the restraining influence of a possible mulct in exemplary damages in retribution of their culpable disregard for the welfare of their men. The compensation laws of Great Britain, and of all of its colonies, preserve this right to the injured person as an inalienable right of Englishmen to have a personal wrong done them redressed through the courts, that reparation may be made them to the full measure of all that they have suffered. Our compensation law has been derived, in the main, from the British laws on the same subject.

On the continent of Europe, and in Germany especially, it is a prerequisite to such a suit for damages outside of the law of compensation that the guilty employer be first convicted of criminal conduct toward his employees, after which the injured employee may sue for damages in addition to his compensation. But this is all of more academic than practical value. Not many employers are guilty of personal gross negligence or wilful personal misconduct toward their employees. Even in Great Britain, where the right of an injured employee to avail himself, after the accident, of any remedy he chooses, exists without limitation, out of 282,000 injuries compensated during 1910, only 217 injured persons elected to sue outside of compensation.

In view of the exaggeration and general misconception of the value of these clauses in the statute, I (and I think that my associates on the Industrial Accident Board agree with me) am of the opinion that these provisions should be so far modified as to permit the Industrial Accident Board, in those cases where injuries have been inflicted through the gross personal negligence and wilful personal misconduct of the employer himself and none other, to double the compensation benefits or increase them in reparation for the injury inflicted to not exceeding double such benefits, coupled with a provision which will prohibit insuring against that species of liability. For the punishment should be visited upon the employer, and him only. He should not be permitted to distribute any loss occasioned through his own culpable misconduct either to his industry, through insurance, or to the consuming public through an increase of price. The penalty should be upon him, and sufficiently deterrent in its character to make the unhumane employer humane per force in default of innate decency and sympathy for his kind in his own makeup.

So far I have heard of no instance under the law of personal gross negligence or wilful personal misconduct upon the part of any employer in the treatment of his men, although among those outside of the law, many instances have come to my knowledge where there was gross personal negligence and wilful personal misconduct toward those who were hurt, after they were hurt if not before, and I am fearful that no case will develop under the law which will permit a judicial construction of what those terms mean. They have been useful mainly to frighten employers into taking liability insurance who would otherwise have accepted compensation and carried their own insurance, and I do not expect them to have any other effect whatsoever. I hope that the next Legislature will so far modify these provisions as to make them less of a bogie.

A. J. Pillsbury.

San Francisco, June 21.

Emerald is ranked among the few really precious stones and by some people is considered the most valuable. It has been prized from early times because of its beauty and rarity. The number of localities where good gems have been found is few, and some of those once known have been forgotten. Emeralds found with the mummies of Egypt probably came from the mountains along the west coast of the Red Sea in Upper Egypt, where ancient workings were discovered during the nineteenth century. Mines in the Salzburg Alps are said to have been worked intermittently for emeralds since the time of the Romans to the present. The world's principal supply of emeralds has come from South America. They were first brought to Europe from Peru by the Spaniards in the sixteenth century. None are now found in that country, and it is thought that the Peruvians obtained them from Colombia. Later two of these were lost, and for many years the only mines worked were those near Muzo. Recently the lost mines of Somondoco were found on the east side of the Andes mountains at an elevation of about 9000 ft. above sea-level.

Special Correspondence

KALGOORLIE, WESTERN AUSTRALIA

HORSE-SHOE ORE.—ASSOCIATED NORTHERN LEASING.

Among important developments, the Horse-Shoe has now 30 ft. of $6 ore on the No. 4 lode at 2650-ft. depth. The Associated Northern is now entirely in the hands of tributers, it paying the company better to collect royalties than to bother with small ore-shoots. The mill is working on custom ore and should be able to keep busy for a number of years. The fall in price of Ivanhoe shares was disturbing, but the bottom levels unquestionably appear doubtful. At the Chaffers-Main Reef an interesting bit of work is under way in the reclaiming of gold from the dump at the roasting plant. It will be remembered that some years since an unsuccessful attempt was made to treat this material by agitation and filter-pressing, the main reason for the failure being the absence of the expected gold. The present plan of operation is to break the lumpy material in a disintegrator, mix it with water, and pump it to a floor which has been laid with tarred canvas to prevent leakage into the ground. The clear water is drawn off at one corner, cyanide added, and the gold precipitated with zinc as usual. Evidently the soluble gold will be thus recovered cheaply, but how much is present is a question.

LONDON

DECLINE OF SMELTING INDUSTRY OF ENGLAND.—SECOND SIGHT AT THE ST. IVES CONSOLIDATED.

A few months ago I recorded that one of the ten smelting plants in Cornwall had been closed, namely, that belonging to the Bolitho family at Chyandour, Penzance. An even more important event is the suspension of the Pembrey copper works at Burry Port, South Wales, owned by Elliotts Metal Co. It is not the want of enterprise, business and scientific ability, or capital that causes the smelting industry to leave Great Britain. The Pembrey works belonged to Birmingham people, chiefly the Elkingtons and Chamberlains, and the equipment was kept up-to-date, but the difficulty of buying copper, lead, and silver ore, matte, and bullion has gradually increased. The smelting and refining industries have gone to the mines, and the British user of metals can no longer be his own producer. The Pembrey works are to be sold at auction next month, and it is probable that they will pass to other industries than smelting and refining. Probably the few remaining copper and lead custom smelters in South Wales will follow suit when current contracts expire. As regards the zinc furnaces, there is still a good deal of activity, but expansion is unlikely owing to labor troubles.

A month ago I sent some details of the want of real progress by the St. Agnes Consolidated, one of the Schiff-Dietzsch group of companies operating in Cornwall. This week a bombastic circular has been issued relating to the happenings at the St. Ives Consolidated, another of the group. I cannot do better than quote the words of the circular. It relates to a report made by Charles M. Rolker, a mining engineer well known in America as the consulting engineer of the Natomas Consolidated, and in Russia as consulting engineer to the Lena Goldfields. The secretary says: "I am directed by my Board to inform you that they have received a satisfactory report from Charles M. Rolker, embodying his recommendations and views on the future probabilities of the company's mines, based on the exhaustive examination made by him during January and February of this year. In his report Mr. Rolker states that the object of the St. Ives Consolidated Mines, Ltd., to reopen these mines and, after freeing them from water, bring them to a producing stage as far as tin ore is concerned, and to search for pitchblende ores in the Trenwith mine, seems a justifiable and legitimate undertaking. He further expresses the opinion that when the Consols mine is unwatered and virgin ground entered, ore averaging 40 lb. black tin per ton may be expected within ore-shoot limits, and that 30,000 tons of ore of this grade sent to the mill with a 20s. cost per ton of ore gives £18,994 profit per year."

I would draw attention to the extraordinary opinion in the above paragraph, to the effect that an unexplored block of ground will provide ore averaging 40 lb. of black tin per ton. Some years ago it was said by a popular paper in England that John Hays Hammond was such a clever engineer that he could appraise the value of a mine without seeing it, but are we to believe that Mr. Rolker, who is such a precise man, really expressed the opinon that virgin ground in a waterlogged mine would yield 40 lb. ore, and in sufficient quantity to warrant calculations involving a production at the rate of 30,000 tons per year? Apparently the days of Albert Grant, Whitaker Wright, and Horatio Bottomley are not over for good and all.

RHODESIA

GOLD OUTPUT.—GLOOMY OUTLOOK FOR LABOR SUPPLY.—FAILURE OF THE BUCK'S REEF.

Th gold output of Southern Rhodesia for the month of April has been declared at 52,587 oz., of a value of £221,476, as compared with 51,072 oz., worth £215,102, in the preceding month. Other minerals produced during April were: Silver 14,181 oz., coal 13,156 tons, lead 51 tons, and chrome-iron ore 6188 tons. But little increase is to be observed in the gold production, and no really material expansion of output can be expected until the Shamva at Abercorn, the Cam & Motor on the Eiffel Flats, the Golden Kopfe, the Eileen Allanah, the Falcon, and the Antelope enter the productive lists. These concerns have been developing for a long while and have developed large tonnages of ore. Their advent as producers will have a marked effect on the gold output of the country. Each of these mines should be producing toward the end of next year. The larger mines of the country which are operating stamp-batteries go on in a humdrum sort of way. The smaller properties, operated by tributors and small syndicates, are the flotsam and jetsam of the industry and while in one month increased return may be recorded from these sources the succeeding declaration, on the other hand, show a substantial decline.

A RHODESIAN PROSPECT.

Much, of course depends on the labor position. So far as can be judged, the new Rhodesian Native Labor Bureau has not up to the present improved it at all. A serious feature is the opposition to the recruiting efforts of the Bureau in Northern Rhodesia by the farming community to the north of the Zambesi. In northwestern Rhodesia agriculture is making slow but steady progress and it is alleged by the farmers that the supply of native labor is not sufficient for their purposes. One or two meetings have been held and vigorous protests have been lodged against the operations of the Rhodesian Native Labor Bureau in the northern agricultural districts. The path of the Bureau is certainly not strewn with roses. The Imperial Government has vir-

tually closed the door to recruiting in Nyassaland. In Portuguese East Africa the Bureau has to compete with the wealthier organizations of the Witwatersrand. The Transvaal and other states of the Union are closed to Rhodesian recruiters, but little labor is forthcoming in Southern Rhodesia itself, and now the northern territories are agitating for the expulsion of the R. N. L. B. Unless more local and Portuguese African labor is obtained it is difficult to see where the natives necessary to operate the large plants starting up shortly will be found.

The profitable ore reserves of the Buck's Reef Gold Mines have dwindled to 3650 tons, or only five months' supply at the present much-reduced rate of crushing. Recent development has been distinctly disappointing and it must be admitted that this property, of which such great things were expected a year or two ago, is a failure. It is in many ways regretable that it was ever floated as a limited liability concern with the comparatively large capital of £150,000. The original syndicate earned large profits but, while the Buck's Reef proved itself undeniably to be one of the best 'small mine' ventures in Rhodesia, its development and progress never really justified its flotation into a large concern with offices in London and Johannesburg, a head office, engineering staff, and all the organization and administration of a really big mine. Such a policy has been the undoing of more than one Rhodesian venture, and it is now all too evident that the name of the Buck's Reef will have to be added to the list of misjudged mines. The 'profit' for the quarter ended March 31 was only £752 and much of it was eaten up by capital expenditure. In Bulawayo it is freely rumored that the mine is on the eve of closing down.

It is reported that cassiterite has been discovered in the vicinity of Selukwe. The statement as yet lacks confirmation but it is becoming apparent that tinstone occurs widely in Southern Rhodesia. The mineral has already been found in three widely separated areas in Mashonaland, and the present extraordinarily high price obtaining for tin is stimulating search for its ores throughout the whole of South Africa.

AUSTIN, TEXAS

DEVELOPMENT AT THE HAZEL.—SALE OF THE BONANZA.—NOTES OF PROGRESS.

Good reports of development work in the Van Horn district, west of Alpine, continue to be received. The Hazel M. & M. Co. and the Commissioners' Court of Culberson county have jointly constructed a good wagon-road from Van Horn to the mine, 14 miles. The company has in operation a number of gasoline trucks, carrying in supplies and taking concentrate and the richer ore to the railroad. The first unit of the new 100-ton mill is now being constructed. The Hazel mine has a record of producing $500,000 worth of ore. Only that which ran 50 oz. silver or better per ton was shipped. This left a dump which is said to contain more than $100,000 worth of ore that will give an average return of $15 per ton gross and a net return of $9 per ton when milled. The company which is now preparing to resume operation of this mine on a large scale is composed of John H. Hughes, W. F. Wright, C. F. Freeman, all of Dallas; Charles A. Cutler, of Houston, and others.

J. F. Johnson, a mining engineer of Parral, Mexico, and associates, recently purchased the old Bonanza mine, situated just west of Sierra Blanca, Texas, the consideration being $14,000. The ores are zinc and lead sulphides carrying silver. There is a large dump, besides the bodies of underground ores that have been exposed. A good market for the ore, which runs about 45% zinc, has already been established. The railroad shipping point is only two miles from the mine. William Linderburgh recently purchased the Black Shaft and Sancho Panzo mines, situated in the Van Horn district, about two miles south of the Hazel mine, and will construct a mill. Considerable development work has been done upon the Black Shaft, which contains copper and silver ore. The surface workings of the Sancho Panzo mine have yielded several thousand dollars in copper and silver.

The New Era mine, situated north of Van Horn, is being developed under the direction of S. H. Worrell. Quantities of ore that contain 17% tungstic acid are being taken out. This ore is worth more than $100 per ton. James Arthur has opened a promising gold prospect six miles from Alpine. He is making preparations to begin regular shipments to the smelter at El Paso. There is much activity in mining prospecting in the mountains around Alpine. In the Shafter district several new claims have been recently located. Preparations are being made for considerable development work in that district during the next several months. The Terlingua quicksilver district, in the southern part of Brewster county, is keeping up its record of production. The sale of several undeveloped cinnabar properties in that section is reported, and it is said the purchasers will start development work some time this fall.

TORONTO, CANADA

SEARCH FOR GOLD IN THE NORTH.—MILLING AT PORCUPINE.—PROGRESS AT COBALT.

An expedition organized by A. W. Scott of Toronto, usually known as 'Lucky Scott,' is preparing to leave St. John, Newfoundland, for an 18 months' trip to Baffin island, to search for placer mines. Mr. Scott has had experience in various parts of the globe and made money in Cobalt and Porcupine enterprises. He was for several years a partner of F. Augustus Heinze. Other members of the party are Alexander Gillies and Ernie Holland, well known in connection with Northern Ontario mining, F. Osgoode Pell, New York, Arthur Langdon, and Thomas Morrisey, Nevada placer miners, and Frank Vasser, a South American miner. The expedition is financially backed by J. R. De Lamar, W. B. Thompson, and F. N. P. Pell, of New York. A ship of 300 tons burden has been chartered and will sail from St. John, Newfoundland, about July 10. Its immediate destination will be Ponds inlet, on the northern coast of Baffins island, across from Greenland, and provisions sufficient for two years will be taken. Reports of placer goldfields on Baffins island were brought back by the Government steamer *Arctic* last fall, Robert James, the second officer, having secured rich samples. Mr. James accompanies the Scott expedition as guide and interpreter. The only inhabitants of the country are small bands of Eskimos, and the nearest white settlement is one thousand miles distant.

Four mills are now in regular operation at Porcupine, the Dome with 40 stamps, the Hollinger with 30, the McIntyre with 10, and the Vipond, with a crusher plant and ball-mill, handling only a few tons per day, owing to the non-arrival of a portion of the machinery. No information as to the actual gold production has been given out. The Merrill plant at the Dome is reported to have been found highly effective and satisfactory, the extraction of gold from the ore being almost complete. The second level at the Crown Chartered is proving up well. Driving was done for 36 ft. on the quartz stringers recently found, and a raise cut at the end of the drift enclosed a lens of high-grade ore. Conditions at the 200-ft. level are reported equally as favorable as at 100 ft. where over 900 ft. of underground development shows parallel rich quartz lenses, with intervening schist which carries good ore in some places. At the McEneany the vein, which was 2 ft. wide at the depth of 200 ft., has widened to 6 ft. on the 300-ft. level, and shows persistent gold content. The company will test 100 tons at the McIntyre mill to decide whether the cyaniding process will be advisable. Another pocket of rich ore has been found at the 50-ft. level of the North Dome. The shaft is being put down to the 100-ft. level, where a cross-cut will be run north to the vein and driving undertaken to explore the orebody. The Porcupine Lake, which is putting down a shaft to 100 ft., discovered gold in the porphyry at the base of the shaft at a depth of 10 ft. At the Plenaurum driving has been done for 125 ft. on the

vein found in No. 2 shaft, where it carries one foot of good ore. A new vein has come into it, widening the quartz to 3 ft. The McIntyre, on No. 2 vein at 200 ft., has opened a body of ore averaging 66 in. wide, which promises well. The main vein of the Swastika has been cut at the 400-ft. level, where it shows over 5 ft. of quartz carrying free gold. The foundation of the stamp-mill is being constructed. Ten stamps will be erected at first, the number to be increased later if required.

The Whiskey Lake region, on the north shore of Lake Huron, which a few weeks ago was the scene of a short-lived gold rush, has been examined by A. P. Coleman, who reports to the Provincial Department of Mines that of all the claims which have been staked only one, the Peyton, shows any promise. It has an outcrop of quartz carrying free gold, but no well defined veins. A number of low-grade copper deposits have been found in the district.

Cobalt and the adjacent silver-producing districts are showing renewed activity, the industry receiving a decided stimulus from the increased price of silver, and the construction of the Elk Lake branch of the Temiskaming & Northern Ontario railway. A number of abandoned prospects are again being operated, particularly in the outlying districts, where the cost of transportation renders the working of all but the richest deposits unprofitable. In the Elk Lake districts, where only two prospects were being worked a year ago, there are now twenty in active operation, and in Gowganda a similar revival has been experienced. At the Ophir property in Cobalt active work has been in progress for two months, and three veins, carrying good milling ore, have been found in sinking a new shaft. The Buffalo has just broken ground for a refinery capable of handling the whole product of the mine. The process employed at the Nipissing plant, with some modifications, will be employed. The old Cobalt Central, which after having been in litigation for some years, and was acquired by the Pennsylvania Canadian Co., is under development and has a considerable amount of milling ore blocked out. The Beaver's financial statement for the quarter ended May 31 showed a cash balance of $55,829 on hand. The mill has been running steadily since March 18, the total production being $43,907, and the net profits $36,895. At the mine the main shaft is down to 590 ft. and cross-cutting will shortly begin at the 600-ft. level. High-grade ore is being taken out on the 400-ft. level. An interim dividend of 3% was declared.

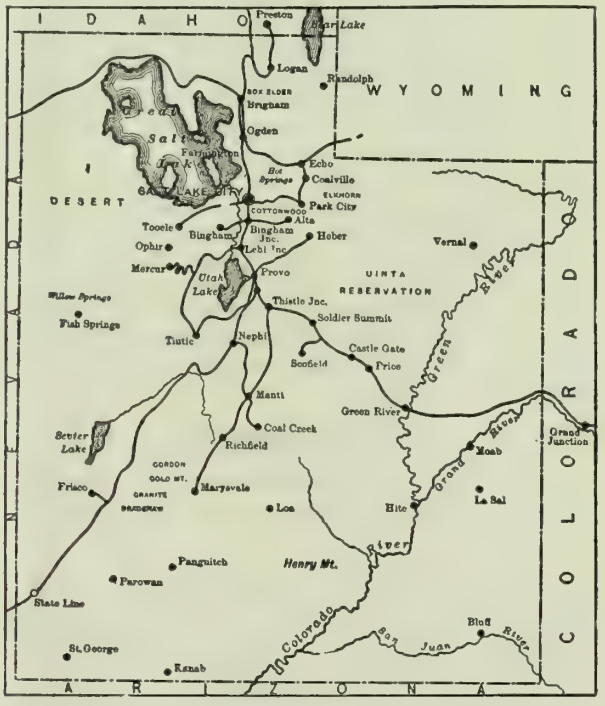
The Trethewey's financial position on May 31 was as follows: Cash in bank and due from smelters, $147,221; ore ready for shipment and in transit, $55,820; total, $203,041. The net profits for May are roughly estimated at $20,000. The statement of the Crown Reserve for the first five months of the year shows a gross production of 1,143,142 oz. valued at $699,847, which after paying royalty, dividends, etc., left a net surplus of $816,741. The Wettlaufer of South Lorrain is maintaining net earnings of $24,000 per month, sufficient to meet the dividend requirements of 20% per year. The new mill is complete, the tailing being re-ground in Huntington mills and treated on slime tables, which produce from 1½ to 3 tons of concentrate per week. These latter are a new feature in the Cobalt district, none of the other mills having yet adopted them. The Dominion Safety Explosives Co., organized by Toronto capitalists, will erect a factory in Coleman township, about three miles from Cobalt, for the manufacture of dinitrolite.

Returns made to the Ontario Bureau of Mines for the first three months of 1912 show an increased value for all items of the mineral output as compared with last year, except gold, which declined because of the Porcupine fire. The silver production was 7,439,044 oz., value $4,092,405, an increase of $383,861, though the quantity produced was sligtly diminished. Cobalt proper produced 7,006,842 oz., South Lorrain, 285,042 oz., and Gowganda, 147,103 oz. Copper was produced to the amount of 2577 tons, value, $306,799; nickel, 4722 tons, $1,009,702; and pig iron 116,824 tons, $1,858,274.

SALT LAKE CITY, UTAH

Coal Situation in Utah.—Asphalt Deposits.—Consolidated Mercur Revives.

Development of the coal deposits continues to occupy a large part of the attention in Utah mining. The lead of the United States S. R. & M. Co. in this direction is being followed by a number of smaller companies, and the outlook is for the free expenditure of money in coal operations for the next few years, as the recent decision of the Interstate Commerce Commission regarding freight rates on Utah coal has given it a great impetus. For a number of years Utah coal has been practically shut out of Idaho and the Northwest through differential freight rates in favor of Wyoming coals. The Harriman railroads have been interested in the Wyoming fields and have sought to maintain a monopoly for Wyoming coal in the Northwest. In the case of the Castle Valley Coal Co. and Consolidated Fuel Co. versus the Atchison, Topeka & Santa Fé and 25



MAP OF UTAH.

other railroads, the Commission has handed down a decision fixing the differential at not over 25c. per ton on Utah coal to points in Idaho, Montana, Oregon, and Washington. Previously, the differential has been as high as 75c. per ton.

The Pittsburg-Salt Lake Oil Co. has begun a campaign to open a market for Utah rock asphalt. The company owns a deposit of 480 acres near Sunnyside, Carbon county, and recently conducted an excursion of Salt Lake and Ogden city officials and others to the property. Utah asphalt has been used spasmodically in Salt Lake, and the paving has given excellent satisfaction, but the organizations controling the better established product have been able to keep control of the city contracts through underbidding. The owners of the Utah asphalt have never been properly equipped for getting out the product economically in quantities. It is announced that the Pittsburg-Salt Lake company proposes to equip its quarries thoroughly for economical extraction on a large scale, and will make a systematic effort to go after the Western market.

The Consolidated Mercur, operating one of the pioneer cyanide plants, is certainly dying a lingering death, if death it is to be. Over a year ago the directors officially informed the stockholders that the property was on its last legs, and would have to close down within the year unless new orebodies were discovered. But the plant was kept in operation through the year, at a slight profit. Again, before

the time for the last annual meeting, the directors notified the stockholders that they would be asked to vote authority to the board to sell the equipment and close down permanently. The stockholders gave this authority, and now it is announced that new ore has been developed which will keep the old mine and mill going at least another six months. The holders of the shares are now hoping that the property will continue this show of vitality and develop more orebodies to prolong this lease of life.

Local shareholders of the Ohio Copper Co. are agitating the formation of a stockholders' protective committee, but as yet nobody has taken the lead to crystallize this feeling. This applies also to bondholders, of whom there are a number in Salt Lake City. Local people have always had a great deal of faith that the Ohio, with proper management and financing, would attain a position profitable to all concerned. The majority still hold to this belief, although they have not taken kindly to the reorganization plan, calling in effect for an assessment of $1, with liquidation of all stock which does not come into the reorganization on a basis of 25c. per share. Those most familiar with the property would like to see the Heinze interests eliminated, control of the Mascotte adit by the Ohio company, enlargement of the mill, and the expenditure of more money for development of ore. While the new financing plan is supposed to provide for all of these things except the ownership of the Mascotte adit, the local stockholders think ownership of the means of outlet for ores should be included in order to insure permanent success. Apparently this is one point on which Heinze intends to stick out indefinitely, for the Mascotte adit has been a source of great profit to him. Despite all this talk, however, the proposed reorganization plan has been acted on favorably by the stockholders at the adjourned annual meeting at Portland, Maine, and indications are that it will go through unless legal action is taken to prevent it.

GLOBE, ARIZONA

INSPIRATION VISITED BY OFFICIALS.—MIAMI PRODUCTION AND PROSPECTING.—OLD DOMINION AND SOUTH LIVE OAK.

Charles E. Mills, formerly manager of the mines at Morenci, and who was recently appointed general manager for the Inspiration Con. Copper Co., has arrived in Globe to assume charge of operations at the mine. He was accompanied by W. H. Aldridge, representing the controlling interests in the company; L. D. Ricketts, consulting engineer, and W. D. Thornton, the vice-president. Over 500 men are employed in development and construction work. Sinking of three development shafts continues, also the main west working shaft, which is now over 60 ft. deep. It is intended to sink this shaft 1000 ft. for the extraction of ore from the Live Oak orebody. The new Ingersoll-Rand compressor of 1200-cu. ft. capacity is now in operation at the portal of the Inspiration adit.

Preliminary figures give approximately 2,700,000 lb. as the production of the Miami Copper Co. for June, or about the same as for May. There were mined 89,900 tons of ore during the month. One churn-drill is at work proving the northeastern part of the property, and a Sullivan diamond-drill is in operation on the 570-ft. level exploring the ground below that level. It is reported that ore has been developed nearly 500 ft. below the level, but B. B. Gottsberger, the manager, will neither confirm nor deny the report and states that the future policy will be to make public no more information on results of diamond-drilling.

The Old Dominion smelter produced 2,112,000 lb. of copper in June, with an average of 2½ furnaces in operation. It is expected that three furnaces will be working in July as the amount of custom ore received is gradually increasing, due to the stimulus of the present high price of copper, and it is probable that the mine production will also be slightly increased. About 1200 men are employed.

Churn-drill hole No. 1 of the South Live Oak Development Co. has been discontinued at a depth of 825 ft. without discovering ore. The drill is being moved to another location, where it is proposed to start a new hole on a faulted zone in the granite formation. John Rose reports the discovery of copper ore in a 100-ft. adit in diabase on the Rose group of nine claims north of and adjoining the Inspiration. He states that a vein of copper-silicate ore, 2½ ft. wide and averaging 15% copper, has just been disclosed. The larger mines of the Miami district are gradually supplanting horses with motor trucks for hauling supplies from Miami to the mines. Inspiration has three trucks, a 3½-ton Alco, a 2-ton Velie, and a 1500-lb. Velie. A 3-ton Velie is hauling supplies to the Live Oak mine, and the Miami Copper Co. is using a 1500-lb. Velie.

BOSTON

UNITED VERDE EXTENSION REORGANIZATION.—BUTTE & SUPERIOR LITIGATION.

The United Verde Extension M. Co. illustrates the futility of announcing a reorganization, and seeking to bolster it with the name of some prominent man. The directors of the company announced a plan of reorganization recently which calls for an increase in the capital stock from 400,000 shares, par $10, to 1,500,000 shares, par 50c. The company owes $20,000. It is proposed that new stock be issued in exchange for that now outstanding, on a basis of share for share; that 40,000 shares of treasury stock be issued to liquidate the debt of $20,000, and that 50,000 shares be sold to James S. Douglas, an Arizona banker, the son of James Douglas, president of Phelps, Dodge & Co., for 50c. per share, realizing $25,000 in cash for deep development work. Mr. Douglas and his associaties, in addition, were to be given an option until June 15, 1915, to purchase all or any part of 400,000 shares at par, 50c. per share. Because of his services in financing the company's affairs, Mr. Douglas, according to this plan, was to receive 150,000 additional shares of stock. When the announcement was made it was apparently so disingenuously worded as to give the idea that the senior James Douglas was to step in as sponsor for this checkered prospect of the Jerome district. It was not until confirmation was sought that it was made plain that he was in no wise concerned in the deal. The fact that his son alone figured in the matter, that the plan of reorganization was not considered equitable, and that due pains were not taken at the outset to disabuse the public of the natural impression that the Phelps-Dodge interests were identified with it, caused the stock to decline, instead of appreciate. A protest is being voiced against the reorganization plan, and there is talk of a protective company of Boston stockholders being formed to present a more acceptable plan of reorganization.

Shares of the United Verde Extension have suffered a good deal in price because of the suggestion that W. A. Clark would institute litigation against the company. A similar case is that of Butte & Superior, which recently suffered an 8 or 9 point decline because of a like menace. Butte & Superior's estate was formerly among the Clark holdings and adjoins the Elm Orlu. Boston market interests were alarmed at the news sent from Butte to the effect that Mr. Clark proposed to start an apex lawsuit against Butte & Superior. The remote possibility of such litigation sent the stock off from the high price of 51¾ it attained a few weeks ago and at the same time sent cold chills up a number of Boston spines. Hayden, Stone & Co. are not believed to be particularly well liked by Mr. Clark, who has more than once given voice to the opinion that the porphyry copper producers have not acted in good faith under the curtailment agreement of two years ago. Hayden, Stone & Co. have resented Mr. Clark's attitude, but when it became definitely known that Mr. Clark intended to fight Butte & Superior, that banking house suggested that the matter be turned over to a disinterested body of engineers to settle by arbitration. It appears probable that this will be done.

General Mining News

ALASKA

Cordova

The Hubbard-Elliott Copper Co. has arranged for packing in 20,000 lb. of provisions this summer. Sixteen men are at work on the 'Albert Johnston' adit, which must be driven 900 ft. to intersect the lode. It is hoped to complete the work in May 1913. It is said that this will make available 694,000 tons of ore averaging 20% copper, but the name of the engineer making the estimate is not given. The Regam M. Co. is working 15 men on a copper property near Kennicott; E. F. Gray is directing the work. Stephen Birch is quoted as estimating shipments from Kennicott this year at 40,000,000 lb. copper, as against 23,000,000 lb. in 1911.

Juneau

The report of the Alaska United G. M. Co. for May shows that 18,634 tons of ore was crushed from the Ready Bullion and 20,790 from the 700 Ft. Claim, realizing $50,232 and $48,820, respectively. The yield per ton of ore in the former was $2.72, and the operating profit $22,222; in the latter, $2.37 per ton, yielding profits of $22,467. On the Ready Bullion 296 ft. of development work was done; on the 700 Ft. 538 ft. At the Alaska Mexican 20,517 tons was crushed, yielding $2.98 per ton, at an operating profit of $30,965. During the month 147 ft. of development work was done.

Small acetylene lamps, worn on the cap like a coal-miners' lamp, are being substituted for candles in the Treadwell mines.

Katalla

The Amalgamated Development Co. has increased the capacity of its refinery to 800 gal. per day. Ore has been found at 580 ft. in an additional well, but drilling is being continued. A rotary drill has been ordered. The Alaska Oil Fields Co. and the Royal company have each ordered rigs for drilling.

Nome

Six new dredges are expected this year, two for the Port Clarence district, two for Casadepaga creek, and two for the Kotzebue country. The New Era Mining Co. has been organized locally to buy the two stamp-mills here and move them to Snow gulch.

Valdez

A steam-hoist has been ordered for the Alice property on Shoup bay. The surface tram, 900 ft. long, at the Fidalgo mine, has been completed, but the aerial tram will not be ready for operation for about three months.

ARIZONA

Much protest is being made among mining men against the new tax schedule. Following the creation of a tax commission and the adoption of tax laws by the last legislature, the assessed valuation of mining property has been raised about 300%. In Yavapai county the assessment was raised from $1,600,000 to $5,200,000, and in Cochise county from $4,000,000 to $12,000,000. Probably a hearing before the commission will be requested.

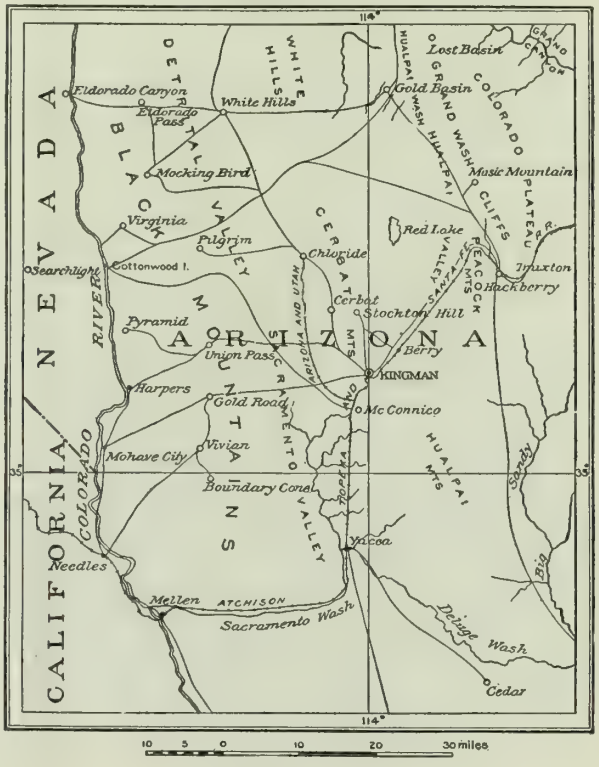
Cochise County

The Mascot Copper Co. is prospecting its property near Dos Cabezos with diamond-drills under the direction of F. L. Sizer. It is now announced that in one hole at a depth of 600 ft. a body of sulphide ore of good commercial grade, 44 ft. thick, of which 33 is high grade, has been penetrated in territory not previously prospected. Mr. Sizer believes that the same lens of ore has been found at two other places.

The Huachuca mine, consisting of 160 acres of patented mineral land near Hereford, has been sold to J. J. Brown and F. W. Graham, of Denver, by Mrs. J. H. Hockley, and the first payment of $5000 has been made. Under the terms of the bond the new owners agree to spend $20,000 on the property during the year. The erection of a mill is planned. The Minneapolis Copper Co. has resumed operation and will ship 50 tons of high-grade ore weekly to the Douglas smelter. The C. & A. mine, near Courtland, has resumed work. Ore shipments from Courtland for the six months ended June 30 amounted to 460 cars of 45 tons each, while the total shipments in 1911 were only 462 cars.

Maricopa County

The Rogers Spring M. & S. Co. smelter at Rogers Spring, 35 miles northeast of Phoenix, is expected to blow in on September 1. The capacity of the plant is 60 tons per day, and a large supply of custom ore is available. Coke will have to be hauled from Phoenix. It is reported that the Harqua Hala mine will be reopened early in July. Robert Browne has purchased the buildings of the Goddard mine. An orebody 6 ft. wide has been found in the Mildred mine, near Stanton; some of the assays run as high as $100 per ton. D. B. Genung is superintendent.



WESTERN ARIZONA.

The Nelson group, in the San Domingo district, has been sold, and a mill will be built by the new owners. The new mill at the Monarch is expected to be in operation shortly. Large bodies of sulphide ore have been found in the Vulture mine.

Mohave County

Thomas McNeely has bonded his property in Mineral Park basin to H. E. Bierce, who is driving a deep adit to cross-cut the vein. The Frisco mines have produced a bar worth $7000 from a two-weeks clean-up. E. H. Barton is manager.

Machinery for the 200-ton mill of the Arizona Southwestern M. Co. has been delivered at the property and it is reported that the mill will be in operation within three months. L. Hoffman is general manager. At the Mitchell 35 men are at work sinking the shaft to the 500-ft. level. The shaft is in ore which is reported to average $100 per ton. Joe Onelto is in charge.

Pinal County

The Calumet Copper Creek M. Co., 35 miles from Hayden, has erected a 150-ton mill, 2½ miles from the mine, and is hauling the ore with auto trucks. About 75 men are employed and high-grade ore is being shipped to the

El Paso smelter. R. Sibley is president and general manager.

The Geeseman-Leatherwood property has been closed down by the Copper Queen Co. and will be allowed to lie idle until a branch railroad can be extended to it. There are large high-grade orebodies in the mine, but they cannot be worked at a profit with the present 70-mile wagon haul required.

YUMA COUNTY

The Swansea Con. M. Co. has arranged to exchange ores with the Blue Bell, as this will give a better smelting charge at both the Humboldt and Swansea smelters, and four carloads per week are thus being exchanged. Reports from Swansea are that the smelter will soon be blown in. C. Clerc is manager. The Steece mine has closed down for the summer. The Corem M. & R. Co. has taken over the Henry Roberts and Burke Bros. property in the Riverside mountains. A. L. Engedow is superintendent.

CALIFORNIA

INYO COUNTY

The Poverty mine, which was bought by A. Baring Gould from the Melton estate, has resumed work. Extensive improvements are being made, two shifts are at work, and the mill is in steady operation. The main shaft at the Custer has reached a depth of 230 ft. John Thorndike is manager. The Christmas Gift is shipping ore averaging $80 per ton; 500 tons is ready in the stopes. L. D. Skinner is manager. Work will be resumed at the Lucky Jim, under the management of Chas. Collins. C. M. Long has bonded his claim, adjoining the Custer, to Mr. Minear for $8000. The Cerro Gordo is making regular shipments of zinc ore to the smelters in Oklahoma. C. J. Borglin has set up a dry washer in the Stringer district. A 15-hp. engine has been installed on the claim of the Gold Placer Mining Company.

MODOC COUNTY

The reported placer strikes on Dry creek, west of Goose lake, have proved to be unfounded. Twenty tons of ore has been shipped from the Sunshine mine to the Selby smelter. Development work is in progress and the erection of machinery is planned. F. L. Schrott and R. L. Mack, who have a lease on the Yellow Jacket claim, are reported to have discovered a 20-in. vein of rich ore. The Eureka Milling & Amalgamating Co. has been incorporated for $50,000 by F. L. Evans, F. O. McFall, and M. B. Rice to construct a custom milling plant on the Del Floy claim.

NEVADA COUNTY

The water supply in the upper Lake region is now so short that all mining operations will soon be compelled to suspend. Rich ore has been found on the 400-ft. level of the Mountaineer mine, owned by P. and J. Bender and F. J. Sloat. At the Red Top rich telluride ore has been found, a lot of 30 tons averaging $32 per ton. F. A. Smith, the manager, is negotiating the purchase of a 5-stamp mill. A. C. Travis has discovered a Tertiary river channel ½ mile east of Graniteville and has organized the Granitevillle G. M. Co. to develop it. Attachments totaling $25,000 have been placed upon the Balsam Flat mines, owned by the Alleghany M. Co., by W. Hatch and G. A. Roberts. Permission has been granted to the Pacific Gas Light & Electric Co. to erect two power plants on the Bear river.

SHASTA COUNTY

The Victor Power & Mining Co. has secured a court order permitting it to make an underground survey of the Midas, at Harrison gulch, which it claims is trespassing on the Victor ground at the 1200-ft. level. The Farmers' Protective Association is still anxious to take steps to force the Mammoth smelter to cease operations, but has so far been unable to raise funds for litigation.

SIERRA COUNTY

(Special Correspondence.)—The gravel channel at the Monte Cristo has been recovered. At point of intersection fair gold content is reported. The Croesus Mining Co. is laying a line of 3-ft. wooden pipe to convey water to mine and mill. The 20-stamp mill has been overhauled. C. W. McMeekin is manager. New machinery has been installed at the Sixteen-to-One and development has commenced. Mark N. Alling and W. J. Belcher have given a short-term bond and option on their Golden Bear claims to P. H. Darrah, of Pomona. The claims are between the Orient and Snowden Hill mines and fair-grade gravel has been found. Charles W. Morse has taken over the Oxford mine, near Downieville. It is reported that the Brown Bear, near Downieville, will be equipped with a steam-power plant this summer; J. G. Jackson is operating the mine under bond. The Oasis M. & M. Co. has arranged to operate the Kenton mine and mill with electric power. The Rio Antigua Mining Co., owning the South Fork quartz and gravel claims at Forest, is being reorganized as the South Fork Mines Co. The company recently acquired the properties, after operating for several years under bond and lease. It is planned to develop the quartz veins disclosed while driving for the gravel channel. F. W. Kuhfeld is superintendent. Arrangements have been made for the extensive development of the Uncle Sam mine, near Forest. A 30-ft. body of quartz has been found 2000 ft. from the adit portal, with shoots of ore showing. The vein is considered a north extension of Alleghany orebodies. G. P. Stone is manager.

Downieville, July 8.

SOLANO COUNTY

The suit against the Selby smelter, by the Supervisors of Solano county, is expected to come up for its next hearing by the middle of August. T. C. Gregory has been engaged as assistant counsel for the plaintiffs.

YUBA COUNTY

J. J. Cusick, president of the Yuba Gold Mines Co., has been sued by Mrs. Jennie E. Robinson of Chicago for $30,000 for the return of money obtained by fraudulent representations. Much interest is being created by the purchases of land made by Newton Cleaveland, but it has not been made public in whose interest Mr. Cleaveland is acting.

COLORADO

CLEAR CREEK COUNTY

An electric pump is being installed at the Smuggler mine, where B. C. Catren is manager. At the Big Indian mine on Leavenworth mountain driving is in progress, and the indications are encouraging. Hummer & Herber are breaking a large tonnage of smelting ore in the Capital mine, and Moscript & Brandsteller are breaking a fair tonnage of ore.

GILPIN COUNTY

The Golden Rod, which owns 12 patented claims and two millsites at the head of Silver creek, will use machine drills in extending its adit, which is in 800 ft. Some promising veins have already been cut, and the adit will be extended 250 to 300 ft. A. Waters and John Hutchens, operating the East Missouri mine on Quartz hill, are taking out good ore from the 150-ft. level. A shipment of three tons of smelting ore recently gave returns of 3.24 oz. gold and 5 oz. silver per ton. A recent trial shipment from the Bates mine gave returns of 2½ oz. gold and 20 oz. silver per ton. At the Oliver mill in Chase gulch, 25 stamps are dropping. Nels Olsen and John Swanson will install a gasoline hoist on the Cicero, in Chase gulch.

SAN JUAN COUNTY

The road to Animas Forks has been opened and trains are now running to the Gold Prince mill. A new mill will be constructed at the Bagley adit and the framed timber is being shipped to the site. The 5-stamp mill of the Intersection is being increased to 10. A 3-ft. vein of rich ore has been uncovered in the Esmeralda, in Minnie gulch, a sample across the face giving assays as high as $1500 per ton. During June the Highland Mary shipped 300

tons of ore, averaging over $80 per ton, to the smelter at Durango. The Shenandoah, in Cunningham gulch, will resume work soon. The Brooklyn mine, on Red mountain, has shipped two cars of ore.

TELLER COUNTY (CRIPPLE CREEK)

The ore treated by the mills of the Cripple Creek district is estimated as follows by the Cripple Creek *Times*:

	Tons.	Av. Val.	Total.
Golden Cycle	32,000	$20.00	$ 640,000.00
Portland	10,000	22.00	220,000.00
Smelters	3,850	65.00	250,250.00
New Portland	13,960	3.51	84,999.60
Stratton's Independence	10,808	2.86	30,910.88
Kavanaugh	1,400	2.00	2,800.00
Wild Horse	800	4.20	3,360.00
Total	72,818		$1,186,320.48

The May production was 76,800 tons of a value of $1,263,344. The Elkton Consolidated made a record production during the month with an output of 3000 tons of $20 ore. The El Paso produced 67 cars of $30 ore on company account, and 40 cars of $20 ore was shipped by lessees. The boiler for the new plant at the Nicholls shaft has been installed. Electric hoists have been installed on the April Fool claim on Squaw mountain and on the Lexington Gold Hill. The Merrimac Con. Mines Co. has been reorganized. The Little Frank S. M. Co. has been sold under writ of execution to Walter A. Dorland for $9767. The properties of the Cable Con. G. M. Co. have been sold by the sheriff to Olive Granfield for $3795. Suit has been brought by the Roxana G. M. Co. against the Doctor-Jack Pot Mines Co. for the alleged unlawful extraction of ore valued at $1,000,000, on the ground that the apex of the vein from which the ore was mined lies in the Mountain Monarch, adjoining the Lucky Corner on Raven hill. In the suit between the Doctor-Jack Pot and the Work M. & M. Co. the court decided that this vein apexed on the Lucky Corner, so the litigation seems likely to be long and costly.

IDAHO

BLAINE COUNTY

It is proposed to consolidate the Bullion, Mayflower, and other mines at Bullion, with the Point Lookout group, the Quincy Junior interests, and others, for the purpose of driving an adit to drain and develop all the claims west of the main road in Bullion gulch. Frank Henderson and C. C. Todhunter have been examining the properties.

IDAHO COUNTY

Sale of the Coeur d'Alene group of claims, in the Ten-Mile district, is reported. Peter Proulx is the vendor. A prospect shaft is being sunk on the Mineral Zone group, recently sold to J. R. Painter. Arthur Hillier is in charge of the mine.

SHOSHONE COUNTY

The 150-ton mill at the Black Horse has begun operation. The Amazon-Dixie M. Co. has a new water-driven air-compressor and an electric lighting plant. Wesley Everett is in charge of the property. The Iron Mountain Tunnel Co. has raised $65,000 for development purposes, and it is planned to resume mining and milling operations by September 1. The Gold Hill M. Co. has nearly completed its 10-stamp mill and crushing is expected to start August 10. The ore is said to average $17.20 per ton. It is reported that the Stewart M. Co. has over $150,000 in the treasury, a loan of $84,000 to the Ohio Copper Co. having been recently repaid.

The Bunker Hill & Sullivan has brought suit against the Caledonia, in order to fix boundary lines and quiet the title to a portion of the ground. The Bunker Hill claims the orebodies below the 500-ft. level and has enjoined the Caledonia from working them. At the meeting of the Bear Top-Orofino M. Co., held July 1, a new company, the Twin Star Mining Co., was incorporated to take over the Bear Top. The new company will assume all indebtedness and will issue shares to the stockholders in the other companies upon a 90% basis. It is expected to resume operation by the middle of July, and the lower adit, now in 100 ft., will be continued to a length of 2600 ft. The third payment has been made upon the Tuscumbia and a contract has been let to drive a 300-ft. adit.

WASHINGTON COUNTY

The Landor Copper Co. is shipping ore that averages 30% copper, in carload lots, according to the Wallace *Miner*. Several of the Eastern stockholders have recently visited the mine and the report has been given out that the equipment will be increased and the scale of working enlarged.

MONTANA

SILVERBOW COUNTY

(Special Correspondence.)—A private telegram received in Butte states that after a conference with W. A. Clark,

SMELTER, GREAT FALLS.

who was hurriedly called to New York, a setlement has been brought about wherein it has been agreed that Mr. Clark will drop his contemplated suit against the Butte & Superior Co. for the alleged extraction of ore from the Elm Orlu mine. It cannot be learned just how much ore it is alleged the Butte & Superior people have taken from the Clark mine, which adjoins the Black Rock, but according to reports it is said that the Clark engineers claim that there has been a very large amount.

Butte, July 6.

The copper output in Butte for June was 24,607,582 lb., or 4,474,780 lb. less than in May. The decline was due to the fact that there were only 29 working days and because the Butte Coalition mines were out of commission on account of changing the hoist from steam to compressed air for power. The Tuolumne output was less on account of mining lower-grade ore. The output in June, 1911, was 20,412,120 pounds.

The mining companies and the miners' unions have signed a 3-year contract providing that the minimum wage shall be $3.50 underground and $3 for surface work. When copper sells between 15 and 17c. per pound these shall be increased to $3.75 and $3.25. When copper is over 17c. underground men will receive $4 and when over 18c. surface workmen will receive $3.50. The Lincoln Trust Co., of

New York, has begun suit to foreclose a mortgage of $2,000,000 on the La France Copper Co. The Lexington Mines Co. has been formed to bid in the La France, and it is reported that the United Copper Co. of which the La France is a subsidiary, will be reorganized. About one-third of the $45,000,000 shares of this company are held abroad, largely in Holland, and a representative of these interests is now in this country to bring about the reorganization. The Butte & Superior mill is working at full capacity, making a 92% recovery. A large orebody has been found on the 1200-ft. level.

NEVADA

Churchill County

Two cars of concentrate from the Nevada Hills has been shipped to the International smelter at Tooele, with which a contract has been signed. Shipments are said to average 600 oz. silver per ton. The mill of the Nevada Hills is now working at a high efficiency. Reports have been received of the discovery of copper deposits about 100 miles south of Winnemucca, and 18 miles from Boyer's ranch, in Dixie valley. Some of the ore is reported to contain 30% copper and the amount of 3% ore is reported very large.

Esmeralda County

The production of the Goldfield Consolidated Mines Co. in June, according to the preliminary estimates prepared by J. F. Thorn was 32,360 tons, the largest tonnage for any single month in the history of the company. This includes ore that has been extracted from the deepest workings of the Clermont and Grizzly Bear mines, at depths of 1000 and 1300 ft., and that has been shipped to the reduction plant of the International Smelting & Refining Co. at Tooele, Utah. Gross recovery of gold from the June production is placed at $542,000, operating expenses at $200,000 and net realization is estimated at $342,000. This shows a gross value of the product to be slightly less than in May, but the net profit is larger than in the previous month. The tonnage produced during the month is more than 2000 tons in excess of the largest output made in any month in the past. It is probable that the final report for the month will show that the high-grade ore shipped to the smelter has increased the profit during June.

Lyon County

Large orebodies are being developed below the fourth level of the Mason Valley mine, the average being 4½% copper. Development work at the New Yerington Copper Co. property is planned and the drifts on the 250, 300, and 400-ft. levels will be extended. Good ore is being found on the seventh level of the Nevada Douglas; the vein is 20 ft. wide. The inclined shaft is being deepened 200 ft. It is reported that the Mason Valley will take over the Bluestone mine. The Bluestone, which is owned by J. R. De Lamar, has been developed to a depth of 350 ft.; drilling to a depth of 700 ft. has shown that the ore is low grade. It is reported that 1,500,000 tons of 2% ore is developed.

Nye County

A fire at Tonopah on July 8 did $150,000 damage to the town, but none of the mines are affected. Rich ore is reported at the Toro Blanco, at Manhattan; F. H. Mitchell is manager. Much interest has been excited at Tonopah by the discovery in the Merger Mines property. The shaft has reached a depth of 970 ft. and has passed through 30 ft. of vein material, of which 12 ft. averaged $25 per ton. The Mizpah Extension is raising from the 500-ft. level in $40 ore. The Jim Butler will utilize the old Belmont mill. Eight mines are now producing in the district and 24 hoists are in operation. The new Belmont mill started work on July 7. The summary of operation of this company for the quarter ended May 31 is as follows:

Receipts from sales of ore, bullion, etc., $855,849; mining, milling, and administration expenses, $450,826; net earnings for quarter, $450,023; miscellaneous income, $9118; total net income for the quarter, $414,141. Available resources, May 31, 1912: Due from smelters, $167,830; due from others, $5020; loans on collateral, $150,000; cash in banks, $789,006; total, $1,111,857.

The annual report of the West End Consolidated shows that during the year ended March 31, 15,903 tons, averaging $16.75 per ton was milled at a cost of $6.30 per ton, giving a total net return of $158,387. Smelting ore, of an average value of $33.07 was shipped to the amount of 1151 tons, with a net return of $26,254. Of tailing, 15,905 tons was milled, with a net return of $2.30 per ton from tailing averaging $8.70. The total net earnings for the year were $91,995.

The mines of the Tonopah district shipped a total of 8777 tons of ore, of an estimated value of $219,425, to the mills last week. The Tonopah Mining Co. sent 3500 tons, the Belmont 1950 tons, Montana 1030 tons, Tonopah Extension 1078 tons, West End 750 tons, and MacNamara 469 tons.

White Pine County

Eight men were killed in the Copper Flat pit of the Nevada Consolidated on July 7, by the premature explosion of the powder in a churn-drill hole, one of them being the powder man. The cause of the explosion is not known. There are 750 men employed in the open cuts, 300 at the Veteran, and 250 at the Giroux mines. The Giroux is shipping ore from the Taylor dump, where 600 tons of high-grade ore is piled up. It is expected that work will shortly be resumed on the 1200-ft. level of the Alpha workings. Shipments during the past month have averaged over 1000 tons per day. The contact deposits in the Veteran are holding out surprisingly well and are creating greater faith in their possibilities as to persistence and extent. The Copper-mines company is shipping ore of a copper content of 13 to 15%. The Berry Creek M. Co. has been incorporated, with head offices at McGill.

The Railroad Valley Saline Co. has been reorganized into the Railroad Valley Co., of 1,000,000 shares, of which 400,000 will be used to take over the Saline company and 200,000 will be sold.

NEW MEXICO

Grant County

The Mineral Mountain M. Co. will begin work within the next two months and continue the adit already started until it cuts the vein. The National G. & S. M. Co. has opened a 4-ft. vein of good ore. At the El Oro rich ore is being extracted. George Ingham is in charge and will let a contract to deepen the shaft to 100 feet.

Sierra County

Copper claims near the Victoria Chief have been bonded to El Paso people by Emory Hickock, but the price has not been disclosed. Some of the best claims of the Caballero district have been optioned by Wilbur Grant and J. C. Tandy, of El Paso. Ore from the St. Lawrence is being hauled to Cutter and accumulated on the dumps.

OREGON

Baker County

At the annual shareholders meeting of the Humboldt Con. Gold Mines Co., F. R. Mellis was elected president for 1912, and J. A. Howard, secretary. The Laclede Con. Gold & Copper M. Co. is developing a quartz property near North Powder; an adit is being driven and has cut a vein 8 ft. wide. J. A. Gyllenberg is superintendent. Emil Melzer will take charge of the new construction planned for the Blue Mountain M. Co., operating the Last Chance and Baby McKee properties in Cable Cove.

Jackson County

Mike Womack reports the finding of a large orebody on Frog creek, 7 miles from Ashland. Assay returns of from $4 to $18 per ton are reported, and it is stated that outcrops of the vein can be traced for several miles. Capital has already been proved for the sinking of a shaft.

Josephine County

The Darkes mine, near the Takilma, has been purchased

by E. E. Phillips. It is expected to begin shipment soon and the ore will be hauled by teams to Grants Pass. Ore assaying $35 per ton is being taken from the Red Bean mine, on Slaveout creek, owned by Riggs, Flamm & Evans. R. S. Tucker has been appointed receiver for the Alameda Consolidated Mines Co., which owns 800 acres of land and has sold $13,000,000 worth of stock.

UTAH

Juab County

The Eureka Hill Mining Co. has filed suit against the Bullion Beck for $18,750 for trespass. Directors of the Tintic Standard have levied an assessment of ½c. per share. Work on the 1000-ft. level of the Opohongo is in progress. The zinc ore being shipped from the May Day averages $30 per ton, and it is expected that a considerable profit can be made from this class of ore. The Eagle & Blue Bell is making large shipments from the 700-ft. level. The earnings for May were $10,000, and those of June nearly as much. The Chief Consolidated now has a surplus of over $130,000. The Iron Blossom has $300,000 in its treasury and will pay a dividend this month.

Summit County

Ore shipments from Park City during the month of June amounted to 196 cars aggregating 7182 tons, 2043 being shipped over the Rio Grande and 5139 over the Union Pacific. The shippers were: Daly West, 2574 tons; Silver King Coalition, 1976; Daly-Judge, 1707; Grasselli company, 290; New York Bonanza, 174; Ontario lessees, 119; Charley Moore, 70; Little Bell company, 143; E. J. Beggs, 72, and Park City Sampler, 42 tons.

The Utah Ore Sampling Co., of which A. W. Gates is manager, has bought the McIntosh ore sampler at Park City. The Utah company, of which Jesse Knight is president, was formed some time ago to take over the Taylor & Brunton sampler at Murray, the Pioneer sampler at Sandy, and the Silver City mill at Tintic. It is reported that the Silver King Coalition may be sold to the consolidated company to terminate the litigation between them. Work has been resumed at the Ontario mill.

WASHINGTON

Ferry County

During April shipments of ore from the mines of the Republic district amounted to 3077 tons, as follows: Republic Mines Corporation, 2433 tons; San Poil Con. company, 360; Knob Hill, 248, and Rathfon Reduction Works, 35 tons.

CANADA

British Columbia

The British Columbia Copper Co. produced 996,000 lb. of copper during June. It is reported that a 7-ft. vein of chalcopyrite averaging 18% copper has been cut in the shaft of the Rocher de Boule company. The Silver Standard reports that in sinking its shaft 135 ft. silver-lead ore worth $25,000 was extracted.

It is stated on good authority that the Red Cliff Mining Co., Ltd., will take up the option on a controlling interest in the stock of the Tyee Copper Co., Ltd., which expires July 31. The mining company is ready to guarantee delivery of ore at the rate of 100 tons per day at $1.15 per ton on shipboard. Several of the British shareholders have recently visited the mine. The Salmon-Bear River Mining Co., which has its headquarters in Vancouver, is incorporated for $1,000,000 in 25c. shares. Of these, 260,000 have been sold for development purposes, and 2,440,000 will be used in a proposed pooling agreement. The company owns eight claims on Salmon river upon which development is in progress. Silver-lead ore has been found in a number of places, and is now being developed.

Ontario

The Vipond mill is treating 75 to 85 tons of ore per day and stoping between the 100 and 200-ft. levels is in progress. The stamp-mill of the McIntyre is at work; good ore is being found on the 300-ft. level, where the drift is in 300 ft. on the vein. A new company has been organized to operate the mill on the Nova Scotia. D. M. Steindler is president. During May the Buffalo mill produced 109,295 oz. of silver from 4553 tons of ore of an average silver content of 28.22 oz. A new vein has been found on the 150-ft. level of the Hudson's Bay mine, where the mill is now treating 70 tons of ore per day. The La Rose Consolidated will pay a 2½% dividend on July 20, making the total for this year 7%. The total dividends paid by this company amount to $2,954,185. Exploratory work in the Keewatin on the 200-ft. level of the Coniagas has so far been devoid of results, and the vein which was followed on the first level for 150 ft. has not been picked up. Brush fires have been raging at Porcupine, but have done no damage aside from the destruction of cordwood. The new power-plant at the Hughes is in successful operation and shaft-sinking has been started. The Dome mine is reported to have reached a capacity of 10 tons per stamp per day. The Dome mill is crushing 8 tons per stamp per day, and the tonnage could be increased except that it would lead to scouring of the plates. The Hollinger has 20 stamps dropping.

Cobalt shows a steady increase in bullion shipments with an accompanying diminution in consignments of ore, with the Nipissing well in the lead. The total bullion shipments for the year up to June 7 were 2,146,778 oz., of the value of $1,250,146, the ore shipments being 8577 tons.

MEXICO

Sonora

Five cars of ore have been shipped from the Abundancia to the smelter at Douglas and showed 5 to 17% copper. O. L. Neer and others have the property in bond and lease, and are planning the construction of a narrow road to simplify the freighting problem. The Tucabe mine, 50 miles east of Magdalena, has been sold to an American company for $150,000, it is reported.

High-graders who have been shipping ore from the El Tigre district to the United States have been detected and the shipments captured. The ore is supposed to have come from the Cinco de Mayo and adjoining mines. The El Tigre mine is making the largest output of its history. W. L. Rynerson has taken a lease of the El Temblor. Work has been resumed on the North Tigre by R. L. Brown.

In a report mailed to the stockholders of the Lucky Tiger-Combination G. M. Co., May 25, it was shown that the net profits from the operation of the mine for the first four months of this year were approximately $45,000 per month. The net profit for the month of May shows a material increase, being approximately $75,000, of which $37,000 was derived from the operation of the cyanide plant, which is now meeting the fullest expectations. The results of operations for the month of May were as follows:

	Tons.	
Crude ore concentrated	6183	
Tailing cyanided	7728	
Estimated value of shipping ore	125	$ 30,000
Estimated value of concentrate	280	64,200
Est. value of bullion from cyanide plant		70,400
Total value of May production		$164,600
Less expenses, including cost of mining, milling, marketing, and general expense, but not including depreciation		87,000
		$ 77,600
Less Kansas City general expense and interest on bonds		2,600
Net profit for May 1912		$ 75,000

Considerable high-grade shipping ore has been discovered on the fourth level of the Sooy vein. At the regular monthly meeting of the directors held on June 20 it was resolved that from this date dividends be declared monthly as the earnings may justify.

Personal.

Professional men are invited to send news of their engagements and travels. Such news is interesting to friends.

D. C. JACKLING is at Butte.

W. C. OREM has gone East.

J. F. NEWSOM is at Iditarod.

W. R. BASSICK has gone East.

ROY L. MACK is at High Grade.

L. LINDSAY has returned to San Francisco.

T. LANE CARTER, of Chicago, is in Montana.

F. LYNWOOD GARRISON is in San Francisco.

E. P. MATHEWSON has returned to Anaconda.

E. H. CLARK was in San Francisco this week.

A. P. ROGERS was in San Francisco this week.

F. H. BOSTWICK is in San Francisco this week.

J. J. COLLINS is in London from North Nigeria.

D. D. MUIR, JR., left for Seattle for Juneau, July 8.

W. E. SIMPSON is at Fundicion de Los Arcos, Mexico.

P. N. MOORE has gone to the Yosemite and Los Angeles.

G. I. ADAMS will sail for China on the *Tenyo Maru* today.

C. M. EYE was in San Francisco and has left for Mexico.

C. H. MACNUTT is in London, having left Antofagasta, Chile.

HENRY B. KAEDING will be in New York for several weeks.

H. V. WINCHELL will sail for Europe July 24, returning in October.

GEORGE M. RYALL is in Mexico, but is expected in Los Angeles soon.

L. D. GODSHALL was in Kingman, Arizona, recently and has gone East.

E. P. JENNINGS has returned to Salt Lake City from a visit to the East.

C. T. NICHOLSON is studying the dredging districts of the Yukon and Alaska.

J. A. AGNEW has resigned from the service of Bewick, Moreing & Company.

J. F. KEMP has been elected a member of the American Philosophical Society.

COURTENAY DE KALB is inspecting properties along the west coast of Mexico.

M. W. VON BERNEWITZ sailed from Auckland for San Francisco on July 5.

BAILEY WILLIS has returned from Buenos Ayres and is at Washington, D. C.

JOHN MCDONALD has resigned the management of the McEneany mine, at Porcupine.

WILLIAM BREWER was in San Francisco this week, but leaves Victoria the last of the month for Seward, Alaska.

CHARLES O'CONNELL has resigned as manager of the Trethewey mine. HORACE G. YOUNG is now manager.

R. T. HILL was in San Francosco on his way to Los Angeles, which is to be his headquarters for the present.

F. R. HULL has resigned as superintendent for the Empire Mines Co., and will be succeeded by E. S. SHEFFIELD.

R. H. ELLIOT was recently married and has gone to Telluride to be superintendent for the Liberty Bell G. M. Company.

Obituary

GEORGE M. HILL died at his home in Alameda on July 10 at the age of 46. A mining engineer, he had been for some years interested in real estate, and recently had served with distinction on the Board of Harbor Commissioners of San Francisco.

Market Reports

LOCAL METAL PRICES

San Francisco July 11.

Antimony	11—11½c	Quicksilver (flask)	48
Electrolytic Copper	18—18½c	Tin	50—51½c
Pig Lead	5.00—5.95c	Spelter	7½—7¾c

Zinc dust, 1400 lb. casks, per 100 lb., small lots $9.50—9.75; large $7.50—8.50

METAL PRICES

(By wire from New York.)

NEW YORK, July 11.—Copper prices in this market for the past week have been weak, despite the decrease in surplus. Lead, on the other hand, is firm, as is also spelter.

Average daily prices for the past week, in cents per pound, based on wholesale transactions, standard brands, are given below.

Date.	Electrolytic Copper.	Lead.	Spelter.	Silver, per oz.
July 4	Holiday.	No market.		
" 5	17.20	4.75	7.10	61⅛
" 6	17.20	4.75	7.15	61
" 7	Sunday.	No market.		
" 8	17.10	4.75	7.15	61
" 9	17.03	4.75	7.15	60⅞
" 10	17.03	4.75	7.15	61

LONDON QUOTATIONS

(By cable, through the courtesy of C. S. Burton & Co., New York.)

	July 11.
Camp Bird Ltd	£ 7
El Oro	3⅛
Esperanza	6⅛
Oroville Dredging	1½
Santa Gertrudis	7⅜
Tomboy	5⅛

COPPER SHARES—BOSTON

(By courtesy of J. C. Wilson, Mills Building.)

	Closing prices, July 11.		Closing Prices July 11.
Adventure	$ 7¾	Mohawk	$ 65
Allouez	44	North Butte	31
Calumet & Arizona	73½	Old Dominion	55
Calumet & Hecla	515	Osceola	114
Centennial	23½	Quincy	89
Copper Range	56⅜	Shannon	15⅞
Daly West	5	Superior & Boston	1⅛
Franklin	10⅜	Tamarack	38
Granby	62½	Trinity	5½
Greene Cananea, ctf.	9½	Utah Con	10⅜
Isle-Royale	33⅛	Victoria	3½
La Salle	6⅜	Winona	5⅛
Mass Copper	6	Wolverine	107

NEVADA STOCKS

(By courtesy of San Francisco Stock Exchange.)

San Francisco, July 11.

Atlanta	$ .22	Mayflower	$ .02
Belcher	.46	Mexican	2.65
Belmont	10.00	Midway	.50
B. & B.	.07	Montana-Tonopah	2.57
Booth	.08	Nevada Hills	1.90
Chollar	.11	Ophir	1.00
Combination Fraction	.16	Pittsburg Silver Peak	1.00
Con. Virginia	.35	Round Mountain	.40
Florence	1.10	Savage	.11
Goldfield Con.	4.00	Tonopah Extension	2.02
Gould & Curry	.01	Tonopah of Nevada	6.50
Jim Butler	.62	Union	.45
Jumbo Extension	.37	Vernal	.13
MacNamara	.23	West End	1.67

MINING STOCK QUOTATIONS—NEW YORK

(By wire from C. S. Burton & Co., New York.)

	Closing Prices. July 11.		Closing Prices. July 11.
Amalgamated Copper	$ 80⅜	Miami Copper	$ 26⅜
A. S. & R. Co.	81⅜	Mines Co. of America	3
Braden Copper	6¾	Nevada Con	21½
B. C. Copper Co.	5⅜	Nipissing	7⅜
Chino	30½	Ohio Copper	¼
First National	1¾	Ray Con	20⅜
Giroux	5	Tenn. Copper	43
Goldfield Con.	4	Tonopah Belmont	10
Greene-Cananea	9⅜	Tonopah Ex	2
Hollinger	13	Tonopah Mining	6⅜
Inspiration	18⅜	Trinity	5½
Kerr Lake	2⅜	Tuolumne Copper	3½
La Rose	3¼	Utah Copper	60⅜
Mason Valley	13¼	West End	1⅜
McKinley-Darragh	1⅜	Yukon Gold	⅞

Metal Mining in Missouri

The value of the mine output of silver, copper, lead, and zinc in Missouri for the calendar year 1911, according to J. P. Dunlop, of the United States Geological Survey, was $30,171,311, compared with $28,086,887 in 1910, an increase of over $2,000,000.

PRODUCTION OF LEAD AND ZINC IN MISSOURI IN 1911, IN SHORT TONS

District.	Ore.								Metal content.			
	Lead concentrates.				Zinc concentrates.				Lead.		Zinc.	
	Galena.		Carbonate.		Sphalerite.		Silicate and carbonate.					
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
Southwest Missouri:												
Alba-Neck City	328	$19,508	.....	.....	15,995	$707,537	.....	.....	262	$23,580	8,826	$1,006,164
Ash Grove-Everton	51	2,646	.....	.....	.....	.....	125	$2,100	41	3,690	41	4,674
Aurora	84	4,076	24	$962	3,273	122,608	1,829	37,239	79	7,110	2,344	267,216
Carl Junction	69	3,696	.....	.....	4,610	189,127	.....	.....	54	4,860	2,479	282,606
Carthage	100	5,500	.....	.....	2,471	98,382	221	4,882	80	7,200	1,353	154,242
Cave Springs	317	18,469	.....	.....	4,497	196,994	.....	.....	248	22,320	2,411	274,854
Duenweg-Porto Rico	2,397	133,201	.....	.....	16,550	649,829	2,552	65,860	1,896	170,640	9,695	1,105,230
Granby	623	33,824	43	1,636	4,330	152,662	9,405	239,194	523	47,070	5,693	649,002
Joplin	6,158	325,885	45	1,512	41,300	1,650,091	1,707	36,488	4,915	442,350	22,667	2,584,038
Oronogo	1,491	82,993	.....	.....	10,173	425,680	.....	.....	1,171	105,390	5,489	625,746
Sarcoxie-Reeds	8	400	6	180	1,836	70,627	990	21,447	9	810	1,326	151,164
Sherwood-Thoms Station	641	35,382	.....	.....	12,603	443,822	.....	.....	513	46,170	6,202	707,028
Spring City-Beef Branch	725	36,974	10	293	2,350	74,946	2,372	50,306	581	52,290	2,008	228,912
Springfield	230	12,203	.....	.....	900	38,006	.....	.....	184	16,560	514	58,596
Spurgeon	868	48,614	106	3,775	80	2,700	400	8,137	749	67,410	184	20,976
Stotts City	44	2,400	.....	.....	820	35,472	.....	.....	35	3,150	451	51,414
Webb City-Carterville-Prosperity	24,626	1,396,167	.....	.....	93,462	3,718,617	.....	.....	19,694	1,772,460	49,282	5,618,148
Wentworth and Barry County	.....	.....	.....	.....	485	19,985	8	191	.....	.....	265	30,210
Zincite	101	5,564	.....	.....	1,964	79,584	.....	.....	80	7,200	1,052	119,928
	38,861	2,167,502	234	8,358	217,699	8,676,569	19,609	465,844	31,114	2,800,260	122,282	13,940,148
Central and southeast Missouri	219,145	10,293,400	.....	.....	113	3,990	510	11,576	147,754	13,297,860	233	26,562
State total:												
1911	258,006	12,460,902	234	8,358	217,812	8,680,559	20,119	477,420	178,868	16,098,120	122,515	13,966,710
1910	247,861	11,286,750	197	6,385	232,341	9,342,139	23,826	561,803	161,016	14,169,408	129,589	13,995,612
1909	249,151	10,893,024	385	11,124	229,023	9,445,826	28,525	677,213	159,435	13,711,410	130,162	14,057,496
1908	218,213	8,629,039	664	18,220	198,340	6,800,359	20,601	451,607	144,459	12,134,556	107,404	10,095,976
1907	193,528	10,535,890	357	11,764	222,347	9,208,465	18,733	427,146	138,675	14,699,550	116,752	13,776,736

a In calculating the metal content of the ores from assays, allowance has been made for smelting losses in case of zinc, but not in the case of lead. In comparing the values of ore and metal it should be borne in mind that the value given for the ore is that actually received by the producer, whereas the value of the metal is calculated from the average daily quotations at New York and St. Louis.

TENOR OF CRUDE LEAD AND ZINC ORE AND CONCENTRATE, SOUTHWEST MISSOURI

	1910	1911
SOFT GROUND. a		
Total crude ore.....short tons..	3,275,705	3,217,166
Total concentrates in crude ore.....per cent..	4.4	4.5
Lead.....do....	.4	.4
Zinc.....do....	4.0	4.1
Metal content of crude ore.....do....	2.5	2.6
Lead.....do....	.3	.3
Zinc.....do....	2.2	2.3
Average lead content of galena concentrates.....do....	79.2	79.9
Average lead content of lead carbonate concentrates.....do....	47.6	54.7
Average zinc content of sphalerite concentrates.....do....	59.1	58.9
Average zinc content of silicates and carbonates.....do....	35.9	40.4
Average value per ton of galena concentrates	$51.06	$54.41
Average value per ton of lead carbonate concentrates	$32.41	$35.72
Average value per ton of sphalerite concentrates	$39.40	$40.80
Average value per ton of silicates and carbonates	$23.58	$23.76
SHEET GROUND.		
Total crude ore.....short tons..	5,779,192	4,944,910
Total concentrates in crude ore.....per cent..	2.6	2.6
Lead.....do....	.4	.5
Zinc.....do....	2.2	2.1
Metal content of crude ore.....do....	1.6	1.64
Lead.....do....	.3	.4
Zinc.....do....	1.3	1.24
Average lead content of lead concentrates.....do....	79.9	79.8
Average zinc content of sphalerite concentrates.....do....	59.3	58.6
Average value per ton of lead concentrates	$52.01	$56.50
Average value per ton of sphalerite concentrates	$40.81	$39.79

a Including also the small production of lead and zinc ores in central Missouri.

TENOR OF CRUDE LEAD ORE AND CONCENTRATE, SOUTHEAST MISSOURI

	1910	1911
Total crude lead ore.....short tons..	3,693,523	3,974,712
Lead concentrates in crude ore.....per cent..	5.7	5.5
Lead content in crude ore.....do....	3.5	3.7
Average lead content of lead concentrates.....do....	62.3	67.3
Average value per ton of lead concentrates	$44.35	$46.94

The production of silver amounted to 49,867 fine ounces, valued at $26,430, an increase of 16,771 oz. over 1910. The production of copper was 640,411 lb., compared with 94,452 lb. in 1910. The quantity of lead concentrate produced increased from 248,058 to 258,240 short tons and the metal content of the lead concentrate increased from 161,016 to 178,868 tons. The low prices paid for zinc concentrate during the first 10 months of 1911 caused a decline in the production of zinc. The output of sphalerite was 217,812 short tons, compared with 232,341 tons in 1910. The production of zinc carbonate and zinc silicate concentrates was only 20,119 tons, which was less than in any year since 1907.

There was an increase in ore mined in the southeast Missouri lead district. In the Joplin region the 'soft ground' mines produced about the same quantity of ore in 1911 as in 1910, but the output of the 'sheet ground' mines was about 800,000 tons less. A large amount of development was done in the Joplin region, and the high prices offered for zinc concentrate during the past two months of 1911, though too late to have much effect on the year's production, will probably cause much larger shipments in 1912. The production of silver, copper, lead, and zinc in Missouri in 1911 is shown in the following table:

PRODUCTION OF SILVER AND COPPER IN MISSOURI, 1910-11

Year.	Copper.		Silver.		Lead concentrate, silver bearing:
	Quantity, lb.	Value	Quantity, fine oz.	Value	short tons.
1910	94,452	$11,955	33,096	$17,872	35,002
1911	640,411	80,051	49,867	26,430	51,109

In the foregoing tables showing the crude (or 'dirt') and concentrate from Missouri the ores of different nature have been segregated. For instance, the disseminated lead ore of southeast Missouri differs radically from the lead and zinc ores of the so-called 'soft ground' deposits of southwest Missouri, and these in turn differ from the 'sheet ground' deposits of the same region. Each class of ore has its peculiar problems of mining and ore dressing. This fact makes desirable the separate treatment of the statistical data. Generally speaking, the tables reflect closely the conditions of the industry.

Silver in Peru

It is reported in the *West Coast Leader* that the company operating the Caylloma mine, in Peru, has been reorganized under the name of Sociedad Explotadora de Caylloma Consolidada, with a capital of £100,000 in shares of 5s. each. Reports from the mine are to the effect that on the No. 5 level a vein 20 in. wide and assaying 396 oz. silver per ton has been discovered. The electric driven pumps on the sixth level have given such satisfaction that two more have been ordered. A deep drainage adit 2600 metres long is now being driven to cut the vein on the eighth level. Progress in driving is at the rate of 28 metres per month, and it is expected to increase it to 40 metres per month soon by the use of larger air drills.

NEW CONSTRUCTION at South African mines is rather extensive just at present. Orders will soon be placed for large additions to the concentrating plant of the Messina copper mine and to the plant of the Transvaal Coal Trust, Ltd. A new plant to handle pyritic ore will be built at the Mali Dyke gold mine, in the Pilgrim's Rest district, and additions and alterations will be made to the cyanide plant of the Benoni Consolidated, while at the Mystery mine, in Rhodesia, a complete new plant will be built. A mill of a capacity of 15,000 tons per month will be built at the Cam and Motor mines. The plant of the Sabi mine will be enlarged, as will that of the Cinderella, and the purchase of a small mill for the Rhodesia Gold Mining & Investment Co. is under consideration.

Book Reviews

Any of the books noticed in this column are for sale by, or can be procured from, the MINING AND SCIENTIFIC PRESS.

BUSINESS LAW FOR BUSINESS MEN, STATE OF CALIFORNIA. By A. J. Bledsoe. Business Law Pub. Co., San Francisco, 1912. For sale by *Mining and Scientific Press.* Price $4.75.

This is the fourth in a series of manuals by the same author and covering the business laws of Oregon, Washington, and New York. The books are designed, not to do away with the lawyer, but to give to the intelligent business man that general knowledge of the law which will enable him to avoid many troubles. It starts with 'Business Contracts and Legal Obligations' covering a wide variety of topics from accident insurance to wholesalers' agents. Following this are chapters devoted to: Collection of Bills and Accounts; Notes and Mortgages; Attachments, Judgments, and Executions; Last Wills; Corporations in California; Bank Laws of California; Mines and Mining; Water and Water Rights; Administration of Estates of Deceased Persons; United States Bankrupt Laws; Automobile Law of California; Taxes and Tax Titles; Trust Deeds; Assignment of Contracts, Guarantee of Accounts, and Powers of Attorney. The book contains a particularly complete table of contents, but no index. It is highly commended by the judges of the California supreme court.

REINFORCED CONCRETE BUILDINGS. By Ernest L. Ransome and Alexis Saurbey. McGraw-Hill Book Co., New York. Pp. 235. Index. For sale by the *Mining and Scientific Press.* Price $2.50.

The large number of competing methods for reinforced concrete construction that have come into vogue during the past few years have resulted in a great deal of confusion in the minds of possible users. Mr. Saurbrey presents a history of the development of the use of reinforced concrete since its inception, together with an analysis of the basic patents, which in itself will be of great value to all engineers who desire to possess a thorough understanding of the subject. The rational design of reinforced concrete buildings is extensively discussed, and is treated under the subdivisions of adhesion, compression, and lateral expansion, bending, transverse stresses, applications to the bending theory, initial and allowable stresses. Practical construction is also treated at length, the first subdivision including materials of construction, floor estimates, foundations, finishing operations, fireproofing, and various repairs to existing buildings, accidents, superintendent's specifications, and the theory of beams. The theory and application throughout is comprehensively treated. The book contains many tables and illustrations.

THE EXAMINATION OF PROSPECTS. By C. Godfrey Gunther. Pp. 222, ill., index. Pocket size, flexible cover. McGraw-Hill Book Co., New York, 1912. For sale by the *Mining and Scientific Press.* Price $2.

This book is designed to assist the engineer in the selection of prospects worthy of purchase or development. It does not cover the general subject of mine examinations, though in the first chapter pertinent suggestions as to the essentials of such examinations are made. The main part of the book is concerned with the geology of ore deposits, excluding iron and the non-metallic minerals. Properly enough, the greatest attention is devoted to the structural features of ores, followed by chapters discussing primary and secondary ores and the criteria for their recognition, the forms of ore-shoots, and the characteristics of outcrops. The material has been carefully compiled, well sifted, and is well illustrated. The criticisms of the author are well put and valuable. While the book will not do away with the need for a thorough grounding and continuous study of the literature of ore deposition, it is much the best thing of its kind yet written and should do much to cultivate a sound discrimination in the selection of prospects.

Decisions Relating to Mining

Specially reported for the Mining and Scientific Press.

Trespass on Lessee's Rights—Damages

A lessee, who has the exclusive right to conduct mining operations upon a tract of land for a stated period, cannot recover more than nominal damages from one who has wrongfully removed a part of the mineral, where it appears that the lessee would not, within the life of his lease, have reached the mineral so wrongfully taken.

Chappel *v.* Foster, (Kansas) 123 Pacific, 870. May 11, 1912.

Patent Entry Canceled Because of Unexplained Delay

An applicant for patent to a mining claim must proceed with diligence to complete his patent proceedings; and where he has not prosecuted his case to entry until more than three years after the completion of the publication of notice, and no satisfactory reason is given for the delay, the entry should be canceled. While a mineral entry allowed on insufficient showing of title in the applicant may be permitted to stand where the applicant subsequently acquires the complete title, he will not be allowed additional time in which to secure outstanding interests or to institute forfeiture proceedings against a non-contributing co-owner, where there has already been an unexplained delay of more than three years between publication of notice of the application of patent and completion of entry.

L. L. Squires *et al.*, (Land Department) 40 Land Decisions, 542. January 25, 1912.

Oil Lands—Rights of Co-tenants.

The holder of an undivided interest in oil land can extract oil therefrom without his co-tenants concurring or participating. In case oil was not found he would have to bear the loss of his experiment and cannot call on a non-participating co-tenant for contribution. But if oil is found and marketed, the co-tenant requiring the working tenant to account to him for his interest in the product, measured by his interest in the land, must allow his proportion of the necessary cost of producing and marketing the product. This reasonable expense would include the cost of machinery and appliances and other means necessary to production. In other words, all reasonable expenses incurred in the production and marketing would have to be deducted from the gross value before a division of the proceeds between the co-tenants.

Burnham *v.* Hardy Oil Co., (Texas) 147 Southwestern, 330. May 8, 1912.

Coal Lease—What Are Not Grounds of Forfeiture

A lessor of a coal mine was held not entitled to declare a forfeiture of the lease because of the payment of insufficient royalties, where the lessee had made an error in his calculation of weights, but had paid each instalment in good faith and in belief that it was paid in full, and it was so accepted by the lessor at the time of payment, provided the lessee is solvent and willing to pay the amount of any shortage found by the court. A covenant against sub-leasing, when relied upon as grounds for forfeiture, will be strictly construed by the court, and where possession of the mine was surrendered by the lessee to another company under a working contract, such contract will not be construed as an assignment entitling the lessor to declare the lease forfeited. Nor can a forfeiture be sustained for improper development of the property where the lessee acted in good faith, and the proper manner of development was largely a matter of judgment.

St. Louis Union Trust Co. *v.* Galloway Coal Co., (Alabama) 193 Federal, 106. December 2, 1911.

Concentrates

Most of these are in reply to questions received by mail. Our readers are invited to ask questions and give information dealing with the practice of mining, milling, and smelting.

QUICKSILVER is consumed mainly in the manufacture of fulminate for explosive caps, of vermilion, of drugs, of electric lighting apparatus, of scientific apparatus, and in metallurgy in the recovery of gold and silver (principally gold) by amalgamation.

BARITE is sold ordinarily in the crude state to mills. In the latter it is washed to free it from iron stains, then ground and treated with sulphuric acid. The principal production comes from Missouri and the crude material sells for $2 to $4 per ton at the mine. After it has been treated in the mill it sells for $10 to $12 per ton. Higher prices are paid for the finest products, such as 'extra ground and floated.' The market is mainly in the East.

ANTIMONIAL tailing presents much difficulty in cyanidation and the following are the chief points to be watched. (*a*) The strength of the working solutions so that the selective action of the gold will be at a maximum while the solution of the sulphide of antimony is at a minimum, also the consumption of cyanide; (*b*) the amount of protective alkalinity present; this must be such that the consumption of cyanide is kept down; yet it must not be too pronounced, as in that case the solution may dissolve the sulphide of antimony and refuse to take up the gold present; (*c*) treating the precipitate, which always contains more or less antimony in metallic form; (*d*) the final production of clean gold.

MACHINE-DRILL footage at the Ready Bullion mine of the Alaska United varies but little according to the character of the work. During the year 1911 the average footage drilled in the mine per 8-hr. shift was 34.18. In stoping 32.71 ft. was drilled per shift, 34.91 ft. in cutting out, and 35.57 ft. in development. The tonnage broken varies greatly, however, amounting to 57.7 tons per shift in stoping, 16.94 in cutting out, and 8.64 in development. The tons broken per foot drilled amounted to 1.764 in stoping, 0.485 in cutting out, and 0.242 tons in development. The average, found by dividing the total footage for the year by the total tonnage, was 0.95 ton per foot drilled. The average cost per shift was $8.59 for labor, $2.88 for explosives, and $5.38 for supplies, power, etc.; a total of $16.85. The average cost per foot drilled was 49.2c., or 51.8c. per ton broken.

WORK existing upon claims when located cannot be entered, except by fraud; for the applicant must make oath that work entered was performed by himself or grantors. Where the claimant re-locates his claim to prevent others from locating it through his failure to do the annual labor, it is believed, though there is no decision or ruling on that point, that he has lost all prior work for patent purpose. It may be said in favor of the claimant, when making his patent application, that he has actually performed the work he reports, and if there has been no intervening location, and his re-location being more a nominal location, his rights date back to the first location on the principle of resuming work. Against him is the $500 expenditure implying that the work must be done on the location entered for patent, and not under a former location; also, that he should be penalized for trying to avoid annual labor by losing for patent purposes the work which he re-located. If the forfeiting owner has the right to relocate his own ground just as a stranger would have, as the court held in one case reported, then he should have no patent rights to his old work, just as a stranger would not. At any rate, the claimant should resume work on his forfeitable location instead of re-locating; he should make amended locations instead of re-locations, whenever defects or changes of location are to be adjusted.

Recent Publications

REPORT OF INSPECTOR OF MINES OF KENTUCKY, 1910. By C. J. Norwood. Pp. 379. Index, tables. Lexington, Kentucky, 1912.

COALS OF THE REGION DRAINED BY THE QUICKSAND CREEKS. By F. Julius Fohs. Kentucky Geol. Surv. Bull. No. 18, Serial No. 25. Pp. 79. Index, tables, maps. Lexington, Kentucky, 1912.

NOTES ON MINING IN SEWARD PENINSULA, ALASKA. By Philip S. Smith. Advance chapter from Bulletin 520, 'Mineral Resources of Alaska, 1911.' U. S. Geol. Surv. Bull. 520-M. Pp. 8. Washington, 1912.

QUICKSILVER IN 1911. PRODUCTION AND RESOURCES. By H. D. McCaskey. Advance chapter from 'Mineral Resources of the United States, Calendar Year 1911.' U. S. Geol. Surv. Pp. 35. Index, tables. Washington, 1912.

THE TURQUOISE COPPER-MINING DISTRICT, ARIZONA. By F. L. Ransome. Advance chaper from Bulletin 530, 'Contributions to Economic Geology, 1911, Part I.' U. S. Geol. Surv. Bull. 530-C. 12 pp.; maps, index. Washington, 1912.

PSEUDOSTRATIFICATION IN SANTA BARBARA COUNTY, CALIFORNIA. By George Davis Louderback. University of California Publications. Bulletin of the Department of Geology, Vol. 7, No. 2. 21-38 pp., plates 3-6. Berkeley, May 25, 1912.

THE POSTAL LAWS AND REGULATIONS PERTAINING TO THE SECOND CLASS OF MAIL MATTER. Form 3500. (Corrected to February 1, 1912.) Promulgated by authority of the Postmaster-General. 54 pp.; index. Washington, February, 1912.

THE EARTHQUAKES AT YAKUTAT BAY, ALASKA, IN SEPTEMBER, 1899. By Ralph S. Tarr and Lawrence Martin, with a preface by G. K. Gilbert. U. S. Geol. Surv. Professional Paper 69. Pp. 130. Index, maps, ill. Washington, 1912.

A COLORIMETER FOR RAPID WORK WITH WIDELY VARYING STANDARDS. By Charles H. White. Reprinted from the *Journal* of the American Chemical Society, Vol. XXXIV, No. 5. 4 pp.; ill. Harvard University, Cambridge, May 1912.

GOLD AND SILVER IN IDAHO. By J. B. Umpleby, F. C. Calkins, and E. L. Jones. Advance chapter from Bulletin 530, 'Contributions to Economic Geology, 1911. Part I.' U. S. Geol. Surv. Bull. 530-G. Pp. 23. Index, map, ill. Washington, 1912.

ZIRCONIFEROUS SANDSTONE NEAR ASHLAND, VIRGINIA. By Thomas L. Watson and Frank L. Hess. Advance chapter from Bull. 530, 'Contributions to Economic Geology, 1911, Part I.' U. S. Geol. Surv. Bull. 530-P. 9 pp.; tables, index. Washington, 1912.

NOTES ON THE NORTHERN LA SAL MOUNTAINS, GRAND COUNTY, UTAH. By J. M. Hill. Advance chapter from Bulletin 530, 'Contributions to Economic Geology, 1911, Part I.' U. S. Geol. Surv. Bull. 530-M. 22 pp.; ill., index. Washington, 1912.

NOTES ON THE CLAYS OF DELAWARE. By G. C. Martin. CLAY IN THE PORTLAND REGION, MAINE. By F. J. Katz. Advance chapter from Bulletin 530, 'Contributions to Economic Geology, 1911, Part I.' U. S. Geol. Surv. Bull. 530-I. 24 pp.; ill., maps, index. Washington, 1912.

GRAPHITE NEAR RATON, NEW MEXICO. By W. T. Lee. MICA IN IDAHO, NEW MEXICO, AND COLORADO. By D. B. Sterrett. Advance chapter from Bulletin 530, 'Contributions to Economic Geology, 1911, Part I.' U. S. Geol. Surv. Bull. 530-L. 22 pp.; ill., index. Washington, 1912.

SULPHUR, PYRITE, AND SULPHURIC ACID IN 1911. By W. C. Phalen. With Notes on the Manufacture of Sulphuric Acid from Smelter Fume at Ducktown, Tennessee. By F. B. Laney. Advance chapter from 'Mineral Resources of the U. S., 1911.' U. S. Geol. Surv. 30 pp.; tables. Washington, 1912.

Commercial Paragraphs

The Ophir Consolidated Mining Co., Ophir, Utah, will make additions to its electrical equipment consisting of one 50, three 35, and one 15-hp. motors and three 50-kw. transformers. This apparatus will be supplied by the GENERAL ELECTRIC CO. The Homestake Mining Co., Lead, South Dakota, will add five motors to the electrical equipment in its mines. These consist of one 10, two 15, and two 25-hp. motors, and will also be furnished by the GENERAL ELECTRIC COMPANY.

THE TRAYLOR ENGINEERING CO., Allentown, Pa., reports that business is good, and that some of the orders recently received are as follows: Three sets of 'AA' extra heavy 42 by 16-in. crushing rolls for the Miami Copper Co., two sets of 36 by 16-in., and one set of 30 by 16-in. heavy-duty rolls for the Ophir Hill Con. M. Co., a re-grinding plant for the United States mint, New York City, consisting of crusher, 6-ft. Chilean mill, driers, etc.; 18 water jackets constructed of American ingot iron for the Garfield Smelting Co.; one heavy-duty jaw-crusher for the Nelson Contracting Co.; 32 water jackets for the Mason Valley mines Co.; a complete set of furnace jackets for the U. S. Smelting Co. constructed of American ingot iron; a set of 18 by 10-in. heavy-duty rolls for the Ridgeview Sand Co.; a special fine jaw crusher for the Bedford Feldspar Co.; a set of water jackets for the Ducktown Copper Co.; 35 water jackets for Phelps, Dodge & Co.; a complete 200-ton amalgamating, concentrating, and crushing plant for the McIntyre Porcupine Mines Co.; a No. 7 ½-in. gyratory crusher for the U. S. Gypsum Co.; and many small orders.

The O'Kelly safety hook manufactured by J. G. O'KELLY Co., Chicago, differs from others in that the load is carried from two points instead of one. The link or clevis not only keeps the load from slipping off, and the hook from straightening out, but supports one-half the load in conjunction with one leg of the hook. The other half of the load is carried by the flat-sided pin through the other leg of the hook. A slot in the upper end of the hook part of the device, with an enlarged or full circular portion at the bottom, admits the hook being raised, and then swung about the flat-sided pin as a centre. It will swing only when the pin is in the enlarged portion of the slot, consequently, after it is opened, the hook must swing into position before it will drop and engage with its two points of support. All forces act in direct lines and there is no possibility of the hook binding. The centre of the load is in line with the centre line of the hook, therefore the hook must close and lock the instant any load is applied. Conversely, the hook cannot be opened until the load is released.

The great importance of non-return boiler stop valves for use on a battery of boilers is universally acknowledged, and in some countries their installation is compulsory. It is evident that should a tube be blown out or a fitting be ruptured in one of the boilers of a battery, the steam from the other boilers would rush into the header and discharge into the disabled one. An ordinary stop valve would here be inadequate, as considerable time would necessarily be consumed in reaching and closing the valve, and a certain amount of danger must be anticipated. The non-return safety boiler stop valve manufactured by THE LUNKENHEIMER CO., Cincinnati, Ohio, has been given very severe tests, and is in use in a large number of high-pressure power plants, in all cases giving perfect satisfaction. When these valves are used, should an accident occur, such as the blowing out of a tube in the boiler or any rupture of the headers, shells, etc., permitting the steam to escape, the valve will immediately close. The plant can be operated with the other boiler or boilers, without interference, thereby preventing the closing of same and the loss of time and money. This valve will prevent steam from being turned into a boiler which has been cut out for cleaning or repairs, as it cannot be opened by hand when pressure is on the header side. It can, however, be closed when desired. The valve can be connected either horizontally or vertically.

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EDITORIAL

FOREIGNERS are returning to Mexico and south-bound trains and steamers are now well loaded. This is an excellent sign, as the men going back are those who know Mexico well.

WESTERN metal mining is to receive serious consideration at the hands of the United States Bureau of Mines if the recommendations of the Senate committee stand. Amendments to the Sundry Civil bill made in the committee provide the $100,000 recommended by the secretary for investigation of technical problems relating to metal mining, and also make ample provision for mine inspection in Alaska. It is to be hoped that the conference committee will allow these items to stand.

PROTEST against change is to be expected, and the metallurgists who have been introducing stage crushing, filter-pressing, and other new features in Rand practice have criticism to meet as well as praise. We republish this week an article by Mr. H. Stadler, printed first in the *Rand Daily Mail,* in which exception is taken to the principles advocated and claims for results on behalf of the metallurgists of the new school. We print this because it is interesting and the best statement we have seen of the position of those who cling to the old practice, and because the author feels that he has not had a fair opportunity to present his case before his local audience. Without entering into the merits of this contention, we are glad to give the material to our readers. To metallurgists away from the Rand the essential question is whether or not the newly introduced methods do actually yield better results. At the proper time we shall hope to have something to say as to this.

CONVERTERS for the treatment of copper matte were first made of a shape similar to the bessemer converter, and the persistence of association of ideas of the two operations is so strong that reference is still made to the 'bessemerizing' of matte, though the action in the copper converter bears little resemblance to the converting of steel, beyond the fact that both are produced by blowing air through a molten mass. In the early converters the tuyeres were placed some distance above the bottom, with the idea of keeping them above the level of the copper formed in the operation. At the Copper Queen this plan was varied by making the longer axis of the converter horizontal, placing the tuyeres in a row on the near side, and by tilting the converter the incoming air was kept above the copper. Both types proved successful, and a semi-geographical distribution of form developed; the plants in the Southwest using the horizontal or Bisbee type, while in the Northwest the vertical or Anaconda form was preferred. Changes in practice have eliminated some of the early considerations, and the present-day converter foreman finds it difficult to believe that the preventing of the blowing charge from getting too cold was ever a problem. At Great Falls the upright type has evolved into a converter 12 feet in diameter and about 15 feet high, using

air at 12 pounds pressure, as compared with the 5½ pounds of the early Bisbee form. The deeper column of matte and higher blast pressure is more effective to produce rapid oxidation, the circular cross-section gives much more effective support to the lining, and is more convenient to reline. Mr. E. D. Peters some time since prophesied an eventual return to the upright form of converter, and the recently announced intention to adopt the Anaconda form for new construction at Cananea, where the Bisbee type has been in use, is strong evidence of fulfillment of the prophecy.

California Miners Association

The California Miners Association is to be resuscitated. For many years this organization spoke authoritatively for the miners and mining industry of California and wielded a powerful influence. Through a series of county locals, it kept in touch with every part of the state and, with thoughtfully planned and carefully executed campaigns, it brought to bear upon the State Legislature and upon Congress the force of informed public opinion in mining matters. The Association was organized primarily to help the hydraulic miners in their contest with the farmers. Its most important single achievement was the securing of the passage of the Caminetti bill through which it was hoped that the revival of hydraulicking would be made possible. That no such result followed does not detract from the credit due the Association in framing and securing the law. Its failure was in resting too easily upon well won laurels and allowing an effective fighting force to disintegrate until only a corporal's guard remained. The Association, however, made clear the fact that the mining industry can be organized on a democratic basis, and that when that is accomplished the opinion of the miners will command respect both at home and abroad. Mining men, if they will but settle their differences among themselves, can have anything in reason that they are minded to ask of Congress or the legislature of any Western state. They must, however, take into account the whole industry, and their opinion, when expressed, must be honest and reasonable. Facts are the most potent of arguments and an organization that can marshal facts will accomplish much.

To achieve results of moment any such movement must be non-partisan and non-political. Whether a Democrat or a Republican be in the presidential chair is of less importance to most mining men than is the question of what constitutes the discovery necessary to legal location of a claim. Just what form conservation legislation is to take, may well mean more to a California oil man than the exact amount of the tariff on wool. Mining men should get together and make their influence felt, but they should recognize that to do so requires a spirit of conciliation within, as well as without their ranks. The fact that the old California Miners Association did actually accomplish results, affords the best omen for the new movement.

The immediate occasion for again calling the Association together is the need for preparing for the Panama-Pacific Exposition. It is elemental that an exposition in San Francisco must excel in mines and mining, whatever may happen to other departments. It was the gold and silver of the Incas that first created a traffic across the Isthmus. It was gold that brought people to California and established industry on the Pacific Coast. California was known first and is known best as the Golden State, and if ever mining, and especially gold mining, is to be prominent in an exposition, it must be in 1915. It happens that gold mining is a non-competitive industry. The owner of a gold mine has nothing personal to gain by advertising his wares. What he gives to an exposition in the line of time, money, or material, he must give for the benefit of all, to promote general education, and with the hope of indirect gain only. It is therefore vital that the fullest coöperation of the mining men be secured if a successful exhibit is to be prepared, and anything less would be a reflection on the great primal industry of the West. In all this California does not stand alone. Nevada, Arizona, Utah, all the Western States, need development. They need more mines and they will benefit from stimulation of the mining industry. In each, as in California, there is little personal and direct interest in preparing an exhibit. Having all this in view, it is proposed to call a meeting of the Association sometime in November and to invite to it delegates from outside as well as inside the state. The first business will be to effect that coöperation with officials of the Panama-Pacific Exposition that will assure making the mining exhibit at San Francisco in 1915, not the largest, but the best exposition of mining ever brought together. That being accomplished, it is probable that the convention will turn its attention to other problems since many of the more acute are sure to come up for consideration. A call for the meeting is being formulated and will be issued in a few weeks. The matter is in the hands of a committee consisting of Messrs. Charles G. Yale, E. B. Braden, and W. C. Ralston, and the project is sure to be pushed vigorously and effectively.

Copper Prices and Surplus

Copper led the market in New York last week so far as public interest was concerned. The followers of the metal market in America have no way of speculating in the metal. In London speculators can traffic in copper warrants in much the same way as traders in this country can deal in grain and cotton. This fact makes London the speculative centre for metals, and when the sensational break occurred in the copper metal market last week, it made its appearance first in London. On Tuesday there was a drop of some £3 per ton, and later in the week quotations on this side went down from 17¾, to 16½ bid, 17 asked. The copper share list reflects the attitude of the public in that it has been much more sensitive on the decline than it has been on the advance in the metal. It was a foregone conclusion that any break in the market would be accompanied by rumors concerning hidden stocks of copper. This story has been put out in so many different forms and in each so strenuously denied, that in order to make the denial good the real explanation had to be brought to the surface. It is true that there has been no mention made in the general press of the requirements of the European governments for war purposes, but there are now appearing tacit admissions of the piling up of blister copper at the refineries in unknown quantities. In a way it may be accepted without argument that this does not constitute a hidden stock of copper, but it does constitute a factor unknown so far as the consumer and the general public is concerned, and it does give to those who are in position to obtain inventories from the smelters a very great advantage. The consumers, especially on this side of the water, have for the past two or three years counted upon the production from the 'porphyries' as a very important element and one that would hold the price of copper within reasonable bounds. It is true that blister copper cannot be counted as a part of the world's visible supply, but the consumer will certainly remain unwilling to fill up his stock-yard at 16 cents or better, so long as there is a possibility of the refiners rushing an accumulation of blister copper into the market immediately after and disposing of it across the water at 13 cents or even lower, as was done two years ago.

Much is being made of the labor conditions at Perth Amboy, but these conditions are hardly sufficient to account for the discrepancy between mine and refinery output. In reality the copper metal situation is in the hands of a small circle of producers, smelter men, and refiners, and it is true that there is nothing to compel the producers to market their product any faster than they see fit, or to manufacture the raw material except as they deem to their own best interest; but the present move is the result of a huge manipulation which has not been carried to a successful completion. In some quarters the attempt is made to estimate the amount of blister copper withheld at the refineries, and 100,000,000 pounds has been published as the total. In fact it would be almost impossible to compute this correctly except by actual inventory at the various plants. It would not be very difficult to arrive at a conclusion by comparing refinery output with mine output if it were possible to secure a definite starting point. Inventories carry no meaning except as compared with previous inventories and in this case no previous inventory exists. If the tape tells the story, and that it does is one of the principal tenets of faith in Wall Street, the copper situation is not so rosy as most of the selling agents endeavor to make it appear. It is a significant fact that a great many of the leading copper shares are selling lower now than they did two years ago when the metal was selling for 12½ cents per pound.

The July figures of the Copper Producers Association showed a decrease of 5,280,638 pounds in accumulated stocks, the copper surplus being 44,335,000 pounds, something less than 14 days output at the present rate of production. While absolutely no suspicion attaches to the figures given out by the Association, it is plain that market followers do not consider these figures as covering the real position of the metal. A great deal is said about the increased foreign demand for copper. As a matter of fact, the increase in exports has been almost entirely due to the needs of Germany, and the German situation is very far from satisfactory. Industrially the country is very much over-extended, and that Berlin finances are in a delicate condition is widely whispered among international bankers. The real salvation for copper lies in the resumption of constructive activity at home—the building of much needed hydro-electric power plants, the electrification of railroad systems—and it is plain to everyone that the political situation and the business situation in this country are so interlocked that at present business interests are all playing politics.

Financing the Institute

Over a year ago the council of the American Institute of Mining Engineers proposed certain radical changes in the constitution and by-laws. Among these was a plan to increase dues of members. At the general meeting last February action on these amendments was deferred and a committee consisting of Messrs J. F. Kemp, C. R. Corning, George C. Stone, W. H. Nichols, Jr., and A. R. Ledoux, was appointed to investigate the affairs of the Institute and report whether an increase was necessary in order to maintain the standard of work already set and to make due provision for the future. The committee was charged with other duties, but for the present we are concerned only with the financial problem. The committee finds, in brief, that the Institute is living beyond its income and has been doing so for several years. The principal reason for this is the debt incurred when the Institute moved into its new quarters. It will be recalled that with practical unanimity the members voted to accept a share of Mr. Andrew Carnegie's gift of a building in New York, and assumed responsibility for payment of $180,000 of the money necessary to purchase the ground. Of this amount $105,700 has been paid and $6000 subscribed; the money having been given by only 90 of the 4000 or more members. It is worth noting also that members living in the West have made no contribution to this fund. In the main we, speaking for the membership at large, have accepted the large gifts of the few, and have made no contribution of our own. In order to pay the remaining portion of the debt and interest by January 21, 1925, which allows one year for contingencies, 12 annual payments of $7884.81 will be necessary. Having in view the fact that the annual income of the Institute is now from $50,000 to $60,000, this does not seem a large amount to set aside for such a series of years. In fact, however, the committee finds that the Institute is not only not providing for these payments, but is running behind $2000 per year on current expenses, and has already used $18,708.76 of the accumulated funds on hand when the change of headquarters was made. The remaining surplus January 1 was $4231.

The income for the year 1912 is estimated at $53,537. The principal items are: dues, $35,500; net advertising receipts, $5000; sale of publications, $4000. The remainder are made up of extra charge for binding, life memberships, initiation fees, interest, and minor items. It will be noted that the expected income from dues is much less than the total found by multiplying the number of members by the rate for dues. The reason is that a considerable number have purchased life memberships and others are perennially delinquent. As no separate fund has been kept to cover the receipts from life members, all such, and the delinquents, involve an annual expense on the part of the Institute. This is estimated by the committee at $3.50 per person. The expenditures for the year, including the annual payment for the land, are estimated at $64,741. The principal items are: printing and binding, $19,557; salaries and clerical assistance, $18,054; meetings and stenographer, $1000; freight and expressage, $4500; miscellaneous office expenses, $1515; library, $3850; building expense, $4500; interest, $2960; annual payment on land, $7500. Taking into account the surplus, this leaves a net estimated deficit January 1, 1913, of $11,204. Faced with these figures the committee had no alternative and made recommendations to the council and directors for economies which it is hoped will bring the expenditures down to the amount available for this year, whatever the Institute may decide to do as to the future.

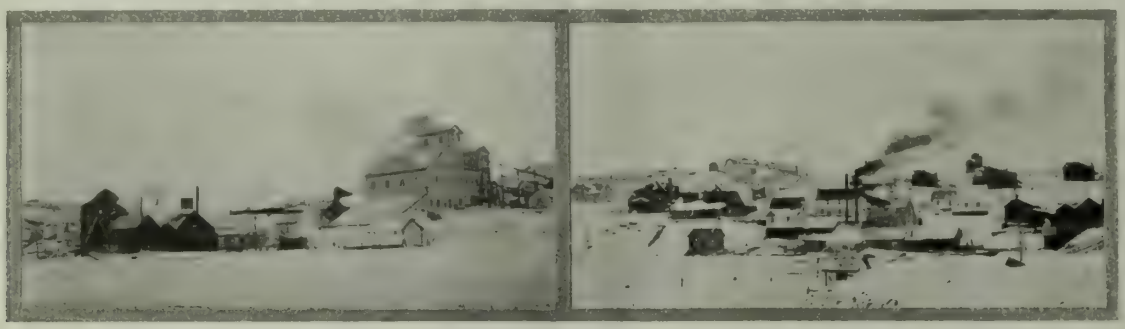
It is not to be taken from what has been said above, and the committee is careful to point this out, that the Institute as a business institution is insolvent. It has, in fact, property worth a half million dollars or more and an income which can be made to cover its necessary expenses. The United Engineering Building is a good investment. It not only affords admirable headquarters for the societies, but it dignifies the profession in the principal American city. When the land debt is cleared, the annual charge to the Institute will not be more than would need to be paid as rent for suitable quarters. It was expected that the land would be paid for by general subscription, and more than half the money has been so raised. Whatever may be the means adopted to secure the remainder, the total necessary, some $2 per member for a dozen years, is not large. In the meantime the Institute, as well as its members, faces the problem of increased cost of living. Some additional expense is inevitable from year to year. Other expenses, while extremely desirable, are optional, and where to draw the line is the problem for the Council and Directors. In making a wise decision the painstaking and candid report of the Committee of Five will be of the greatest assistance.

Silver Mining at Cobalt, Ontario

By Reginald E. Hore

Cobalt mining companies in 1911 had a very successful year, and the district made new high records for both silver produced and profits earned. The output was 31,507,791 oz. worth about $16,000,000. The profit made was over $9,000,000. Dividend paying companies distributed $8,620,558, and two privately-owned mines made large profits. At the end of 1911 the silver mining companies had paid in dividends a total of $30,391,095. The output for producing years 1904-1911 was 125,571,980 oz., valued at about $65,000,000, and yielding to the mine-owners a profit of about $35,000,000. A noteworthy feature of 1911 shipments was the falling off in the total tonnage, and increase in amount of concentrates and bullion. It is to be expected that the tonnage shipped will continue to decrease, while the proportion of concentrates and bullion will become greater. An important advance in metallurgical treatment is a process of amalgamation and cyanidation being used at the Nipissing mine for winning the silver from high-grade ore. It is stated that in modified form this process can be successfully applied to the treatment of low-grade ore, and a mill is now being constructed for the purpose. In 1910 there were 14 mills in operation at Cobalt, and two additional ones were built in 1911. The Nova Scotia mill was to treat ore brought by aerial tram from the Crown Reserve, Kerr Lake, and Drummond mines, but has been recently closed down.

In spite of the large production during 1911, there is probably as much ore developed as a year ago, and a large production for 1912 is assured. A number of rich ore-shoots were discovered during the year, and improved methods of treating low-grade ore make it possible to now include as reserves a large tonnage which was formerly of doubtful value. It must be kept in mind, of course, that each year's work leaves a very much smaller area to be prospected; but there is still a considerable area in which



COBALT LAKE AND NIPISSING MILLS. NIPISSING MINE.

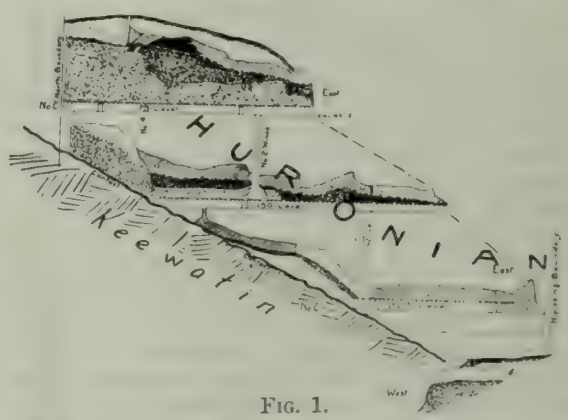


Fig. 1.

Table I. Silver Production, Cobalt Mines, 1904 to 1910

Year	Producing mines, No.	Shipments. Ore, tons	Shipments. Concentrate, tons	Shipments. Bullion, oz.	Silver contents. Ore, oz.	Silver contents. Concentrate, oz.	Silver contents. Bullion, oz.	Avg. silver cont., per ton. Ore, oz.	Avg. silver cont., per ton. Concentrate, oz.	Value of silver shipments. Ore	Value of silver shipments. Concentrate	Value of silver shipments. Bullion	Total value
1904	4	158	.....	.....	206,875	.....	.....	1,309	....	$111,887	.....	.....	$111,887
1905	16	2,144	.....	.....	2,451,356	.....	.....	1,143	....	1,360,503	.....	.....	1,360,503
1906	17	5,335	.....	.....	5,401,766	.....	.....	1,013	....	3,667,551	.....	.....	3,667,551
1907	28	14,788	.....	.....	10,023,311	.....	.....	677	....	6,155,391	.....	.....	6,155,391
1908	30	24,487	1,137	.....	18,022,480	1,415,395	.....	736	1,244	8,468,293	$665,085	.....	9,133,378
1909	31	27,729	2,948	.....	22,436,355	3,461,470	.....	809	1,174	10,809,872	1,651,704	.....	12,461,576
1910	41	27,437	6,845	980,633	22,581,714	7,082,834	980,633	821	1,030	11,360,489	3,590,098	$527,460	15,478,047
Total		...102,078	10,930	980,633	81,123,857	11,959,699	980,633	795	1,094	$41,933,986	$5,906,887	$527,460	$48,368,333

Table II. Concentration of Silver Ore, 1910

Name of mine.	Ore concentrated, tons.	Concentrate produced, tons.	Silver in concentrate, ounces.	Average silver in concentrate, per ton, ounces.	Ratio of concentration.
Buffalo	39,038	969.0	1,154,470	1,203	40 to 1
City of Cobalt	9,367	214.0	201,802	943	43 " 1
Coniagas	38,709	907.1	1,318,836	1,486	42 " 1
King Edward	8,805	152.7	87,549	573	62 " 1
La Rose	32,303	809.5	585,152	783	40 " 1
McKinley-Darragh	43,279	1,922.3	1,615,468	849	22 " 1
Nipissing	13,984	328.6	381,155	1,017	42 " 1
O'Brien	25,687	211.5	251,889	1,170	.....
Temiskaming	21,683	653.1	529,099	811	33 " 1
Trethewey	19,013	236.5	400,391	1,729	80 " 1
Standard Cobalt	22,426	310.0	141,458	473	74 " 1
Various other mines	31,275	300.0	317,471	1,058	104 " 1
Totals	305,569	7,014.3	7,084,740	Av., 1,030	Av., 43.5 to 1

it is reasonable to expect that some rich veins will be found. Aside from the rich ore there is certain to be mined a very large tonnage of low grade.

The accompanying table, No. I, from the report of T. W. Gibson, deputy minister of mines, gives the results obtained in the years 1904-1910, and brings out the rapid increase in production of concentrates in the past few years. The ore milled averaged about 30 oz. per ton. Table II, also from Mr. Gibson's report, shows the results obtained by concentration in 1910.

found, but there are apparently but few large faults. The nature of the smaller faults is indicated in Mr. Robbins' section of the McKinley-Darragh mine, Fig. 2. An interesting feature of recent explorations is the work being done along what is known as the 'big' or Cobalt Lake fault. This, the only great fault which has been disclosed in the mine workings, is a thrust dipping to the east at an angle of 62°. On either side there are minor thrust-faults dipping at low angles, and frequently displacing the veins for a few feet. The actual vertical displacement along the big

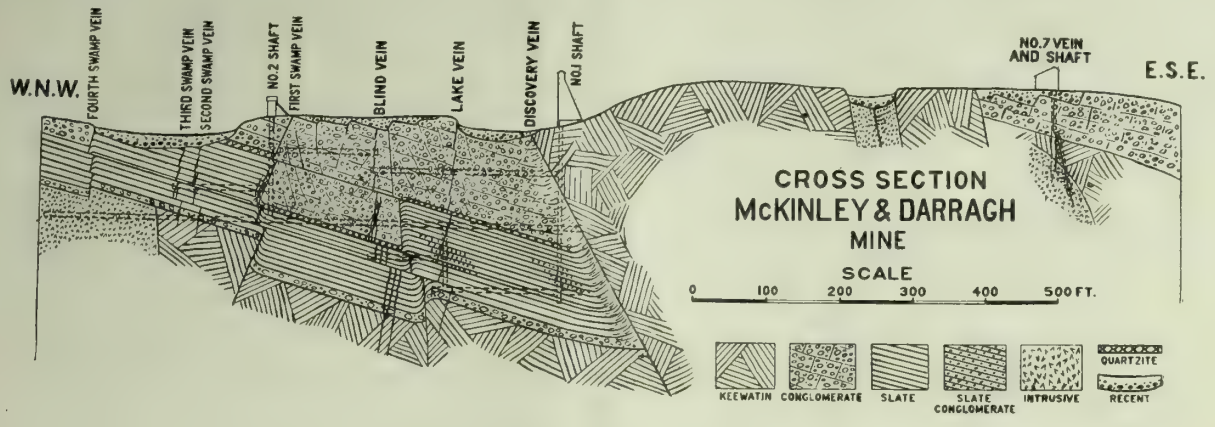


FIG. 2.

During the year preparations have been made for exploring at somewhat greater depth. There has been a remarkable disinclination so far to test some ground that seems not unlikely to contain ore at lower levels than the present workings. This delay is chiefly due no doubt to the fact that where the ore outcrops at the surface, the ore-shoots have generally failed at a depth of less than 200 ft. In most cases the decrease in value occurred near the bottom of the

fault is not known, but, as may be seen from Mr. Robbins' cross-section, Fig. 2, it is at least 300, probably 400, ft., and possibly much greater. From the cross-section it will be seen that at the McKinley-Darragh mine the ore-bodies are on the down-throw side, in Huronian sediments, and that there are no corresponding sediments remaining on the up-throw side. They have evidently been eroded. At the north end of the lake, however, what is probably the

BATTERY, NORTHERN CUSTOMS MILL.

HYDRAULIC PROSPECTING.

Huronian formation, and the underlying Keewatin has produced comparatively little. Since in nearly every case where the ore outcrops at surface, the Huronian is there comparatively thin, the mines so far are all shallow. In some cases rich ore is found in the underlying Keewatin, but the shoots are usually less regular.

The accompanying illustration, Fig. 1, showing the workings at the Coniagas mine, indicates the form of the ore-shoots in the case of deposits in Huronian sediments lying unconformably on the Keewatin complex. It has been found that the ore pitches down in a direction parallel to the contact. It outcrops in places where the conglomerate is thin and the shafts and most of the workings up to date are thus situated. The result of development indicates that deeper ore will be found farther from the outcrop. The deposits are being developed by a step-like series of drifts and winzes. The valuable deposits being chiefly in the Huronian, it is not likely that the ore-shoots will continue to great depths; but it is quite probable that some ore will be found a few hundred feet deeper than most of the present workings.

In most of the mines numerous small faults have been

same fault, shows Huronian sediments at the surface, on both up-throw and down-throw side. The ore deposits which have been worked here are on the up-throw side, and it is not unreasonable to expect that similar deposits occur at greater depth on the down-throw or western side.

At the La Rose mine a winze is now being sunk to investigate the possibilities at greater depth. The main shaft at the La Rose, after passing through about 150 ft. of Huronian conglomerate and quartzite and about 50 ft. of Keewatin schists, cuts into Huronian conglomerate again. This second conglomerate, while undoubtedly Huronian, differs from that at the surface. It is characterized by numerous pebbles of gray chert. The conditions at the La Rose mine are illustrated by Fig. 3, which is based on a section described by W. G. Miller and C. W. Knight,* of the Ontario Bureau of Mines, and my own notes. Mr. Knight states that the vertical displacement at the La Rose mine is 233 feet. Messrs. Miller and Knight† also studied the fault in the workings at Cobalt Lake, and found the structure to be similar to that at the McKinley-Darragh and La Rose

*Bulletin Canadian Mining Institute, Feb. 1912, pp. 21-26.
†*Eng. & Min. Jour.*, Sept. 30, 1911.

mines. According to A. A. Cole, the fault was also found in the early workings at the Right of Way mine. Where first found there are Huronian sediments on both up-throw and down-throw side; but one is a coarse conglomerate and the other a greywacke with but few pebbles. Of deposits in the Keewatin series the most extensively worked are

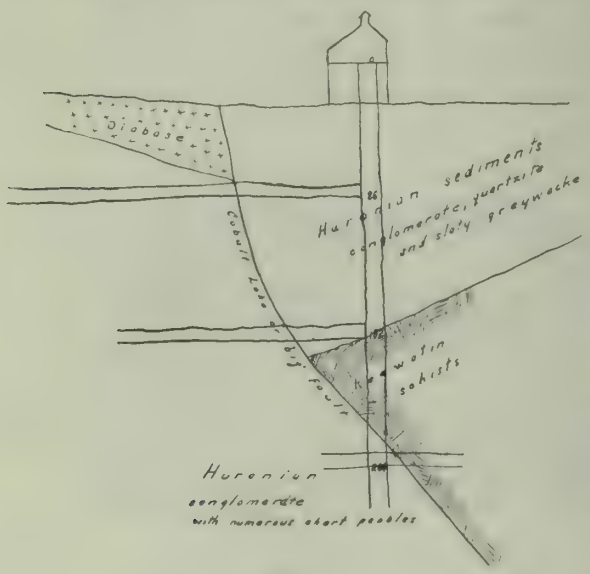


FIG. 3.

those at the Temiskaming mine. The accompanying maps, Fig. 4, showing stoping on No. 1 and No. 3 veins up to December 31, 1911, illustrate the mode of occurrence of ore-shoots. The Keewatin series in which the deposits occur has been penetrated in some of the workings and the underlying diabase has not yet proved productive here.

The veins at Cobalt are nearly vertical, only a few inches wide, and usually in hard firm rock. In mining the ore in the early days it was the practice to break only enough of the wall-rock to make it possible to take out the vein matter. The drifts and stopes were often made so as to leave the vein standing on one wall. The broken rock was cleared out and then the ore taken down by the aid of hand-picks. In this way a clean separation of vein matter from wall-rock was made in the mine. It was soon found that there are often several narrow veins running nearly parallel, and spaced only a few feet or a few inches apart. It then became necessary to break vein and rock at the same time. The high-grade ore then became intimately mixed with wall-rock, and it was necessary to pay more attention to sorting methods. The sorting was then done at the surface, on various types of tables and belts. The rich ore was picked out and the discard went on the dumps.

The material on these dumps was found to contain quantities of recoverable silver, and in 1908, the treatment of low-grade ore was first extensively undertaken. In most cases it was found that rock taken from a few feet in either side of a rich vein contains enough silver to make milling profitable. This silver is not commonly disseminated through the rock; but occurs in the narrow crevices.

The successful operation of the first mills led to the building of several others, and when these were running, the companies that had taken out high-grade ore broke large tonnages of low-grade from the old stopes. In mining new ground the companies owning mills revised their method so as to break both high-grade and low-grade ore at once, and improved the methods of ore-sorting so that the finely broken particles of rich ore would not be left with the low grade.

At the Nipissing mine the present practice in mining is to sink a vertical shaft on the lode and to develop ore at levels less than 100 ft. apart. Drifts are run following the vein, which is kept well within the face. The drifts are cut wide and high. On the Meyer vein the drifts are 12 ft. wide and 14 ft. high; a 5½-ft. cut being taken off with but one set-up. On most veins the drifts are 5½ to 6 ft. wide and 14 ft. high. In development work 2-man piston drills, and in stoping 1-man hammer drills, are used. In stoping, a filling system has been found satisfactory. The level is

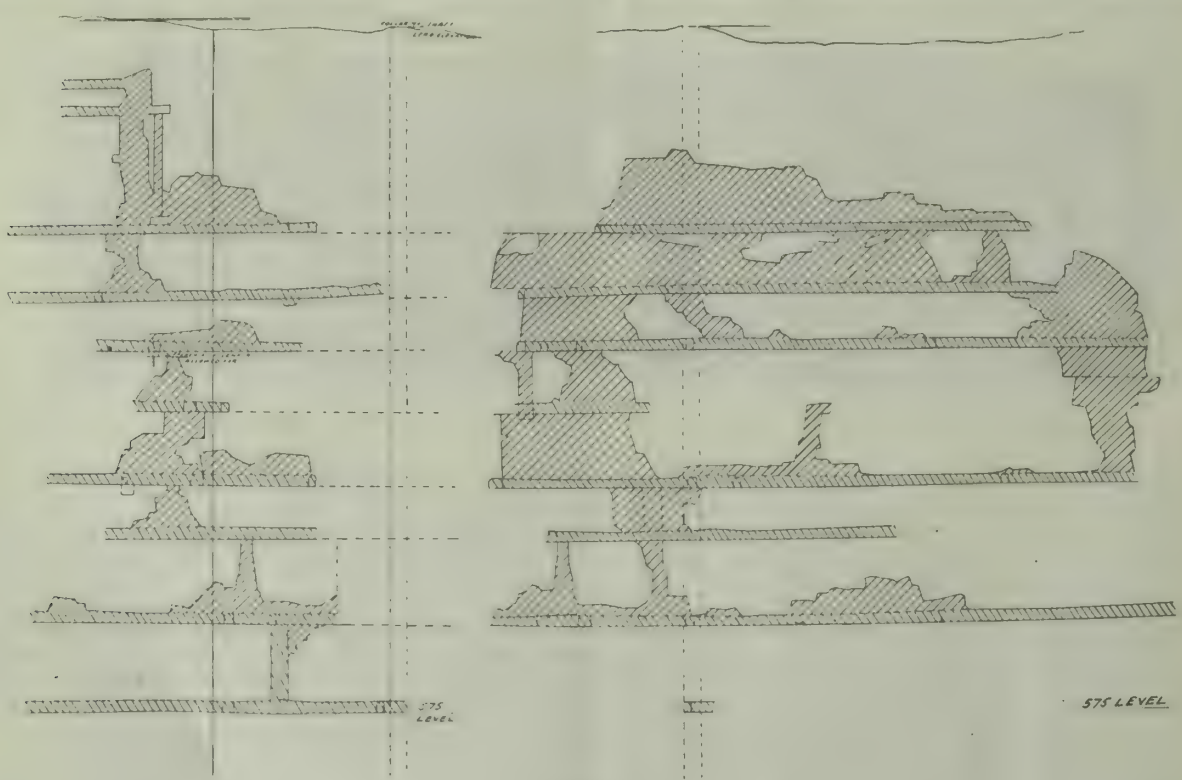


FIG. 4.

protected by a lagging of poles laid on caps supported by posts. At intervals of about 25 ft. chutes are built in for drawing off the ore. The ore is then broken down onto the timber, and enough is drawn off to leave the desired space for miners. The rock on both sides of the vein is broken, and there is no sorting whatever done in the stope. The ore

lies as it falls, and becomes intricately mixed before it reaches the surface. The conglomerate in which so great a part of the rich ore occurs, has a tendency to break into large pieces. These are 'buldozed' in the stope so as not to choke the 4-ft. chutes.

From the chutes the ore is run into small cars. These are trammed to the shaft, hoisted in the cage, and trammed to ore pocket or mill stockpile, according to the tag placed on them in the mine. From the pocket the ore is fed automatically to a table. It first, however, passes over a plate perforated with 1½-in. holes. The undersize goes to a trommel. From the trommel the fine goes to a Wilfley table and oversize to jigs. These jigs are of a type constructed especially for the ore by H. E. Kee, of the Nipissing mine, and are apparently very successful. All the ore which passes over the 1½-in. holes is washed by a sprinkler. The washings go through a screen to the Wilfley table. The ore passes to the table, where it is hand-picked by four or six men. The sorters pick out two grades—high and low grade—and the remainder goes into a chute, from which it is loaded into a car and taken to the mill-rock stockpile. Sand from the Wilfley tables passes into a simple dewaterer and slime is allowed to settle in tanks, the water being re-used.

Cyanidation of Pyritic Ore

By F. B. Reece

The cyanidation of concentrates and of ores of high sulphide content, has been described, and the difficulties attendant discussed, by J. W. Hutchinson, A. B. Parsons, Huntington Adams, and others.

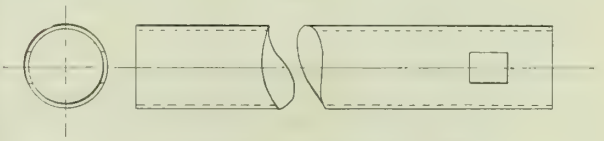
Some heavy sulphide ores which do not offer any special difficulties as regards excessive consumption of chemicals, and which yield a satisfactory extraction to cyanidation, give much trouble from a mechanical point of view. I was called upon to operate a plant, situated in a remote district, which had been designed and erected by others to treat an ore of this character, a mixture of arsenopyrite, pyrite, galena, and blende. The equipment consisted of stamps, tube-mills, cone-classifiers and thickeners, 'Brown' type agitators, and vacuum leaf-filters. Supplies and renewals took from four to six months from date of order to reach the mine. The valuable part of the ore was the sulphide, and to maintain the ore at a profitable grade it was necessary to sort it so that it contained from 20 to 25% of sulphides. Due to the necessity of using very soft local pebbles the regrinding was not as fine as is desirable for the proper agitation of such material. On an average 90% passed 200 mesh.

The supply of air for the four 27½ by 10-ft. tanks was inadequate. Allowing for the altitude, 7000 ft., it amounted to a total of 32 cu. ft. of free air per minute at 25 lb. maximum pressure. It was found impossible to do more than agitate two tanks at one time, and continuous agitation was out of the question until additional capacity in air could be provided. The design of the central agitation pipe was faulty. It was originally 16 inches in diameter and was far too large, and set so low that there was only a 3-in. annular space between the bottom of the pipe and sides of the cone of tank. This space would probably be too small to prevent choking while agitating a purely silicious slime, it was found to be quite inadequate for the material under discussion. After long and expensive delays and when two or three charges had been lost, the centre pipes were replaced by others of 11 in. diameter placed so that their lower ends were 22 in. from the apex of cone, giving a clearance of about 7 in. between pipe and side of cone.

Bernard MacDonald has drawn attention to the necessity of using the smallest air-lift tube consistent with the amount of liquid to be pumped. His opinions were certainly justified in this case. Smaller pipes than 11 in. would probably have been advantageous, but none were available.

Further, the suggestion put forward by Lloyd Kniffin of reducing the length of the central pipe, was carried out, leaving the pipe about two-thirds of its original length. These alterations caused a great improvement in the agitation. To assist in keeping the solid matter in agitation during the time of filling and emptying, two holes were cut in the lower part of centre pipe on opposite sides of pipe. The tendency to settle was much reduced by this simple expedient, and it was decided to cut two more holes about 8 or 9 ft. higher up, but unfortunately no opportunity was afforded for trying this experiment. The effect of these apertures on the circulation of pulp was very noticeable as the level of pulp gradually rose during filling of a tank. It is questionable if they are an advantage after the tank is in full agitation, but this could easily be overcome in the manner suggested by Mr. Adams at the Natividad mill, where sliding doors were fitted on the central air-lift tube and opened and closed as the level of pulp in tank varied.

Much trouble was experienced from the choking of the ¾-in. air-agitation pipes which had not been provided with non-return valves. These pipes were the only means that had been provided for agitation, the usual side and 'spider' pipes not having been supplied. It was impossible to install these during the time of running covered by this article. The only remedy was to remove, clean, and replace this pipe after every stoppage of the air supply. To force this down again into the mass of settled slime the end of pipe was closed and drawn out to a sharp point. Two sets of ⅛-in.



IMPROVED AGITATION PIPE.

holes were then drilled through the pipe, the lower set coming very close to the bottom of cone when the point of pipe rested on the apex, and the other set coming 3 in. above the intake of the central column.

Discharging the tanks to pulp-stock tank by gravity was a tedious process on account of the lack of means of efficiently agitating the charge to the last moment. The leaf-vacuum-filter employed gave poor results, as might have been expected in treating material of this weight. It was impossible to prevent segregation and dropping of the bottom and heavier portion of cake. The only kind of filter to use in a case like this is a pressure-filter, making cake very rapidly, and preferably one which has no excess slime to displace. The solution of the difficulty in a case like the foregoing would appear to be the employment of mechanically driven classifiers and thickeners, of continuous agitation, pressure-filters, and a plentiful supply of air to the agitation and pulp-stock tanks. I am convinced from personal experience at the Hacienda Guadalupe, Pachuca, that it is not necessary to use the 'diagonal' method of connecting the tanks in series recommended by Mr. Grothe and Mr. Kuryla. The overflow method used by Mr. Adams gives excellent results, with more simple construction.

The foregoing experience shows how necessary it is to carefully design agitation plants to deal with material containing more than say 6 or 8% of sulphides.

W. P. Lass* has described and illustrated a valuable device in the shape of an adjustable spider pipe, which can be lowered on top of a settled charge, to gradually bring it into a state of agitation. In agitating this heavy material, it is a great advantage to be able to remove the air pipes at will, as, despite all care that can be taken, choke-ups are not infrequent. Furthermore, a pipe which is in its correct position when the tank is in brisk agitation, may be quite unable to make headway against the depth of settled pulp which overlies it, when a tank has settled for more than a few minutes. It will be noticed in referring to the article by Mr. Lass that the central air-lift pipes are 10 inches in diameter for a 10-ft. diameter tank. Probably a still smaller pipe would be even more effective.

**Mining and Scientific Press*, Oct. 21, 1911.

The New Metallurgy

By H. Stadler

In some recently published oversea papers, certain critics took exception to the following paragraph contained in a recent contribution of mine.[1]

"In face of the fact that the New Kleinfontein mine, run on conservative lines, with single-stage crushing (according to the annual reports for 1910), still holds the record in reduction costs, against two of the largest progressive mines, I cannot help feeling that metallurgical business on the Rand has become too refined, and that from the introduction of the cyanide process to the present date very little, if any, real economical progress has been made."

As a contributor connected with the Crown Mines accuses me[2] of being apt to flounder in my broader inference, I have collected data so as to produce conclusive arguments in place of mere impressions. I am now ready to say definitely that practically all the metallurgical improvements introduced, and unduly boomed, during recent years have proved disastrous economic failures. The non-fulfillment of the promises made is one of the underlying causes of the steady fall in the value of the shares of our big mining companies.

In the report of the committee of inquiry on the facts connected with the recent reputed fall in ore yield and recovery of gold from the East Rand Proprietary Mines, Ltd., and the causes which occasioned the decline in the shares of that company, I miss a paragraph of about the following tenor:

"With inexcusable frivolity, immense sums were spent during recent years to remodel the old plants, and for their adaptation to the 'New Metallurgy,' which already had been proved to be based on utterly wrong premises. The only result of this expenditure was an increase in reduction costs of at least 1s. per ton, remembering that certain facts (such as cheaper power and larger tonnages handled), which are not peculiarities of the 'New Metallurgy' account, in themselves, for a considerable reduction. This shilling on 2,000,000 tons per year, capitalized at 10%, itself accounts for a depreciation of, say, £1,000,000 in the share valuation."

Fine Grinding and Extraction

In order to review the position five or six years ago (before the advent of tube-mills), I take the following representative figures from Table C of the paper by H. S. and G. A. Denny 'Rand Metallurgical Practice and Recent Innovations' given in Table I, below.

From these figures Messrs. Denny drew the logical conclusion that in order to get a total extraction of 95% (as far as these fields are concerned), it is theoretically unnecessary, and in any case uneconomical, to grind ore beyond the point at which 58% passes 100 mesh. In view of the lessened cost of plant, due to the possibility of quicker treatment of a 150-mesh product, they were rather inclined to think that all ore should pass 150 mesh, "as from an ore comminuted to this extent 95 to 96% extraction should be consistently obtained."

Instead of building upon this sound foundation of conscientious research-work and exhaustive data collected from test-runs on a practical mining scale, some Rand metallurgists, with the motto: 'The finer the crushing the better the extraction,' rushed unthinkingly into an extravagant ultra-fine grinding policy, without regard to economic or other important considerations. In the keen race to beat metallurgical records, they have quite overlooked the following factors:

1. The higher extraction claimed for finer grinding has, in consequence of mistaken deductions, been grossly exaggerated. In criticizing my methods of efficiency calculation,[3]

Table II

I.M.M. Mesh.	Residue Value on Grade per ton.	Stamp and Tube Mill Combination.		Single Stamp, 1,600 Mesh.	
		Weights.	Residue Value on Grades.	Weights.	Residue Value on Grade.
Per lin. in.	dwt.	%	dwt.	%	dwt.
+ 60	1·5	2·3	·0345	8·7	·1305
+ 90	0·7	9·8	·0686	16·5	·1155
+ 200	0·3	23·2	·0696	17·1	·0513
- 200	0·2	64·7	·1294	57·7	·1154
	Total ...	100%	·3021	100%	·4127
Total Extraction on 7·5 dwt. ore ...			96·0%		94·5%

[1] *Jour.* Chem., Met. & Min. Soc. of S. A., May 1911.
[2] *The Mining Magazine*, July 1911.
[3] *The Mining Magazine*, September 1911.

Table I

Mesh.	Weights.	Screen. Av. 10·869 dwt.		Final Pulp. Av. 4·867 dwt.		Residue. Av. 0·801 dwt.		Total Extractn. on each Grade.
		Ass. Val. p. Grade.	Individ. Extractn	Ass. Val. p. Grade.	Individ. Extractn.	Ass. Val. on Grade p. Ton.	Total Value on each Grade.	
Per lin. in.	p.c.	dwt.	p.c.	dwt.	p.c.	dwt.	dwt.	p.c.
+ 60	33·40	5·5	12·51	4·81	69·76	1·45	·484	73·54
100	17·20	10·0	53·66	4·63	84·40	0·72	·124	92·77
150	7·71	13·5	73·17	3·62	92·37	0·27	·021	97·95
+ 200	6·04	18·25	79·93	3·66	93·39	0·24	·015	98·67
- 200	35·65	14·50	62·03	5·55	92·04	0·44	·157	96·98
	100 p.c.	Extraction by Amalgam, 55·22 p.c.		Extraction by Cyanide. 37·38 p.c.			·801	
		Total Extraction, 92·6 p.c.						

A. Quartano, of El Oro, Mexico, again falls into the old blunder, already refuted, that the exposure of surface represents the 'metallurgical value' of crushing work done. There is not the least objection to adopting this standard, provided all other factors are reduced to this same unit, especially the assay value, which is taken by weight (or volume), and varies therefore at a much slower rate than the surface exposed. From the statement made by E. H. Johnson[4] that the stamp and tube-mill combination produces, for the given cases, 9.5% more surface than single stamps, the impression is produced, perhaps unintentionally, that the 'useful work' is increased in this same proportion. It follows, however, from data in Table II, that, on the assumption of average values for the various grades the higher extraction obtained in favor of the fine pulp is only 1.5%, or 5.4d. in a 7.5 dwt. ore. This amount is hardly sufficient to repay the higher costs of finer grinding.

2. One of the most important results of the research dork done by the Mines Trials Committee is, not the discoverey, but the realization, of the fact that any classifier with its overflow velocity well adjusted, acts as an efficient concentrator, in which the specifically heavier pyrite particles tend to be retained in the underflow. Roughly, it may be said that the assay values of the + 60 and + 90 grades in the overflow are halved, with a corresponding enrichment of the underflow. For instance, 10% of + 60 grade of such an overflow, assaying 2.5 dwt., yields just as good an extraction as a 5% overflow, assaying 5 dwt. Those experienced in panning know how easily the segregation of pyrite from quartz can be disturbed and upset by hasty and maladroit movements, and it is therefore not surprising that partly banked up and disturbed classifiers are complete failures as concentrators. The abandonment of the old proved spitzkasten in series, in favor of cones in sets, with or without the much-advertised diaphragm, is also an improvement of a retrograde kind.

3. With the very fine final pulps now generally in use, it is no longer reasonable to take the percentages left on the + 60 grade as a criterion for the fineness of pulps. Besides the inaccuracy of screen measurements (which may amount to 2% and over), it must be remembered that some of the particles left on the + 60 grade are of an exceptional flat or long shape, and more amenable to chemical treatment than a similar volume of spherical form; or they are specifically lighter materials, and of a nature quite different from the ore, since they carry neither pyrite nor gold.

4. The profit resulting from higher extraction by finer grinding is practically nullified by forfeiting the good effect which a higher percentage of extraction by amalgamation has on the total extraction. Crushing by impact in a mortar-box is much more adapted to free the pyrite and gold from the gangue, than the abrasive action of the tumbling contents of tube-mills, in which the particles are not broken up, but largely ground down by surface wear. The greater amenability to amalgamation of battery pulps is borne out by the fact that in Messrs. Denny's time, as well as now, an amalgam extraction of up to 70% was easily reached, while, where the mill plates have been discarded, this extraction has now dropped in most cases to 50% (South Randfontein Mines, 48.6%; East Rand, 50.11%). Besides the advantage of quick realization of profits, a high extraction by amalgamation has a far-reaching effect on total extraction, consequent on the lowering of gold contents left on the final pulp for cyanide treatment, where only 85 to 90% is recoverable under the best actual conditions. Assuming for argument's sake that it were possible to obtain an amalgam extraction of 90% from a low-grade ore, say 5 dwt., the low residue value (0.5 dwt.) would make the cyanide treatment altogether unnecessary. The argument which has been advanced that the free gold, not extracted by amalgam, is caught in the cyanide works, though borne out by assays of residues, is not conclusive. The maintenance of the accepted standard for residues, even with an enriched final pulp, is simply a matter of more or less thorough treatment and therefore of cost. The actual facts are, that neither the East Rand nor the Crown Mines, with all their up-to-date and costly methods of treatment, have succeeded in raising the percentage of extraction by cyaniding much above the level of 85%, which is easily obtained all over the Rand. The extraction of the East Rand in 1910 was 85.7%, and on the Crown Mines 88.3 per cent.

5. Metallurgical experts coming here from abroad should at once realize that, so far as these fields are concerned, grinding finer than the + 200 mesh is mere waste of energy and money. The reduction of the last few percentages of the + 60 grade by tube-milling cannot be done without the stern necessity of simultaneously grinding down the rest of the pulp. The greater amount of over-worked slime unnecessarily produced inevitably demands more perfect washing and dewatering equipment in the cyanide works, with consequent additional working costs and additional capital expenditure for the machinery required to perform this unnecessary work.

TABLE III.

GOLD RECOVERY PER TON. See Annual Reports, 1910.	SINGLE STAMP CRUSHING. New Kleinfontein Co. 1,200 mesh. Grading p.c.: + 60 18; + 90 22; + 200 14; − 200 46; 100. Output 1910: 466,882 tons. Estimated Ore Reserves: tons. dwt. 1,397,412 6·46			SINGLE STAMP CRUSHING. Meyer & Charlton, 1905. 400 Mesh. Grading p.c.: + 60 33; + 90 17; + 200 14; − 200 36; 100.			DOUBLE STAGE FINE GRINDING. East Rand Propr. Mines. Grading p.c.: + 60 3; + 90 10; + 200 23; − 200 64; 100. Output 1910: 2,126,334 tons. Estimated Ore Reserves: tons. dwt. 13,950,277 5·4			DOUBLE STAGE FINE GRINDING. Crown Mines (Regrinding by Double Stage Tube Milling). Grading p.c.: + 60 5; + 90 15; + 200 12; − 200 68; 100. Output 1910: 1,514,000 tons. Estimated Ore Reserves: tons. dwt. 6,282,719 7·6		
	dwt.	Recovered dwt.	p.c. of Extract p.c.	dwt.	Recovered dwt.	p.c. of Extract p.c.	dwt.	Recovered dwt.	p.c. of Extract p.c.	dwt.	Recovered dwt.	p.c. of Extract p.c.
Assay Value of Mill-Ore	7·063			10·869			7·008			8·37		
Amalgam Recovery	4·454	4·454	63·06	4·867	4.867	55·22	3·512	3·512	50·11	5·71	5·71	68·2
Assay Value of Final Pulp	2·609			6·002			3·496			2·66		
Cyanide Recovery	2·233	2·233	85·6	5·200	5·200	86·60	2·996	2·996	85·70	2·35	2·35	88·3
Assay Value of Residue	0·376	6·687		0·802	10·067		0·500	6·508		0·31	8·06	
Total Extraction			94·5			92·6			92·85			96·2

[4] *Jour.* Chem., Met. & Min. Soc. of S. A., July 1910.

Working Costs

Accounts and elaborate statistics, although admirably kept at all mines from a purely mathematical standpoint, fail entirely to give engineers any grasp of the true working costs of individual units of crushing equipment, or of the economic merits of innovations and improvements introduced. The variety of methods of accounting as practised on different mines, and the more or less arbitrary entries of expenses in accounts where they do not belong, make it practically impossible to get at really significant figures. For instance (during the transition stage in 1909), the books of one of the amalgamated mines of the East Rand show an amount of £2497 4s. 5d. under 'sundries', while at the same time another mine of about the same size is debited with only £12 3s. under the same heading. More significant detail and greater uniformity are desirable.

Mining expenses and development redemption are most variable factors in individual mining ventures. Their inclusion in the working costs brings a factor of great uncertainty into the statistics, rendering them useless for monthly comparison. Would it not be better (as is the practice in many other mining centres) to exclude mining and development expenses altogether from monthly statistics, and to keep separate suspense accounts for them, to be balanced up yearly or half-yearly? This method leaves the management a free hand for a more efficient disposition of underground work. One month is evidently too short a time for the apportioning of costs of underground work. Mining and development expenses are not items suitable for monthly discussions by shareholders. They should be considered in connection with the position of the mine in general, of reduction costs, grade of mill ore and ore reserves, and discussed at longer intervals on the basis of comprehensive interim reports issued by the Board. These reports should explain the actual position and outline the policy to be adopted in the near future.

Mining and development costs apart, the purely industrial reduction costs are fairly constant all over the Rand, depending exclusively on the economical efficiency of the reduction work and reduction management. There exists some diversity in the apportioning of the general charges, which in some mines are to a larger extent included in the various items of working costs, but the general result, which shows about 1s. per ton higher working costs for the 'progressive' mines, can be taken as fairly representing the true position.

Capital Expenditure

The ease with which money is forthcoming on the Rand for new innovations and inventions—if boomed enough—is no inducement to responsible engineers to pay any more respect to the reservoir of 'capital account' than that due to a waste-paper basket. At one time, however, W. A. Caldecott was very anxious about the question of economy in capital expenditure. In heralding the revolution which the 'New Metallurgy' would bring about in Rand practice, in 1910,[5] he said: "This capital expenditure is likewise reduced by the addition of such crushing units as tube-mills at half the cost or less than the equivalent even in heavy stamps." The metallurgical advisers of the East Rand, faithful believers in the new gospel, made Sir George Farrar say at the March meeting, 1910, that it was expected "to crush with 440 stamps more than now with the whole 820 stamps with consequently much decreased costs." At the time when enthusiasm as to Mr. Caldecott's discovery was at its highest, we were led to believe that all that was necessary was to use coarse screens in the battery, and to buy so many tube-mills, at so much per dozen, to reap the promised profits. By the irony of Fate, only one year and a half later it was Mr. Caldecott's privilege to discover that the capacity of the cyanide works at the East Rand was inadequate to deal with the increased proportion of slime, produced by the score of tube-mills.

Table IV

REDUCTION COSTS PER TON. See Annual Reports, 1910.	Single Stamp Crushing. New Kleinfontein Co. Output 1910: 466,882 tons.	Double Stage Fine Grinding. East Rand Proprietary Mines. Output 1910: 2,126,334 tons.	Crown Mines. Output 1910: 1,514,000 tons.
	£ s. d.	£ s. d.	£ s. d.
Mining and Development (excluded)	—	—	—
Crushing, Sorting, Conveying	0 0 10·552	—	0 0 8
Stamp Milling	0 1 8·280	—	0 1 4
Tube Milling	—	not specified.	0 0 7
Sand Treatment	0 1 0·376	—	0 1 8
Slime Treatment	0 0 3·406	—	
Total	0 3 10·614	0 4 11·6	0 4 3
General Charges	0 0 8·110	0 0 6·2	0 1 6
Total Reduction Costs	0 4 6·724	0 5 5·8	0 5 9

For technical purposes, the accounting of an industrial concern may be carried out with one of two ends in view. It may give a clear insight into all details of working costs and capital expenditure, so as to enable those who desire true progress to judge new inventions and innovations on their economic merits. It may conceal blunders and failures. In either case, with very few exceptions, the annual reports give no details of the distribution of capital account and expenditure over the various units of the reduction plant. Consequently the amount of money spent in forcing the 'New Metallurgy' on the old plants cannot be even roughly estimated; but the figures in Table IV are quite good enough to give an idea as to how far the promises of a reduction of capital expenditure "at half costs or less" have been fulfilled.

Future Possibilities

In order to prevent any misunderstanding, I want to make it quite clear, that in emphasizing the better economic ef-

[5] *Jour.* Chem., Met. & Min. Soc. of S. A., April 1910.

ficiency obtained with the sounder and older methods, I am far from advocating a policy of stubborn conservatism, or preaching a dogmatic and definite doctrine of single-stage stamp crushing. On the contrary, I think multiple stage crushing should be practised in every rationally designed plant, so as to realize the advantages derived from intermediate classifiers. The use of tube-mills, for the purpose of grinding, is not in question, but rather their abuse. The abuse consists in transferring to them that part of the crushing work which can be more efficiently done with stamps. It has been proved experimentally that the mechanical crushing efficiency increases with the coarseness of the battery mesh, and it appears that even a screen as coarse as 4-mesh is not the limit of highest efficiency. However, the advantage of a high amalgam extraction, got by double amalgamation, before and after tube-milling, is so marked, that to forfeit this advantage by crushing so coarsely that the mill plates have to be discarded, is not advisable, unless the extraction in the cyanide works can be materially raised above the present level of 85 or 90%. The use of fine screens will, therefore, be advantageous, even at the cost of a possible loss in mechanical efficiency. With classifying well carried out, the suitability of the type of tube-mills adopted as a standard on the Rand is doubtful. Other crushing machines may prove more efficient and should be given a trial. It is to be hoped that the tests of the Hardinge mill, now going on under the auspices of the Central Mining & Investment Co. at the Village Deep, will be more thorough and exhaustive than those of the Nissen stamp recently carried out by the same company. A. E. Crosse's regrinder (a drum revolving round a central axis with sliding mullers inside) also warrants testing and holds out promising prospects.

A great fuss was made when it became known that the New Kleinfontein company is deciding upon an increase of capacity of their reduction works, in order to deal with a further quantity of 10,000 tons per month (25% increase) had gone over to stage crushing. The methods adopted, on the advice of the consulting engineers—progressive in their conservatism—are, however, in no way a negation of their policy as hitherto practised, but only a logical combination of both methods in perfect accordance with theory. Of the 220 stamps only 40 will be made responsible for the increase of output. These will crush through the coarsest screens, while the remaining 180 stamps will crush, as hitherto, through fine screens. The underflow of the total pulp (run into classifiers of the type successfully adopted at the Benoni Consolidated) is to be reground by the tube-mills, which will work at a high efficiency, because the 40 coarse-crushing stamps will provide them with the right amount of coarse material to produce the most suitable mixed feed. A high amalgamation extraction will be secured by double amalgamation of the mill pulp produced by the 180 fine-crushing stamps, before or after tube-milling.

My remarks against the wisdom of the all-sliming policy refer exclusively to Rand ore and actual Rand practice, and may, under altered conditions, be reconsidered. Another case in which all-sliming may prove to be advantageous, is in adding free cyanide at the head of the tube-mill. H. F. Marriott[6] said in this connection that it had been demonstrated satisfactorily to those responsible for their system, that the gold in the ore passed into solution so readily during its normal course through the tube-mills, that there was not enough left undissolved to make it worth while to continue any subsequent treatment. This he (Mr. Marriott) believed had not yet been demonstrated on a practical scale on the Rand, but if it should prove only partly correct, and it were found possible to effect satisfactorily the rearrangement of solution circuits, it would eventually lead not only to a modification of our great cyanide plants, but probably to a tandem tube-mill and the doing away with the cyanide plants altogether.

Table V

ROUGH ESTIMATE OF CAPITAL Invested in STAMPS and TUBE MILLS. (Monthly Analysis of Chamber of Mines, 31st December, 1910.)	Estimate of Cost per Unit.	Single Stamp Crushing (1,200 mesh.)		Double Stage Fine Grinding.			
		New Kleinfontein Co. Output per year, 1910: 466,882 tons.		*East Rand Proprietary Mines.* Output per year, 1910: 2,126,334 tons.		*Crown Mines.* Output per year 1910: 1,514,000 tons.	
		No. of Units at Work.	Total Value.	No. of Units at Work.	Total Value.	No. of Units at Work.	Total Value.
	£		£		£		£
Stamps (say 1,450 lbs.) erected, including Motor, Ore Bins, Amalgam. Plates, Building, etc., complete	230	220 (Duty 5.9 t.)	50,600	820 (Duty 7·82 t.)	188,600	675 (Duty 7·6 t.)	155,250
Tube Mills (22ft. x 5ft. 6in.) erected, including complete Tube Mill Circuit (Motor, Classifiers, Pumps, Launders, Amalgam. Plates, etc.)	3,000	—		25	75,000	18	54,000
Total Costs of Stamps and Tube Mills			50,600		263,600		209,250
Do. reduced to tonnage of Kleinfontein Mine			50,600		57,880		64,540

A high amalgamation extraction will be secured by double amalgamation of the mill pulp produced by the 180 fine-crushing stamps, before or after tube-milling.

The investigation of this question was contemplated in connection with the Giesecke mill tests, but unfortunately, from commercial considerations, they were dropped, on the ground of the non-fulfilment of the expectations of mechanical efficiency. The above figures refer to the two principal units only. Spare tube-mills and other expensive innovations, such as filter-tables and vacuum-filters, are in no way taken into consideration.

Conclusion

The bare facts, revealed by the annual reports of our largest producers, show that all this enormous capital expenditure, which has not even yet ended, has only increased reduction costs. The actual results, far from fulfilling those promised, fall short even of those obtained five years ago, if due allowance is made for the progress attained in directions which have no direct connection with the 'New Metallurgy'. The figures, published in Messrs. Denny's paper on the extraction percentages obtained at that time on mines of the Central Rand, with battery pulps as coarse as 20 mesh, leave no room to doubt that the East Rand Mines

[6] *Bull.* Inst. Min. & Met., 81, June 1911.

could at once reduce their reduction costs considerably by simply returning to the sounder economical methods of the older days. There is no earthly reason to prevent this mine and the Crown Mines reaching an economical efficiency equal to that of the New Kleinfontein mine, which is run on old-fashioned lines without any tube-mills at all. The much abused excuse that the different nature of the ore is responsible for the poor results obtained is hardly borne out by the records filed at the reduction offices, and if any considerable prejudicial effect of this kind were proved it would yet be more than balanced by the advantage of the enormously larger tonnage dealt with.

In face of this array of facts, it would be highly interesting if W. A. Caldecott or F. L. Bosqui, the most prominent exponents of the new school, would explain why it is not desirable to go back a few years, and, with the experience now at our disposal, make a fresh start on the sound basis of actual knowledge gained by the eminently useful research work carried out by the Mines Trials Committee.

Kirunavaara

By H. V. Winchell

*This mine is in Swedish Lapland, and is called Kirunavaara or Ptarmigan mountain. It has been opened and put in operation during the past ten years under the management of a Swedish 'captain of industry' named Hjalmar Lundbohm. Here within the Arctic circle, north latitude 67°, where the electric lights are started at 2:30 on winter afternoons, are 1200 men mining iron ore for shipment to England, Germany, and the United States. The daily output is about 9000 tons; and it is shipped over a first-class modern railroad in steel ore cars about 100 miles farther north to the harbor of Narvik on the Norwegian coast. Narvik is the most northern ice-free port, and railway station. Here every day in the year iron ore is loaded on vessels at a latitude north of Cape Nome; such is the powerful influence of the Gulf Stream.

The amount of ore in the Kirunavaara has been repeatedly estimated; and each time the estimate is larger. When it is realized that this deposit of hard ore averages about 275 ft. in thickness and is more than two miles in length, and rises in a mountain about 800 ft. above the surrounding country, it may not be so difficult to believe that it contains approximately one billion tons of iron ore.

It is mined in open cuts or terraces;; and the blasting can be heard for 50 miles. The annual output of ore now amounts to about three million tons. It is limited by the Government at present to 3,500,000 tons. The Swedish government not only owns one-half of the stock of the operating company, but has an option to purchase the remaining half at an agreed price in about twenty-three years' time.

Although attention has been repeatedly called to this mountain of iron by Laplanders and hunters returning from the far-away northern wilds, yet very little was known about it until the Swedish Geological Survey and Mr. Lundbohm camped there and collected material for reports. The first visit was in 1875 and the second in 1896. Situated about 145 kilometres north of the Arctic circle, 300 kilometres from Lulea on the Baltic, and 170 kilometres from Narvik, the distance from Stockholm is 1413 kilometres, or about 850 miles. The first work preparatory for mining was in 1898. In 1899 the railroad (owned by the Government) reached Kiruna, and in 1902 was built to Narvik. Shipments began in 1903 with a production of about 800,000 tons.

Kiruna is situated in a desolate country, uninhabited before mining began, and only periodicallly visited by the nomadic Laps, for hundreds of years the only dwellers in the district. The climate is severe, the yearly average temperature being 30° F. Winter lasts from the first of October to the end of May, and the snowfall is heavy. Kiruna is now a well-built town of about 7800 inhabitants. An electric railway carries the miners to the foot of the mountain, and covered tramways or inclines take them up to the working faces. Hitherto the work of quarrying the ore has not been attended by any unusual problems, but as depth increases and the amount to be mined becomes more nearly equal to the tonnage of ore, there will be an opportunity for the display of engineering skill of a high order. The average dip of the ore is about 55° to the east, and the foot-wall rock as well as the hanging is already being mined in considerable quantity.

The ore is massive and dry, and the rocks above and beneath are likewise solid and fresh crystalline rock. Hence, the ground stands well and only an occasional pillar is needed even in large excavations. The grade of the ore is high. Indeed, these Swedish ores constitute one of the most important sources of high-grade ore in sight today. The chief impurity is phosphorus in the form of apatite. This, however, is so plentiful that instead of being detrimental it becomes an important asset. By the use of the Thomas-Gilchrist process the phosphorus is saved and converted into phosphoric fertilizer. Indeed, the Germans pay about as much for a unit of phosphorus as for a unit of iron. The ore thus far produced from this far northern mine has averaged as follows:

Grade.	Tons.	Fe.	P.
A	1,141,302	69.63	0.024
B	67,387	69.25	0.67
C	371,854	68.60	0.162
D	7,003,158	62.48	1.88
F	278,966	59.34	2.78
G	708,636	57.77	3.09

The amount of titanic acid in the ores is generally less than 0.5%, and the sulphur averages 0.05% or less.

But little is known concerning the geological age of the Kiruna ore and the surrounding sedimentary and igneous rocks. They are presumed to be pre-Cambrian and post-Archean. The geology of the ore deposits is complex and most interesting, and has been made the subject of careful study by Messrs. Lundbohm and Geijer.

It is a remarkable fact that the great orebodies of Kirunavaara, and Luossavaara, which lies a mile or two farther north, almost in line of strike, occur between two beds of porphyries of rather acid composition. The foot-wall consists of syenitic rocks with a silica percentage of tbout 60, the hanging wall of quartz porphyries with about 70% silica. The quartz porphyry is interwoven with innumerable dikes of finely crystalline apatite, generally small, but sometimes more than one metre in thickness. These dikes are often rich in magnetite and hematite. They also often contain much tourmaline and sometimes quartz and albite and show flow structures and orientated intergrowths. The quartz porphyry on the eastern side of the ore also contains numerous fragments of magnetite similar to that in the iron mountains. No dikes of magnetite are found cutting the quartz porphyry; but many intersect the syenite on the west. The contact between ore and country rock is generally sharp and distinct. The ore chiefly consists of magnetite, but contains hematite in small irregular lumps, in isolated crystals, and in small veinlets. The ore is sometimes laminated and intimately banded with alternating layers of apatite. Some geologists have mistaken this structure for evidences of sedimentary origin.

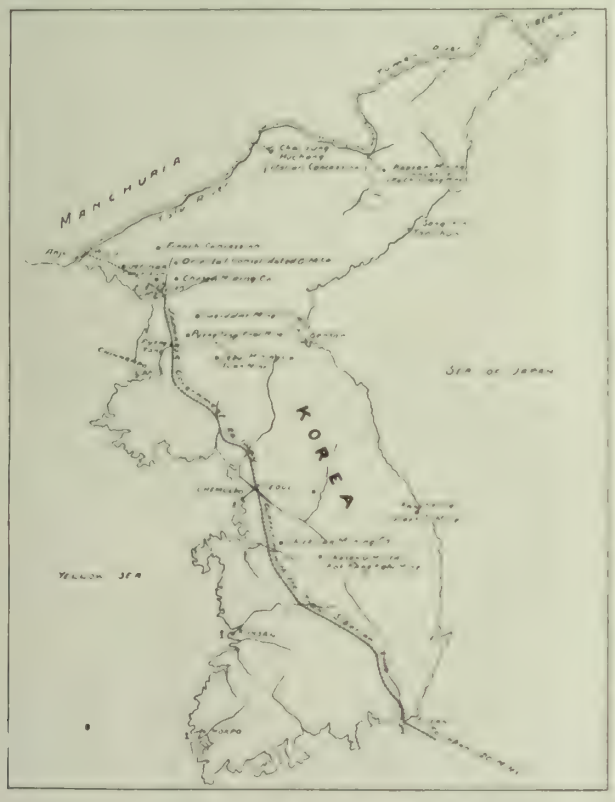
According to the two main theories, this ore is either pneumatolytic-hydrothermal or magnetic. It occurs in a series of bedded eruptives; is younger than the underlying syenite porphyry and older than the overlying quartz porphyry. It was, therefore, formed either by gaseous emanations from the older rocks during an interval or pause in the outpouring of solid eruptive matter, or is an actual eruptive sheet or dike of magnetite from an acid magma. In either case it is a deposit of rare type and phenomenal importance. I have purposely refrained at this time from advocating either theory.

*From a report on the Stockholm meeting of the International Geological Congress, made to the Minnesota Academy of Science.

Gold Mining in Korea

By J. D. Hubbard

The Oriental Consolidated Mining Co. still holds first place in Korea as to output. For the fiscal year ended July 1, 1911, the company mines produced 344,097 tons of ore valued at $5.19, or $1,787,628. The total receipts for the year were $1,541,347; total operating costs $839,857; and the operating profit for the year was $701,488. On new construction and development work, $28,768 was expended. The net receipts over all expenditures for the year were $672,720, and the surplus was increased from $532,791 to $561,426 during the year. From the granting of the concession to 1912 the company has produced over 2,600,000



PRINCIPAL MINING CONCESSIONS, KOREA.

tons of ore, valued at over $16,000,000. Alf Welhaven is general manager in Korea, G. M. Ford is general superintendent, and A. E. Drucker consulting metallurgist. During 1911 the company paid dividends of $644,085 on the net capitalization of $4,293,900. H. C. Perkins of New York City is president of the company.

The ore reserves on July 1, 1911, were estimated as follows:

Mine.	Tons.	Gold Content.
Tabowie	410,000	$2,000,000
Taracol	285,000	1,302,000
Chintui	13,000	51,900
Kuk San Dong	35,700	79,350
Charabowie	47,000	297,000
East Candlestick	11,580	124,520
Totals	802,280	$3,584,770

All the mines of the Oriental Consolidated are in good shape, except the Kuk San Dong and Chintui, which are about exhausted of pay ore. The increase in the value of the ore reserves in the other mines, however, offsets the decrease in the Kuk San Dong and Chintui mines.

During the past year the new cyanide plant, designed and erected by A. E. Drucker, at Kuk San Dong for the regrinding and retreatment of the concentrate dumps from the leaching vats of the old cyanide plant, was put into successful operation. The net extractions by the old percolation treatment have been quite high during the past few years, but unquestionably can be bettered by modern treatment, and the cost of treatment lowered. This concentrate dump retreatment is rather a new departure in cyaniding, and Mr. Drucker's experience will be awaited with interest. The Oriental Consolidated is to be congratulated on this effort to bring the plants up to date. Heretofore the methods used have been antiquated. It must be borne in mind however that this was the first mining company in the Far East to successfully treat low-grade ores, and its pioneering has helped other successful companies in getting started.

Last year this company had much trouble over the matter of cordwood and mine timbers. A large amount of both is required and the company has practically exhausted the visible supply within the limits of its concession. They commenced to cut wood and timbers outside the limits of their concessions, and being perhaps inconsiderate of the rights of other concessionairs, were stopped by the authorities, upon complaint of those trespassed upon. As cordwood and mine timbers are necessary for the operation of gold

TARACOL HEAD-FRAME, ORIENTAL CONSOLIDATED.

mines, and as the Japanese government has heretofore always encouraged the development of mines in Korea, deriving revenue therefrom, there is no doubt but that the matter will be adjusted to the satisfaction of all concerned. It is unfortunate that the Oriental Consolidated did not do some reforestation many years ago, especially as the ore reserves have always been developed so far ahead as to prove a good life to the mines. It is not yet too late, for the company is still good for many years of productive life.

The Seoul Mining Co., operating mines at Suan, in Hwang Hai Do province, has had another successful year. The 40-stamp mill was completed December 1, 1909, and has been in continuous operation ever since. During 1911, 70,229 tons of ore was crushed (an average of 5.53 tons per stamp per day), from which an average recovery of $7.85 was made, at a working cost, including development, of $3.01. This cost is divided as follows: Mining, $1.25; milling, $0.62; transportation, $0.05; concentrate expense, $0.24; general expense, $0.85. The mill recovery was $6.21 per ton; concentrate $1.62 and from ore sales to the Tacoma smelter $0.02 per ton. The last item represents an adjustment in 1911 on shipments made in 1910, as no high-grade ore was shipped during the year. The average extraction obtained was 79.1% of the gold and 18.4% of the copper content of the ore, or 69.4% of the total. The greatest loss of copper is in the slime, and investigations

are under way to increase the saving. Microscopic examination has shown that the bismuth is closely associated with the copper and exists in a finely disseminated state, probably as native bismuth.

The ore reserves on January 1, 1912, are estimated as follows:

Orebody.	Tons.	Gold.	Copper, %.	Bismuth, lb. per ton.	Gross value.	Per ton.
Eastern	191,400	$10.58	1.3	3.50	$3,024,000	$15.80
Central	5,000	20.00	3.0	12.00	172,000	34.40
Western	15,000	13.50	1.8	4.00	303,000	20.22

The net returns from mining and milling operations for the year was $339,844. During the year two dividends, of 30% and 15% respectively, were paid, $20,000 was written off for depreciation, and $18,000 was expended for directors' fees and administration expenses. The company is capitalized for $500,000, of which $400,000 has been issued. The company has the exclusive right to select mining property within the limits of the Suan concession until 1916. Prospecting is now being carried on, especially at Tul Mi Chung, where silver-lead ore occurs; Sang Dei, where gold-copper ore is found; and Paa Whan, where low-grade gold-copper ore occurs. This company has so far paid dividends amounting to $220,000. The excellent treatment accorded employees of the Seoul Mining Co. has culminated in good results obtained, loyalty and long service rendered. The company looks forward to a prosperous year in 1912. A. H. Collbran is general manager at the mines.

The Chiksan Mining Co., operating a concession in North Chung Chyong Do province, is after many vicissitudes, getting solidly established, and during 1911 a new organization was effected. Formerly the concession was owned jointly by the Korean Exploration Co. and the Shibusawa-Asano Mining Partnership. Under the new organization the Korean Exploration Co. owns 24% of the capital stock, Baron Shibusawa owns 24%, and the Chiksan Mining Co. owns 52%. G. R. Gerry of the American Electric Co. of Yokohama is president, and G. A. Bagnall, of the same company, is vice-president. A. W. Taylor is general manager in Korea, and the directors are W. D. Townsend of Chemulpo, and Messrs. Hillis and Mairabara of Yokohama. The Chiksan Mining Co. is capitalized for Y2,000,000, the par value of the shares being Y50 each. The stock is fully subscribed and the money is in Japanese banks. The stock was practically all subscribed locally, that is in Japan and Korea.

The mining concessions of the Chiksan company comprises an area of about 20 square miles. It is the most conveniently situated of all the mining concessions in Korea as regards transportation, the headquarters at Yangdei being but 9 miles from Seikwan, on the main line of the Korean Central railroad. From tidewater at Tsunpo to Yangdei is but 14 miles. The company expects to erect a central electric power plant at Tsunpo, using coal as fuel, and transmitting power to the different plants.

There are many strong veins on the concession, besides valuable placers. Between Kurangkohl and Sajunkohl there is an orebody 8000 ft. long on the strike and 30 ft. wide, averaging $5 per ton on the paystreak. Some of the outcrops run up to 80 ft. in width, showing assays of from $3 to $5 per ton. There are 75 veins on the concession, besides 1500 acres of placer ground. The placer ground has been prospected and its estimated total value is $2,500,000. The working costs are estimated at 6c. per yard.

A 150-ft. two-compartment shaft at Sajunkohl is being deepened, and the old Homune mine is being unwatered preparatory to re-opening. The Homune shaft is down 225 ft. Among the native Korean miners the Homune mine is recognized as the standard of wealth. When asked what they think of a good prospect in other localities they will reply "as rich as Homune". Some very rich ore has been taken out of the old workings by Korean miners. The company is rapidly getting its mines in good shape for profitable working. In the Yangdei mill dump is over 10,000 tons of tailing of an average value of $3.50 per ton. A cyanide plant is now being erected to treat it.

A good timber supply, sufficient for 6 or 7 years, is available 8 miles from Yangdei. The company now has 17 stamps dropping. Up to December 1911, when the new 10-stamp mill was started, the average bullion production was $8000 per month in gold and $2000 per month in concentrate, and the clean-up for the year was $25,000. The concentrate is shipped to Tacoma for treatment. No doubt this company will later treat its own concentrate. Up to the advent of the new 10-stamp mill, 825 tons of ore per month was crushed. This mill was built in Japan. The net profits last year were 33⅓%. The mills are distributed as follows: Two 5-stamp batteries at Yangdei, also 4 Nissen stamps, and a 3-stamp triple discharge Hendy mill at Kurangkohl. I have been unable to get estimates of the ore reserves for 1912.

One strong new company came into the field during 1911, the Chosen Mining Co. This company was incorporated to take over the interests of the Morris-McGary partnership mining concessions in North Pyeng An Province, Yeng Byen district. J. H. Morris and E. M. McGary, through the native prospectors, obtained the Kosung and Wha San orebodies, among the best in Korea. They did about one year's development work prior to the incorporation, proving the value of the ore on both concessions. The Chosen Mining Co. was then incorporated under the laws of Arizona, for $50,000 in shares of $5 each. Two-fifths went to Morris & McGary as the purchase price of the concession, one-fifth is held as reserve, and two-fifths, or 40,000 shares, was sold at par value, $5. The capitalization of this company is rather low for large operations, but the management has definite plans, and will start moderately and increase the reduction plant from the operating profits. This should insure large dividends, which is the ambition of the management.

In the Kosung mine, the ore reserves on July 1, 1911, were estimated at 150,000 tons of ore of an average value of $5 per ton. By the end of the year the ore reserves were increased to 300,000 tons. Some of the ore assays very high, up to $200 per ton, and shows free gold. Practical laboratory tests prove the ore to be free-milling. With such a start and such an ore reserve the Chosen Mining Co. should quickly take its place as one of the important mines in Korea. J. H. Morris of Seoul is vice-president and general manager, E. M. McGary is general superintendent at the mines, and W. F. Perkins of San Francisco is president.

For the past two years the French concession in the Chang Song district, one of the largest in Korea, has been worked by Koreans under the leasing system. The company has derived some revenue from this source, but it leaves the mines in bad shape and is not to be commended. Also the primitive methods of the Korean millmen are wasteful. I have assayed tailing from their mills that contained $90 per ton. Some intelligent Koreans, who had been trained at the Taracol cyanide plant of the Oriental Consolidated, soon found that the tailing was readily amenable to leaching with cyanide solution, and have been making money ever since. There are many strong and well defined veins on the concession, and some are assaying very high. The concesssion is also well forested. M. Saultreaul, of Paris, owns the concession and is represented in Korea by E. Martel of Seoul.

Recently the concession has been leased to L. Rondon & Co., of Seoul, for a yearly rental of Y40,000, the lessees to pay all taxes and assume all responsibility for the concession. Also, as in the case with the Chiksan Mining Co., 25% of the net profits go to the government. The lessees have bought the 5-stamp mill of the German concession and will install it at Chang Song. I hope the lessees will get things going in good shape and make a good profit. Although some distance from the railroad the French concession has many natural advantages, and has a larger visible supply of timber than any other concession in Korea except the Chosen Mining Company.

An editorial appearing in the *Mining and Scientific Press* of October 29, 1910, refers to the extra-territorial rights of foreigners as having naturally disappeared. This is true except in one case. The extra-territorial rights of American citizens have not disappeared, nor has any notification to that

effect been given by the American Consul-General in Seoul. As I understand the treaty, one year's previous notification must be given. It should be understood, however, that all the American citizens now resident in Korea are only too anxious to preserve Japanese authority, and in several cases recently have voluntarily submitted to the local authority to facilitate good relations. Foreigners may obtain mining concessions in Japan proper now, as the Oroyo-Brownhill syndicate did last year. And mining promotion is far from a standstill in Korea, as the three latest companies to organize the Seoul Mining Co., the Chosen Mining Co., and the Chiksan Mining Co., have all been financed in Japan and Korea. The investing public in the Far East is ready at all times to buy good mining stocks, and many more good mines will yet be financed here.

Korea is far ahead of Japan in gold production. According to an official report, the total amount of Korean gold exported during the first half of the year 1911 was Y6,350,140. During the same period gold ore in addition to the value of Y119,422 was exported. The total amount of gold produced in Korea during half a year is greater by over Y300,000 in value than the annual output of Japan. The Korean miner is probably the best native miner in the world, all considered, and he seems to take to mining naturally. Prospecting is active and the Mining Bureau receives numerous applications from foreigners, Japanese, and Koreans. There are many virgin goldfields in Korea yet, and I think there will be a mining boom here when the facts are known.

Western Mining Districts

The United States west of the 103rd meridian, comprising the Rocky Mountain, Plateau, Desert, and Sierra Nevada regions, is one of the most important producers of precious and allied metals in the world. In this area are many mining regions or camps, which are known as 'mining districts.' In most of the states the boundaries of these districts are well recognized and some of them are legally recorded, and nearly all can be plotted on state maps with a fair degree of accuracy. In the Mother Lode country of California, however, there are no 'mining districts' in the sense that the term is used in the other states.

The output of the mines in the United States is reported yearly to the division of mineral resources of the U. S. Geological Survey, and by a study of the district reports for a number of years the values of the most important metals produced in each district can be fairly well determined. In some districts, notably those in Colorado, the values of several products are nearly equal, but in most of the districts the output of one metal has a greater value than of the rest.

The U. S. Geological Survey has published reports on the economic geology of a large number of the mining districts of the country. In 1908 the Survey published in its annual volume, 'Mineral Resources of the United States', a map of the Western states showing the position of the mining districts. Bulletin 507, 'Mining Districts of the Western United States,' which contains a revised edition of the original map, together with much new material, is an index of the gold, silver, copper, lead, zinc, quicksilver, iron, and rare-metal mining districts of the Western states.

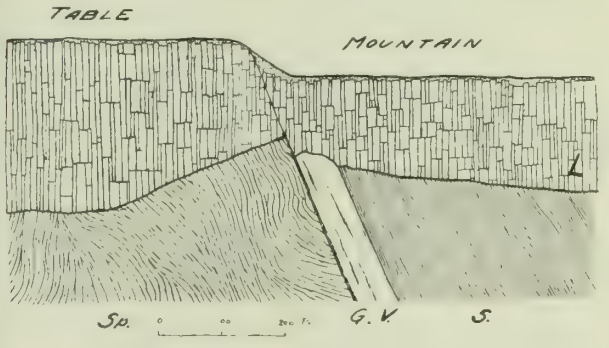
A geologic introduction to this report, by Waldemar Lindgren, not only gives a general summary of the geology of the states, but also describes in some detail the economic geology of the more important districts as well as some of the less widely known mining regions. This part of the report includes a small map of the Western United States showing the general distribution of the mining districts. The report contains 14 state maps, which show the position and area of over 1400 mining districts. The map including the largest number of districts is that of the northern counties of California, which contain 222 districts; the smallest is the map containing that of trans-Pecos Texas, which shows only 11 districts. With every mining district symbol on each of these maps is a number which refers to its name in an accompanying list. A bibliography of the publications of the U. S. Geological Survey on each district is included in the text, as well as a condensed statement of the geology and nature of the ore deposits, a list of the metals produced, and the shipping point of the camp.

The bulletin contains the latest available information, but the Director of the Geological Survey desires that any mistakes or omissions be brought to his attention by men in the field who are in a position to aid in this work.

Tuolumne Table Mountain

By Augustus Locke

Near Jamestown, California, the important Mother Lode veins stand up in a low ridge. On this ridge lie the Harvard and App mines. North of the town, the ridge buries itself beneath Tuolumne Table mountain. It will be recollected that Tuolumne Table mountain is a lava-cap of a Tertiary river course, brought out to its present relief by the depression of the adjacent land surface. The top of the mountain



CROSS-SECTION, TUOLUMNE TABLE MOUNTAIN.

is essentially uneroded, and is remarkably flat. An interesting condition is the stepping up of the mountain immediately southwest of the place where it crosses the quartz-bearing ridge. The 'rise' is covered by débris; in the volcanic rock, no fault materials are visible. But the large facts indicate definitely enough that a displacement of 50 ft. or so in the plane of the gouge shown in the accompanying section has taken place since the solidification of the lava, and since, therefore, the formation of the quartz. The immediate cause of this displacement may have been the expansion of the foot-wall serpentine. In a general way, the fact that the portion of the mountain which is above the serpentine is rougher than that above slate suggests that the serpentine has been moving.

Queensland Gold Production

The yield of gold in Queensland for April shows an increase, compared with that for April 1911, of 3720 oz. fine in quantity and £15,801 in value. The total output for the month was 30,689 oz., valued at £130,358. The improvement shown in the return is all the more satisfactory, inasmuch as it is spread over several fields. Thus, at Croydon there was an increase of 831 oz.; at Cloncurry, 110 oz.; at Etheridge, 356 oz.; at Mount Morgan, 2173 oz.; at Ravenswood, 1209 oz. At Charters Towers there was a decrease of 330 oz., and at Gympie of 344 oz. The yield for the first four months of the present year was 109,389 oz., of the value of £466,354, a decrease, when compared with the corresponding period of last year, of 3646 oz. in quantity and £15,487 in value.

Aniak is the name of the district to which the most recent Alaska stampede is directed. The discoveries are along Marvel, Fisher, Cripple, and Dome creeks, tributaries of the Kuskokwim river.

Marble Deposits of the Inyo Mountains

By Robert T. Hill

These marbles occur on the southwest side of the White Mountain Inyo range, a parallel range to the Sierra Nevada, lying to the east of Mount Whitney and separated therefrom by the Owens River valley, in Inyo county, California, directly alongside the Southern Pacific railroad, and on the east shore line of the Owens Lake basin.

The White Mountain range is one of peculiar geographic and geologic interest. It may be said to be the last and westernmost of the desert ranges of the Nevada type, and the first of these ranges east of the great eastern escarpment of the Sierra Nevada of California. The range has a northwest-southeast direction, and is the surviving remnant of ancient rocks which were folded in a similar direction. The material of the mountains is altered, folded, and faulted sedimentary rocks of the older or lower half of the geological column, which have undergone regional metamorphism into quartzites, slates, and marbles; accompanied by occasional small dikes of basic rocks, cutting across the folded strata, and apparently a large extrusive mass of the late Tertiary volcanic rocks, seen just east of Lone Pine station, which constitutes the northwestern end of the marbleized block. Proceeding from northwest to southeast, the marbles are seen outcropping from a distance of six miles along the southwest, or Owens valley, side of the range, from three miles northwest of Inyo station to a mile and a half southeast of Swansea.

Geology.—In the '60s the area was reconnoitred by Mr. Brewer of the California (Whitney) Geological Survey, who found a single fossil in the rocks of the White mountains, from which he reached the deduction that they were of Jurassic age. This fossil, however, was a cephalapod, which in those days prior to the era of rock cutting and polishing was a very unsatisfactory criteria for determination. In another year the area was visited by G. K. Gilbert, who pointed out, in his brief notes, some of the interesting structural features. In 1894 C. D. Walcott made several reports of the White and Inyo Mountain ranges, and gave sections showing the existence of a great thickness of Cambrian and other succeeding Paleozoic rocks, and pointed out the facts of their Appalachian structure.

The rocks of the range are bands of strata which have been folded into anticlinal arches, the axes of which are parallel to the trend of the range. The limestones of this locality were marbleized during the Appalachian mountain period, when they were folded and the beds of marble all co-extensive with certain well defined strata now tilted at various angles in harmony with the faults. Subsequent earth movements have fractured and faulted these layers, dislocating them somtimes vertically, sometimes horizontally. The effect of these later movements is variable. In some areas they shattered the ancient marbleized strata into minute blocks, in others the small fracturelets thus created have been re-cemented and solidified with mineral oxides, producing the effects of color which gives to the marble in places the peculiar beauty which renders it of great artistic and commercial value. Other large areas seem unaffected by this cross-faulting. The important fact concerning this structure is that the marbleization is ancient and general, and took place in the older geologic periods mentioned, and is not local or spotted, as is found sometimes adjacent to recent fault lines. The marbleization itself is homogeneous and thorough.

The Marbles.—The marbles outcrop the entire distance previously mentioned, except for a short interval occupied by a stream valley just east of Swansea, but are not in continuous line on account of east-west faults which have thrown them back and forth in horizontal blocks or massive hills, as elsewhere mentioned. In places these faults or fault-zones result in many cross-fractures, so that the material is very much shattered at the surface. In other places, however, as at the Inyo quarry and at Swansea, the marble is found in blocks or squares of large dimensions, and there seems no question but that the blocks of any workable size desirable may be found in abundance. This is especially true about a half mile east of Swansea, where the white marble stands in vertical strata and is unshattered, and where, owing to the verticality of the strata, it can be quarried to a depth with a certainty of continuity.

At Inyo only has commercial quarrying been conducted and from this locality much material has been taken in times past which has been used in various structures in San Francisco, Los Angeles, Stockton, and other places. There are several openings in the southwest slope of the hill, one of which produces marble of a pure white, and two others which yield a variegated product. These quarries are within a quarter of a mile of one another. Two of these quarries are situated from two to three hundred feet above the valley plain and are equipped with tramways and cranes for quarrying, but of a type which can be replaced to advantage by more modern facilities.

The White Marbles.—The white marble quarry lying to the northwest apparently has an inexhaustible quantity of material, which if properly quarried can be obtained in blocks of any desired size. The quality is the purest white, fine grained, and, as stated by G. P. Merrill, "equal in texture to Italian marble, but much harder, firmer, and more compact." It is certainly handsomer and purer white than any American marble with which I am acquainted, and this fact alone should render the material of great value. These white marbles are singularly free of what has been termed the 'skim-milk blue' which characterizes all of the graphite-tainted marbles of the Eastern United States.

The Colored Marbles.—Geologically the variegated marbles at the quarry a short distance southwest of the white marble quarry, are a continuation of the same stratum and are of the same substance, which has been variegated by the addition of the coloring mineral oxides of manganese and iron, which have been introduced through the transverse fissures. G. P. Merrill may be again quoted: "In texture this is of the same quality as the last, but the white ground-mass is injected in every direction with blotches, streaks, and finely divided branching, feathery dark brown, nearly black, dendritic, or fernlike markings —and which, added to occasional blotches of sienna yellow, produce an effect that must be seen to be appreciated. Still a third variety is sienna yellow of varying shades. This last, while nearer the true Italian sienna than any now produced, differs in being distinctly granular in texture, and can be more correctly compared with the well known Estromoz or so-called Lisbon yellow, from Alemtojo province, Portugal."

The Blue Marbles.—There is still another type, which produces a radically different but nevertheless desirable group of colors. About a mile north of Inyo and also north and east of Swansea, there are vast outcrops of marble of the black variety—apparently representing an ancient stratum adjacent to that of the white marble, and probably below it in geological sequence. Here may be seen a vertical exposure of several hundred feet of thick bedded strata, of a dark-blue color, in most places homogeneous and even in texture, but presenting among the others one thick bed in which the blue matrix is studded with white, oval bodies, suggesting the blue and white effects used by the makers of Wedgewood pottery. The entire material is thoroughly calcified and dolomitized into massive stones. The whole gamut of blacks is to be found here, blue-blacks, the gray blacks, and the pure black marbles, in unlimited quantities, and can be gotten out in blocks of any desired size.

Extent and Quantity.—The quarries which have been opened, as above described, represent only a fractional portion of the material, which extends both to the northwest and southeast for several miles, and which has been undeveloped. The southernmost point examined, some three miles south of the Inyo quarries, and about a half-

mile southeast of Swansea, shows a magnificent vertical stratum of the pure white dolomite marble, estimated to be over 100 ft. thick and which has an indefinite depth. The white marble beds extend from here to northeast of Inyo, some three miles, but they are much shattered by cross-faulting at the latter point. Concerning the quantity of the marbles, there can be no doubt but that it is ample for development.

Determination of Small Amounts of Platinum

By F. P. Dewey

In the regular course of assaying for the precious metals, gold is parted from silver by dissolving the silver in nitric acid. If platinum be present in small amounts only, it will readily go into solution in the nitric acid. If now a limited amount of hydrogen sulphide be added to the solution from parting, any platinum present will be precipitated as sulphide, along with some silver sulphide. On filtering off the precipitate (which generally is sufficiently washed by the operations necessary to transfer it from the precipitating-dish to the filter), the moist filter is transferred to a small porcelain crucible, dried at a low heat, and burned off by gentle ignition. This transforms the sulphide precipitate into a metallic sponge, which is wrapped in a small piece of thin lead foil and cupelled. The resulting bead is then parted in strong sulphuric acid, when the platinum will be left as a dark residue, generally collected in spongy form, even when minute in quantity. This sponge, after reboiling in fresh acid, if necessary, is suitably washed by decantation, annealed, and weighed.

Generally, the final metal speaks for itself as being platinum, but if there should be any doubt, it may be dissolved in a drop or two of aqua regia and gently evaporated. The solution obtained may be tested with potassium iodide, or a few small crystals of ammonium chloride may be added, when the characteristic precipitate will show itself. As a further test, this may be filtered off and gently ignited to produce spongy platinum. If the amount of the final metal be considerable, the platinum may be determined by the double-chloride method. Any decided difference shown would indicate the presence of other members of the platinum group, for which direct test could then be made.

For precipitating the platinum and the necessary silver from the parting solution, a very dilute solution of hydrogen sulphide should be used. One part of a strong solution should be diluted with from 10 to 20 parts of water. If the solution of silver nitrate be strongly acid, it should be largely diluted, or it may first be evaporated and then diluted. The very dilute hydrogen sulphide solution should be added very slowly to the silver nitrate solution with constant stirring. The solution is, of course, at once darkened, but there should be no immediate separation of a visible precipitate. The solution should be stirred occasionally, and in about 2 hr. flocks of precipitate should appear. It may be filtered in from 3 to 4 hr., but it is a good plan to let it stand over night if possible.

The amount of hydrogen sulphide required depends, of course, upon the amount of platinum present. If this should be roughly known or suspected, the amount used should generally be enough to precipitate the platinum and from three to five times as much silver. On an entirely unknown ore, I should at first use 1 c.c. of strong hydrogen suplhide solution diluted to 15 c.c., and reserve the filtrate from the sulphides for re-treatment if necessary. On an unknown bullion, I should use 2 c.c. of strong solution diluted to 30 c.c., partly because bullions are liable to carry much more platinum than any ordinary ore, and partly because the volume of the silver nitrate solution from parting the gold must necessarily be larger. If, however, it is known that minute amounts of platinum are present, it is still necessary to use sufficient hydrogen sulphide to give a silver bead large enough to handle comfortably. For this reason, I seldom use less than the equivalent to 1 c.c. of strong hydrogen sulphide solution.—(From the *Bulletin,* Amer. Inst. Mining Engineers.)

Estimation of Sodium Peroxide

By H. L. Easton

The following method for the estimation of sodium peroxide was devised by J. P. Walker as a modification of the method given in Sutton's 'Volumetric Analysis,' and has been slightly modified by myself.

Preparation of Solution.—A N/10 solution of $K_2Mn_2O_8$ contains 3.16 gm. to 1 litre of water. Standardize such a prepared solution with 0.250 gm. of oxalic acid ($C_2H_2O_4 . 2H_2O$). By comparison of equations for the oxidation of $C_2H_2O_4$ and Fe by $K_2Mn_2O_8$, it will be seen that the same quantity of permanganate is required to oxidize one molecule (126) of oxalic acid as is needed to oxidize two atoms (112) of Fe. Then, if 0.250 gm. oxalic acid was taken, the proportion is:

$$126 : 112 :: 0.250 : X \ (0.222)$$

That is, 0.250 gm. oxalic acid = 0.222+ gm. iron.

Say, for example, it is found by titration that it takes 40 c.c. of the permanganate solution to oxidize 0.250 gm. oxalic acid. Then 0.222 divided by 40 = 0.0055.

$$1 \text{ c.c. } K_2Mn_2O_8 = 0.0055 \text{ gm. Fe.}$$

according to the reaction:

$$5Na_2O_2 + K_2Mn_2O_8 + 8H_2SO_4 = 5Na_2SO_4 + K_2SO_4 + 2MnSO_4 + 5O_2 + 8H_2O$$

$$1 \text{ part } K_2Mn_2O_8 = 5Na_2O_2$$

$$(A) \text{ or } 316\ K_2Mn_2O_8 = 390Na_2O_2$$

Also according to reaction:

$$10FeSO_4 + 8H_2SO_4 + K_2Mn_2O_8 = 5Fe(SO_4)_3 + 2MnSO_4 + K_2SO_4 + 8H_2O$$

$$(B) \quad 316\ K_2Mn_2O_8 = 560\ Fe$$

Then by (A) and (B) 560 Fe = 390 Na_2O_2.

It results that 1 c.c. permanganate solution equals 0.0055 Fe.

Then 560 (Fe) : 390 (Na_2O_2) :: 0.0055 : X

$$1 \text{ c.c. } K_2Mn_2O_8 = 0.00383 \text{ gm. } Na_2O_2$$

Process.—On account of the hygroscopic character of sodium peroxide it is practically impossible to get an accurate average sample for analysis. To surmount this difficulty, three or four samples are taken from different parts of the can or bottle, analyzed separately, and their results averaged. This procedure will give a fairly accurate estimate of the percentage of the sodium peroxide in the product.

After shaking well the can containing the peroxide to be analyzed, take out, with a clean dry spatula, 15 or 20 gm. and transfer to a clean dry weighing bottle. In taking this sample, dip the several portions composing the 15 or 20 gm. from different parts of the can, the object being always to get as nearly an average sample as possible. Take three or four such general samples, using as many weighing bottles, and shaking can well after taking each. Do not leave the peroxide, either in the can or the bottles, exposed to air longer than absolutely necessary.

From the weighed bottle take out from two to three grams of the peroxide on the end of a dry spatula and drop it into a flask containing some 400 c.c. of a previously cooled solution of 20% H_2SO_4. Wash off spatula with water jet, close flask, and shake well. While the sodium peroxide is dissolving, weigh bottle again to ascertain exact quantity taken for analysis. Dilute contents of flask to a litre and with a pipette draw out 100 c.c., deliver into smaller flask, and titrate with the permanganate solution until pink color does not disappear by shaking.

The number of cubic centimetres of permanganate used, multiplied by the value of the permanganate solution in

terms of sodium peroxide per cubic centimetres multiplied by ten, gives the grams of peroxide in the weighed portion. This multiplied by 100 and divided by the accurate weight of the peroxide used for analysis gives the percentage of sodium peroxide. Treat each sample taken in like manner and average the results. If the available oxygen is required, multiply the percentage of sodium peroxide obtained above by the factor 0.205.

South Dakota Metal Production

The total value of the production of gold, silver, and lead in South Dakota for 1911, as reported from 37 productive mines, 17 of which were placers, amounted to $7,550,758, according to C. W. Henderson of the U. S. Geological Survey. This yield is only slightly below that of the record output in 1908, and when compared with the value of $5,467,031 in 1910, shows an increase of $2,083,727. The gold output was 359,903.90 fine oz., valued at $7,439,874, almost 99% of the total value. The increase in gold for the year was 98,569.72 fine oz. in quantity and $2,037,617 in value. The yield of silver also increased from 118,800 to 203,755 fine oz. Smelting ore from South Dakota in 1911 carried 64,311 lb. of lead, against 14,136 lb. in 1910. Placer gold increased from 143.77 fine oz. in 1910 to 584.03 fine oz. in 1911.

A total of 1,946,127 short tons of ore was mined and treated in 1911, compared with 1,523,929 tons in 1910. Of this total, 1,940,661 tons was treated in the mills of the state, yielding as bullion $7,317,942 in gold and 172,598 fine oz. of silver, valued at $91,477, with an average recovery per ton of $3.77 in gold and 5c. in silver. Smelting ore, 5466 tons, averaged 0.959 oz. of gold per ton and 5.69 oz. silver.

The gold mines of the Black Hills, chiefly in Lawrence county, were steadily operated in 1911, and in addition there were a few productive mines not operated in 1910. The Homestake mine, which produces most of the gold bullion from this state, at the beginning of the year had completely overcome the labor difficulties of 1909-10 and was again operating at the full capacity of its plant of 1000 stamps. Developments of note in the northern Black Hills were the advancement toward completion of the Homestake hydro-electric plant; the building at Galena of a new smelter and the Gilt Edge-Maid concentrating plant; the proposed construction of a roaster at the Golden Reward mine to handle the newly developed sulphide ores; the open-cut mining and continuous operation of the Wasp No. 2. Co.; and the building of the 300-ton cyanide plant of the Bismarck company. In the southern Black Hills the first dredge to be built in the state was operated for 5½ months at Mystic, Pennington county. The dredge is owned by the Castle Creek Hydraulic G. M. Co., and has close-connected buckets of 5-cu. ft. capacity.

	1910		1911		Increase.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
Gold.....fine ounces..	261,334.18	$5,402,257	359,903.90	$7,439,874	98,569.72	$2,037,617
Silver.....do....	118,800	64,152	203,755	107,990	84,955	43,838
Lead.....pounds..	14,136	622	64,311	2,894	50,175	2,272
Total.....	.....	5,467,031	.....	7,550,758	.....	2,083,727

SOUTH DAKOTA METAL PRODUCTION, 1911.

Copper Output, 1912

Statements of the copper production of the principal companies for the first six months of 1912 and the following estimate of earnings have been made by Hayden, Stone & Co. Except for the new companies, the production in 1912 does not greatly exceed that of last year.

	Production, 1911.	Approximate production, 6 months, 1912.	Net earnings, 1911.	Net per share, 1911.	Net estimated, 6 months, 1912.	Net per share, 1912 (15c. cop.).
Ahmeek	15,196,127	7,818,165	$ 870,273	17.40	$ 603,500	12.06
Allouez	4,780,494	2,570,410	6,379	0	75,000	0.75
Anaconda	259,407,093	140,000,000	8,316,063	1.90	7,700,000	1.78
Calumet & Arizona	49,945,905	26,556,000	2,525,322	4.24	1,987,500	3.31
Calumet & Hecla	74,130,977	36,493,946	3,077,000	30.00	2,372,500	23.72
Centennial	1,493,834	853,855	6,045	....	27,000	0.30
Copper Range	29,310,579	16,027,200	804,561	2.01	920,000	2.30
Granby	17,858,860	10,978,487	217,416	1.45	440,000	2.93
Greene-Cananea	45,440,000	24,050,000	1,184,750	0.48	1,380,000	0.57
Isle Royale	7,490,120	3,986,315	156,708	1.00	180,000	1.20
Miami	15,385,783	14,794,396	489,603	0.65	962,000	1.33
Mohawk	12,091,056	6,894,994	300,786	3.00	345,000	3.45
Nevada Consolidated	78,541,270	36,757,107	4,336,216	2.16	2,880,000	1.44
North Butte	24,816,669	13,000,000	641,858	1.56	650,000	1.62
Old Dominion	19,195,181	12,843,000	621,964	2.13	704,000	2.34
Oseeola	18,388,193	8,381,840	664,628	6.65	378,000	3.78
Phelps-Dodge	134,149,627	66,581,233	4,278,481	9.50	4,329,000	9.62
Quincy	22,252,943	11,300,000	507,597	4.60	508,500	4.62
Ray Consolidated	14,935,047	14,000,000	298,640	0.25	840,000	0.58
Shannon	15,168,108	8,696,000	118,854	0.39	320,000	1.06
Superior	3,236,233	2,243,340	64,516	0	22,433	0.22
Tamarack	7,494,077	4,058,200	196,934	0	80,000	1.33
Tennessee	13,808,940	7,000,000	407,049	2.03	315,000	1.57
Utah Consolidated	9,162,023	5,000,000	438,430	1.44	400,000	1.33
Utah Copper	93,514,419	54,000,000	6,237,928	3.96	3,915,000	2.48
Wolverine	9,617,168	4,500,000	487,895	8.09	247,500	4.10

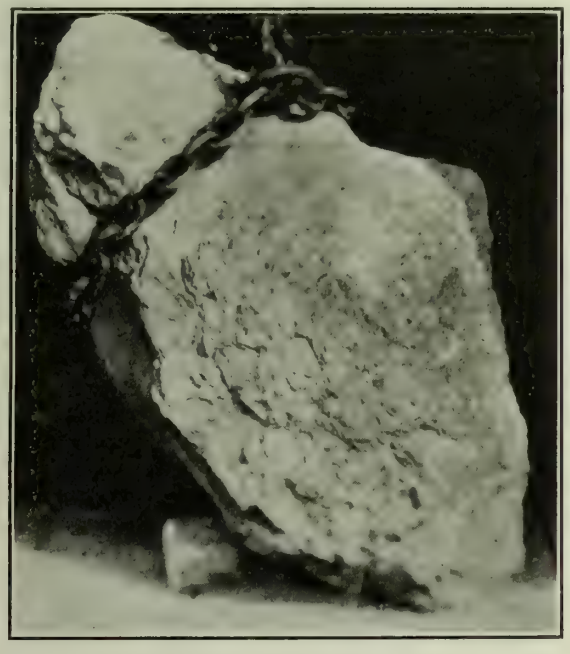
Discussion

Readers of the MINING AND SCIENTIFIC PRESS are invited to use this department for the discussion of technical and other matters pertaining to mining and metallurgy. The Editor welcomes the expression of views contrary to his own, believing that careful criticism is more valuable than casual compliment. Insertion of any contribution is determined by its probable interest to the readers of this journal.

A Mountain of Gold

The Editor:

Sir—Referring to my article under this title published in your issue of December 2, 1911, I have now obtained a photographic print of the biggest mass of silver ever mined. This I owe to the courtesy of D. W. Brunton. This mass of silver came from the Smuggler mine, at Aspen, weighed 1840 lb., and was of a purity equal to sterling silver. Such impurities as were present consisted of rock. It came from a small lenticular body of



MASS OF SILVER, SMUGGLER MINE.

native and sulphide silver ore, ranging in thickness from 2 inches to 2 feet, that yielded in all nearly 10 tons, sold for a trifle over $90,000. It was part of the same deposit of high-grade sulphide and native silver ore that was found in the Mollie Gibson, although the two orebodies were widely separated by a fault.

T. A. RICKARD.

London, June 20.

The British Language

The Editor:

Sir—In your editorial on the British language in the issue of March 9, 1912, the sentence in parentheses, "(The Horse-Shoe and Ivanhoe lodes are frequently disturbed by slides)", is mine. "Lode disturbed by slide" is from the mine cable to London. I just wished to point out this feature of these two mines. Yet, I quite agree with your comment on the word 'slide', and will use the correct word, 'fault', in future.

In mixing with miners and millmen some peculiar phrases are heard. In West Australian mills, especially the roasting plants, a great quantity of sulphates are precipitated from the circulating waters in pipes, pans, agitators, and the like. This forms a hard slaty scale, which is easily removed. The men invariably call this corrosion. Why, I do not know; and I have often explained to them that when corrosion goes on, something is being eaten or worn away. Scale is as handy a term for this material as can be found. Tautology is heard all day long, whether at work or in town. The term 'running' is commonly used in a mill. The engine, crusher, battery, pan, tube-mill, or pump is 'running.' Why not working? Also, the solution 'runs' down the launder, or the pulp then 'runs' to the agitator. Why not flows? Men and animals run, not liquids.

"When do you reckon to get going?" is often heard in reference to starting a new plant, or any particular machine which may be under repair.

I am glad to say that few of the men I meet use the plural on slime, sand, concentrate, or middling. A collective noun of this type requires no 's' to indicate the plural; besides, it sounds better without. The drive-ropes on an engine are often spoken of as 'cables.' Ropes is the correct term. One speaks of ship's cables, and sometimes cables for transmitting electric power. In one dry-crushing plant in which I worked, everybody, from mill manager down, spoke of the dry-crushed ore as 'pulp.' "The pulp-bins are nearly full.' Why not fine-ore bins? I never used the term, but could not break anybody of the habit; in fact at first my use of 'fine ore' was not understood. A mixture of water or solution with crushed or ground ore, I call pulp. Nothing else.

'Re-precipitation' has always been a mystery to me. Why the 're'? This means again. Nothing has been precipitated again. If a solution has dissolved the gold from the slime in an agitator, or other machine, and through some cause there is a loss of gold, this has not been re-precipitated, but simply prematurely precipitated, before it reached the precipitating-boxes. These are a few local failings not mentioned in that useful little book, 'A Guide to Technical Writing.'

KALGOORLIE CORRESPONDENT.

Kalgoorlie, May 6.

Free Use of Timber From Public Lands

The Editor:

Sir—In the issue of June 22, Ernest V. Orford criticizes as erroneous a 'Concentrate' item on use of public-land timber which was taken from my book on mining law. The public-land laws regarding the use of timber are as much of a 'hodge-podge' as some of our other public-land laws have become since the radical conservationists of the East and the sane (?) conservationists of the West began pulling in opposite directions. My statement was prepared from some experience and from close association with those engaged in overseeing the use of public-land timber, both in the field and at Washington. Therefore, I consider it very accurate, notwithstanding that it varies somewhat from the interpretation of Mr. Woodbury. A new set of timber regulations relating to Alaska was drafted last winter. These will not really alter the old conditions, only reduce to some extent the amount of timber allowed. This is strictly 'progressive' and in line with the idea that the natural resources are much more valuable in 'poor Alaska'—as some of us have come to term it—than in the United States proper.

H. W. MACFARREN.

Williston, North Dakota, June 29.

ALASKA miners have had much to contend with in their efforts to discover ore, but the first comers have developed great ingenuity in monopolizing a creek, once a discovery is made. There being no limit to the number of claims that can be staked, and power of attorney being recognized, only the amount of wood available and the length of the telephone directory at hand has determined the territory covered by 'association claims.' At Aniak they have gone even further. The men first on the ground covered the creeks with claims. These they promptly leased to themselves. The newcomer, therefore, who wants a 'lay' must content himself with a sub-lease. Such a system must operate to limit development except where the discovery is so obviously rich as to lead men to take even unfair chances in the effort to develop a mine.

Special Correspondence

NEW YORK

NEWS FROM THE COPPER MINES.—A LARGE COMMISSION.—TONOPAH.—MARKET RUMORS.

The directors of the Tennessee Copper Co. have declared a dividend of $1 per share. The last dividend was paid in February and was at the rate of $1.50 per share. The directors failed to state the period which the present disbursement covers, and the annual rate is consequently left in doubt. The stockholders of the Ohio Copper Co. have voted in favor of the reorganization plan under which the holders of the old stock are permitted to exchange their present holdings on the basis of share for share of new stock upon the payment of $1 for each share of old stock held. The new stock is issued as having $3 paid on a par value of $5. This will give the company a call of $2 per share upon the stock, and amounts to an ability to assess without going through a reorganization. The $2,000,000 mortgage given to secure the bond of the La France Copper Co., covering the Lexington mine, the Basin reduction plant, and several mining claims at Butte, is being foreclosed by the Lincoln Trust Co. The suit for a receiver to take charge of the Stewart Mining Co. is soon to be heard in Boston. Besides asking for a receiver, the plaintiffs are demanding that a large amount of treasury stock be returned to the company as having been wrongly issued to F. A. Heinze and his associates, and also demand an accounting from each of the defendants.

There is a well defined rumor that the Utah Consolidated is to cease operations. Should it do so, it is probable that the plant of the International Smelting & Refining Co. at Tooele, Utah, will become exclusively a customs smelting plant. There is hardly a property in the country that has gone through all stages of mining activity any more completely than Utah Con. Originally opened as a gold mine—and a very real one—it later developed into what was then the world's lowest-cost copper producer. The recent addition of lead stacks to the plant at Tooele was made for the purpose of taking care of the lead ores that were being developed in Utah. The shares of the First National Copper Co., which controls the old Balaklala, and which was at one time one of Lawson's market features, have been exceedingly weak in the New York market on the strength of a report that a large part of its fuel and mine supplies has been sold to the Mammoth Copper Co. N. L. Amster, of Boston, has started shipments from his R. R. R. property near Patagonia, Arizona, to the Copper Queen smelter, and is sending out one carload per day of 10% ore.

L. D. Ricketts, of the Greene-Cananea, and W. D. Thornton, also a part of the Cole-Ryan forces, are both at the Inspiration property on a tour of inspection. Inspiration is looked upon as a possible factor in some coming consolidations, and it is believed that the controlling interests are not endeavoring to bring it to the point of production in record time until some additional properties shall have been secured.

Recently the workmen employed by Henry C. Frick began tearing down the old Lenox Library in Fifth avenue, New York, which was erected in 1865. The copper roof was found to be as good as when it was placed on the building. When the roof was purchased, copper was selling as high as 50c. per pound, and the cost of the copper sheets was considerably in excess of that figure.

The amount of interest that prevails in the Cobalt issues is evidenced by an inquiry made by one broker of another for a market in Nipissing; the quotation was given $7.62 to $7.87, 100 shares sold during the entire week. The company is in a strong financial position and has over $1,000,000 of cash reserve. Nipissing is now doing some of its exploratory work with a hydraulic giant. David Fasken, one of the leading members of the legal profession in Canada, has brought suit against the McMartin-Timmins-Dunlap syndicate for a commission of $640,000 which he claims he earned in the sale of the La Rose to E. P. Earle, William B. Thompson (of Thompson, Towle & Co., of New York), and their associates. The contention of the defendants is that Mr. Fasken's services were only those of an attorney and that he was not acting as selling agent for the property.

Tonopah issues have been a feature of the New York mining market. The fire which destroyed a part of the business section of the camp gave the bears an opportunity for a little action, but when it was learned that no mining property was destroyed the market quickly regained all lost ground. Traders in Butte & Superior were somewhat stampeded at a story that litigation on the company had been started by W. A. Clark, who owns the adjoining Elm Orlu property. Mr. Clark was one of the original owners of Butte & Superior, and it is not believed that any question will arise that cannot be settled without resort to the courts. D. C. Jackling is now making an inspection of the Butte & Superior and is to go from Butte to Alaska in behalf of the Guggenheim interests there. The Isle Royale and the Lake Copper Co. interests, headed by Reginald C. Pryor of Houghton, Michigan, have organized the Onondaga Copper Co., holding some 10,000 acres of ground adjoining the White Pine property.

BOSTON

BRADLEY PROCESS AT BUTTE.—UTAH COPPER PUZZLING.—BIDDING FOR THE BLUESTONE.

Boston is waiting and watching for the real news from the Copper Extraction Co.'s experiments at Anaconda on the slime of the Anaconda company. The Copper Extracton Co. is the name of the company operating the Bradley process, which is owned by the inventor, Mr. Bradley, and A. C. Burrage and Thomas W. Lawson, of this city. Mr. Burrage financed the building of the experimental plant at Anaconda, and has a representative at Anaconda watching the experiments. The plant has been shut down from time to time to make repairs and readjustments, so it has been hard and slow work finding out what is going on. It will be remembered that the Bradley process is the one which Lawson brought out with a great flourish of trumpets three or four years ago to begin treatment at the Santa Rita (now the Chino) mine. He afterward stated that the Heinze interests in Ohio Copper were securing from him the rights to use the process in treating its low-grade ore. He exploited the new process extensively in newspaper stories and then it dropped out of sight until it came to light again in connection with the experiments with the Anaconda slime. The plant which Mr. Burrage has built at Anaconda has a capacity of 250 tons per day. The Anaconda company has over 1,000,000 tons of slime piled up at the Washoe smelter carrying about 2¼% copper and about $1 per ton in gold and silver. This is promising material for copper extraction when it is recalled that it is about the average of the recovery of the large mines in Nevada, Utah, Arizona, and New Mexico.

There are two opinions in Boston regarding Utah Consolidated. The *News Bureau* faction is bearish upon the issue, while G. L. Walker of the *Boston Commercial* claims to have "information from authentic sources that Utah Consolidated will have a very profitable year." Mr. Walker may be considered somewhat in the line of a specialist on Utah Consolidated, since he led the insurgent fight, two years ago, to take the management away from Urban H. Broughton. The *News Bureau* printed a story that underground developments at the Utah Consolidated continue to be disappointing and that there were rumors in the West of the mine being shut down. The *Boston Commercial* telegraphed R. H. Channing, Jr., at Salt Lake City, and received a denial of the story, which is published. Utah Consolidated has been, in the language of the Street, a 'bad actor,' and market interests here are prepared to hear and believe the worst about it. It has been going from bad to worse so long that traders associate the name

of this one-time show property of Bingham with slow but sure disaster.

"Bluestone, Bluestone! Who's got the Bluestone?" A variation of the old nursery game is going on in the bidding for J. R. De Lamar's copper mine, the Bluestone, at Yerington, Nevada. It has been published in the East more than once that this property is to be taken over by the Mason Valley. It is said that the Gunn-Thompson interests have agreed to pay Mr. De Lamar $1,500,000 for the property. I met the representative of one of the large interests of the Yerington district here a few days ago, and he told me in confidence a story quite to the contrary. He says the ownership of the Bluestone is to pass in that district, but not to the Mason Valley. The Bluestone, while inactive, has been one of the notable copper prospects in the West for the past six years. The bluestone from this mine was shipped 60 years ago to the Comstock, 35 miles away, to be used in milling the silver ores there. Mr. De Lamar has spent approximately $350,000 in developing the Bluestone mine. It has been opened to a depth of 540 ft., and drilling operations have been conducted to a depth of 750 ft., proving that the ores go that deep. The Bluestone claims developed ore amounting to 1,600,000 tons, averaging 2.6% copper. Magnetic separation tests have demonstrated that a saving of over 98% of the copper can be obtained, yielding a self-fluxing produce which averages over 15½% copper. The Bluestone is an interesting mine, and Boston would like to see it acquired and amalgamated by one or the other of the dominant interests in Yerington, so that it would no longer be inactive. I believe there will be a spirited contest to secure control of this property, and it is by no means settled that the Mason Valley interests will get it.

LONDON

PODEROSA MINE UNPROFITABLE.—UNFAVORABLE WORKING CONDITIONS.—MINERAL OUTPUT OF FEDERATED MALAY STATES.

The Poderosa copper mine has been one of the unsuccessful English speculations in South America. A company was formed in 1908 to acquire the mines from local owners, situated in the Collahuasi district of Chile, not far from the Bolivian border. The management of the properties was placed in the hands of Robert Hawxhurst, of San Francisco, who was subsequently succeeded by C. H. MacNutt. Results have been disappointing, owing to the many difficulties of working and to the unsatisfactory nature of the orebodies. The altitude, 15,000 ft., the climate, the cost of transport, and scarcity of supplies, all have combined to hinder energetic operations. The flooding of the mine in March 1911 seriously interfered with work, and the provision of additional pumps was a tedious affair. In addition, the last wet season and the winter were both unusually severe and long, and their effects on the health of the men and on the condition of the mine were disastrous. Not only did the production fall, but the cost was increased. The amount of ore exposed recently has been disappointing, and a large proportion of the output during 1911 came from the auxiliary veins which at best are narrow and irregular. During the year 18,357 long tons of ore was raised, of which 15,577 tons came from the Poderosa and the remainder from the San Carlos and Rosario mines. The average assay was 17.3% copper. In addition, 27,776 tons averaging 3% copper was raised and placed on the dump for future concentration. The shipments were 13,392 tons averaging 22% copper and 7½ oz. silver; this was sent by rail to the port of Mejillones, whence it was forwarded partly to America and partly to Europe. The ore reserve on December 31 was calculated by Mr. MacNutt at 21,000 tons averaging 22% copper, mostly at the Poderosa and San Carlos. In addition, there is 110,000 tons on the dump averaging 4½% copper. The net proceeds from the sale of ore was £112,707. The mining expense was £105,947, and £19,649 was allowed for depreciation. The loss for the year was £16,995, which brings the debit balance to £47,033. The financial outlook is therefore decidedly discouraging.

The output of the Federated Malay States mines in 1911 is summarized in the report of the Warden of Mines, recently made public. The total tin output of the year, 44,149 tons, was reported earlier, and the additional statements furnished by the Warden are somewhat lacking in detail, as is but natural, since the tin industry is so largely in the hands of the Chinese, who are not anxious to furnish accurate figures. Of the 196,500 men employed in mining, 189,000 are Chinese, 4600 Indians, and 2500 Malays. The year's output in piculs[1] of some of the larger companies is as follows: Tronoh, 64,780; Pahang Con., 18,181; Serendah, 9070; Kampar, 8645; Tambun, 8092; Lahat, 7403; Kalumpang, 5447; Batang Kali, 4959; Chenderiang, 4306; Roman Tin (vein), 4069; Menglembu Lode Syndicate (vein), 3833; Société des Elains de Kruta, 2344; Sun Wen, 2705. The North Tambun and Khan Kellas companies have installed Australian dredges, but did not start in 1911. Several French and German companies are in process of development. The production of tungsten was 2816 piculs, valued at £84,500 (local currency). The gold output was 9228 ounces, a large decrease, owing to the decreased output at Raub, only 8581 ounces.

PIOCHE, NEVADA

RAILWAY OPEN.—SHIPMENTS RESUMED.

The railroad spur, 8½ miles long, recently built by the Prince Consolidated Mining Co. from Pioche station to the Prince mine, was opened on June 30. A special excursion came from Salt Lake City to take part in the ceremony of driving the golden spike, with appropriate speechmaking. In this excursion were represented a majority of the business interests of Salt Lake City, especially the banks, smelters, attorneys, brokers, and many commercial houses. On the train that went out to Caliente, carrying the excursionists Monday afternoon, were 23 cars of ore furnished by the Prince Consolidated, 12 cars from the Prince and 11 from the tailing dump at Bullionville.

PRINCE CON. SHAFT, PIOCHE.

The control and management of the Prince Consolidated still remains with the Godbe brothers, but an option on the control of the stock has been given to a syndicate including Charles E. Knox of Tonopah, John Kirby of Salt Lake City, George Wingfield of Reno, and others. A payment of $20,000 has been made on this option, which will undoubtedly soon be exercised and the management pass to the new owners. Nearly forty years ago W. S. Godbe came to Pioche, saw what the camp had done, and determined to have his part in the riches which he foresaw must

[1]The picul = 133 pounds.

still be here. He first purchased the tailing dump at Bullionville, and began the campaign which has now reached fruition. At present about 300 tons per day is being shipped from the Prince, and an average of perhaps 400 tons from the tailing beds at Bullionville. It is the expectation of the management to continue shipments from the tailing beds for a year, and to increase the Prince shipments soon to 500 tons per day. The Nevada Utah Mines & Smelters Corporation is beginning to straighten out its tangles. A number of the most embarrassing obligations have already been settled in cash. From these indications it is generally believed that Allen H. Rogers, engineer for the Nevada Utah, who recently made careful examination of the properties here, reported favorably.

KALGOORLIE, WESTERN AUSTRALIA

LABOR UNREST.—POOR RESULTS AT THE LANCEFIELD.—APRIL GOLD PRODUCTION.

There is a spirit of unrest among the mine and other employees in this state, as in every country in the world. No sooner was the engineers' dispute settled than the molders went out, though they returned under old conditions after losing eight weeks' pay at £5 to £5 1d. per week, besides overtime. The union called out the only three molders employed on the Lancefield mines, with the result that Bewick, Moreing & Co., who were praying for an excuse to close down the mine, promptly did so, and threw 450 men permanently out of work. The shovelers and trammers on the recently started Yuanmi struck for an advance from 11s. to 11s. 8d. per shift. As only 18 men were affected, the extra 8d. was granted and the men signed a three-years agreement on that basis. All the industrial agreements at the Kalgurli expire on September 30 on a month's notice on either side. The men are already holding informal meetings, and the trammers and shovelers will claim higher wages. The former have the worst job in the mine, as they are the first to return after firing, run the greatest risk of miner's complaint from smoke, fumes, and dust, and also are most commonly exposed to falls of ground. Even if a raise in pay is granted, it is more than probable that nine-tenths of these laborers will desert the mines for work on the transcontinental railway which may start any day. Their places will be filled by Austrians and Italians, who have been immigrating in large numbers, expecting to work on the railway. The present Labor Government intends giving preference to union men, even for clerical work, and this will debar foreigners, who rarely join local unions. The railway will require two or three years to build, and employ hundreds of men, and as many of these will be prospectors, new gold and mineral fields may be found in hitherto inaccessible country.

The Lancefield, after producing £830,000 from 540,000 tons at a loss, has closed down, and it is hard to say when it will be reopened. The vein varies from 25 to 28 ft. in width, and the ore yields over 30s. per ton, but costs have been about one-sixth more; treatment alone costing 17s. 6d. per ton. The mine was originally equipped with a 40-stamp mill, but when the sulphide zone was reached the ore was so impregnated with arsenopyrite that extraction without roasting was found impossible. New capital was raised to the extent of £60,000 and a roasting plant constructed, but the design, although a copy of that on the South Kalgurli, was so faulty and the construction so poor that the roofs of the furnaces collapsed almost at once, and work had to be stopped. More capital was raised and the plant remodeled, but a faulty plant can never be remedied, and an entirely new plant will probably have to be provided at a cost of another £50,000 or £60,000. The vein at 1000 ft. is over 20 ft. wide and assays over 40s., so that there are great possibilities in the mine, if an economical plant is installed.

The Mountain Queen at Southern Cross, one of Bewick, Moreing & Co.'s mines, started crushing with a 2-head Holman pneumatic stamp in January, and the output gradually increased until in April 3735 tons was treated, yielding £3446 at a profit of £1129. The ore is soft and oxidized, and the tailing consists almost entirely of slime carrying nearly as much gold as has been saved. A Cassel's vacuum slime-plant has been ordered, and should more than double the profit. The ore developed above 200 ft. is estimated at 58,500 tons, worth 34s. 6d. by assay. The Queen of the Hills, another Bewick, Moreing & Co. new venture, is developing well. Above the 160-ft. level 70,800 tons assaying 53s. 11d. has been developed, and sinking is in progress. This mine will also be equipped with a Holman pneumatic drill and a suction gas-engine, similar to the Mountain Queen, but there seems to be some difficulty in raising the money at the moment. Bewick, Moreing & Co.'s operations at Porcupine have not been a success, nor their oil ventures at Maikop, in Russia, and at present they are opening an old mine in California, all of which requires capital.

During April the gold mines of Western Australia produced 107,392 ounces fine, and paid £108,219 in dividends. The chief producers were:

Name.	Tonnage.	Value.	Profits.	Dividends.
Great Boulder	17,702	£46,972	£25,807	.....
Ivanhoe	20,330	38,895	16,035	£70,000
Kalgurli	10,310	21,296	9,075	.....
Gwalia	12,020	19,016	3,056	24,000
Lake View & Star...	17,704	21,080	3,580	10,000
Oroya Links	11,010	13,395	3,373	.....
Black Range	2,227	7,520	3,061	2,719
South Kalgurli	9,351	11,975	2,683	.....
Oroya Black Range.	4,700	8,497	2,644	.....
Burbanks Main Lode.	1,700	4,500	2,330	.....
Mararoa	2,636	5,375	2,175	.....
Yuanmi	4,280	8,741	4,089	.....
Golden Horse-Shoe..	24,269	33,948	1,905	.....
Golden Ridge	2,936	5,269	1,751	.....
Perseverance	20,758	21,242	1,410	.....
Sand Queen	924	2,885	1,249	1,500
Ida H.	1,100	4,187	1,460	.....
Associated	10,530	14,096	1,723	.....
Lake View Consols..	8,820	7,722	600	.....
Mountain Queen ...	3,735	3,446	1,129	.....
Boulder No. 1.....	2,392	2,650	691	.....
Hainault	5,622	6,487	504	.....
Great Fingall	5,557	10,192	1	.....
Associated Northern.	1,282	4,117	.....	.....

BRITISH COLUMBIA

REPORT OF THE MINISTER OF MINES.—PROGRESS IN SLOCAN DISTRICT.—MINING AT AINSWORTH.

The annual report of the Minister of Mines for British Columbia for the calendar year 1911 was issued by the Provincial Department of Mines on July 3. The preliminary review and estimate issued by the department early in the current year showed $23,211,818 as the estimated value of the 1911 mineral production. The revised returns included in the Annual Report give the value as $23,499,072, so that the estimate of the provincial mineralogist, published shortly after the close of the year, was only $287,256 short of the actual total value for the year. The report contains much of interest apart from the statistical information. Several of the gold commissioners of the province give particulars of mineral claims and mining operations in their respective dstricts, and the provincial mineralogist contributes reports and compilations of data on various districts and some important mines, notably a number in Slocan district, the Britannia mine, the Skeena district (both mineral claims and coal areas), and others. His notes on French's process for the separation of zinc and lead, and on investigations made in connection with the reported discovery of metals of the platinum group in dikes in the vicinity of Nelson, are of particular value, since they will serve as a warning to the public to be

careful before spending money on them until the reliability of statements made in connection with these matters shall have been thoroughly tested. The report gives particulars of the French zinc process, and some results of investigations made, but adds that the department "has made no attempt to test the commercial value of the process, but has made some investigation as to the principles involved." The results of these investigations, it may be added, do not indicate complete success of the process. As to the platinum, samples of the dike and concentrate were supplied by the mining company chiefly interested and vouched for "as being from the dike, and from that part of the dike reported to have given results in platinum metals." Identical samples sent by the department to eminent chemists in London and New York, as well as to the laboratories of the Geological Survey of Canada and the provincial department of mines, were reported on, without exception, as not containing any of the platinum metals. The concluding paragraph in the official account of this investigation runs thus: "As will be seen by the evidence just given in detail, this bureau has tried impartially to ascertain whether there is any foundation of fact in the alleged discovery of the platinum metals in these dikes, but the conclusion which must be arrived at is that they do not exist in the material tested. Should it be claimed that these metals do exist in other dikes in the vicinity, that fact will have to be thoroughly established before it can be accepted."

Mining in the Slocan district of West Kootenai appears to be on a better basis now than at any time for a number of years past. In the vicinity of Slocan lake, at what is known as Fourmile or Silverton, there is much activity in three mines, namely, those of the Standard Silver-Lead Mining Co., Van-Roi Mining Co., and Silverton Mines, Ltd. During six months to July 1 the Standard has shipped to the smelter at Trail about 4800 tons of sorted ore and silver-lead concentrate. Its mine and concentrating mill are being regularly operated. Results are profitable, for in April a dividend of 1¼c. per share was paid on the company's 2,000,000 $1 shares, while in May, June, and July dividends, each of 2½c. per share, have been paid. The total amount distributed in the four months is $175,000. It has been announced that it is expected the company will be able to pay a monthly dividend totaling $50,000 for some time to come. The Van-Roi mine appears on the published list as having shipped 1500 tons of silver-lead concentrate during the first six months of this year. This company also makes a silver-zinc concentrate, but no information has been obtained as to its quantity. Recent reports are to the effect that another orebody has lately been found in the mine. The Silverton Mines, Ltd., has had the misfortune to be deprived of the use of the Wakefield mill, which has been destroyed by fire. The company leased this mill, and it had been engaged in experimental milling for some time, to determine how best to recover the high silver content of its Hewitt-Lorna Doone mine ores, some of which are rich in ruby silver.

The most satisfactory development in the Slocan district of late has been the finding of high-grade ore on the 1400-ft. level of the Rambler-Cariboo mine, in McGuigan basin. Large shoots of ore of excellent grade has been opened on various levels down to the 1200-ft., but similar ore had not heretofore been found on the lowest (1400-ft.) level. Construction of an aerial tramway from the mine down to the new millsite alongside the railway, and equipment of the concentrating mill, are in progress. The branch railway is nearing completion also, and it is expected that in the ensuing autumn shipment of sorted crude ore and silver-lead concentrate will be considerable.

More information concerning mining in Ainsworth division will be given later. Just now the position must be briefly summarized. At Retallack & Co.'s mine (the old Whitewater property) development of orebodies found during the winter is being pushed, in readiness for shipment of ore as soon as the railway shall be available for its transportation. The Utica, also, is awaiting similar facilities for sending its ore to the smelter.

PORCUPINE

PORCUPINE MILLS AT WORK.—SALE OF THE SCOTTISH ONTARIO.—DEVELOPMENT NOTES.

At latest accounts the four mills at the Porcupine were all being satisfactorily operated, with, of course, occasional interruptions for adjustment of machinery. The management of the Dome continues to pursue its policy of reticence as to the results of milling operations, and the others have so recently got fairly under way that accurate figures as to the output are unavailable. Estimates give the daily tonnage of ore handled by the mills at 615 tons, and the aggregate value of bullion produced at from $40,000 to $50,000 per week. The Dome is shipping bullion at regular intervals and its output is supposed to approximate $3000 per day. The Hollinger made its first shipment of a brick worth $5000 on July 6. It is only treating lower-grade ore until the mill is perfected. The Vipond is only working a little more than half capacity and has not so far made a clean-up. It has now 6000 tons of medium-grade ore on the dump, and stoping from the 200-ft. level to the 100-ft. level is in progress. The Jupiter is in good ore at the 100, 200, and 300-ft. levels. On the second level four veins have been found, two of them having visible gold. The Hughes is in full operation again, having completed its new compressor and steam plant. The shaft will now be sunk to the 200-ft. level and cross-cutting and driving undertaken at 150 and 200 ft. A new 6-drill compressor has been ordered for the McEneany, on which a vein 5 ft. wide at the 300-ft. level is yielding ore worth about $25 per ton. Negotiations for a sale of the Scottish Ontario to British capitalists are pending; engineers, who examined the property for the prospective buyers, having reported favorably. Peter McLaren, the engineer in charge, has gone to London in connection with the deal. The McIntyre is in rich ore at 300-ft. level in No. 1 and 4 shafts. The Plenaurum has cut a quartz stringer 3 ft. wide, running at right angles to the main vein at the 200-ft. level. Free gold shows in a small streak. The Miller, Middleton, and Dixon-Gillies claims are being rapidly proved. At the former there is a 125-ft. ore-shoot that will average $6 per ton. At the Dixon-Gillies three veins of high-grade character have been cut at depth.

PROSPECTING AT PORCUPINE.

General Mining News

ALASKA

Cordova

Shortage of labor at the Kennicott mines was reported recently. The new concentrator is running night and day, and shipments have begun. The crude ore is said to assay 25% copper, while the concentrate contains 65% copper and 18 oz. silver. W. H. Seagrave, the manager, has also started men at work on the Jumbo.

Fairbanks

Additional information regarding the tin ore found near Hot Springs has been made public. Stream tin here attracted attention of Falcon Joslin, three years ago, and at his instigation a Mr. Robinson took up the search, which has now resulted in the discovery of an important tin-bearing lode crossing Sullivan, Tofty, and Idaho gulches. The average width of the lode is 12 ft., and the orebody has been traced by trenching 3700 ft. The dike with which it is associated has been followed 10,000 ft. The average value of the lode has not been determined, but the ore is obviously of workable grade.

Seven stamp-mills are now in operation in this district and freight receipts on the railway have increased 34% over the corresponding month of 1911. Angus McDougall is buying a 2-stamp Nissen mill to be placed on the Pioneer claim. The Newsboy shaft is now 400 ft. deep and the grade of ore continues satisfactory.

Nome

The season opened with a rush, June 15, with the *Senator, Victoria,* and *Umatilla* in port. The *Edith* and the *Sheridan,* the latter carrying troops, got caught in the ice and were delayed for some days. Twelve new dredges are reported as arrived or on the way, and of these four will be built by the Union Construction Co., one by the Yuba Construction Co., two by J. S. Kimball, two by American Construction Co., and one by the Union Iron Works.

Seward

(Special Correspondence.)—Conditions in the interior are unusually favorable, the season having opened several weeks earlier than usual. The Gold Bullion Mining Co., which is mining a high-grade gold-quartz vein on Craggy creek, a branch of Willow creek, and 35 miles from Knik, began milling June 1. The plant includes seven stamps and is in charge of W. E. Bartholf.

Seward, June 5.

The Kenai-Alaska G. Co. has ordered from the Trenton Iron Works an 8200-ft. tramway which is to be in operation about August 1. The Rotchford dredge of the Kenai Dredging Co. has been started and is reported to be working satisfactorily. Placer work is active on Stetson creek. Harper Bros. are now ready to pipe into the boxes. The ground was prospected last year. The Kenai M. & M. Co. has discarded the Ruble elevator and will also pipe direct into boxes. Hobson & Davis are hydraulicking on Bear creek and have already cleaned up $3500. Nutter & Dawson have 14 men at work on Cow creek and have been piping for several weeks. Nels Anderson and Nate White have completed a 500-ft. drainage adit on Lynx creek, and Adolph Young, who has been working alone on Gulch creek, while short of water, reports an average of $11 per day. Mike Connolly and J. A. Z. Turner are busy on Six Mile creek, and John Hirshep, on Palmer creek, is getting ready to mill the rich quartz discovered last fall.

ARIZONA

Gila County

(Special Correspondence.)—At the McMorris mine in Richmond basin, 8 miles northeast of Globe, the 800-ft., 2-compartment shaft has been retimbered to the 200-ft. level. The McMorris mine was a producer of rich silver ore in the early days of Globe, when only the highest grade ore could be shipped. The mine is being operated by the White Metal Development Co., of which the principal stockholders are H. B. Snell, R. B. Hegardt, W. D. Fisk, A. W. Crawford, George Wilson, and others. Mr. Wilson is superintendent. Beautiful specimens of wire silver have been taken from the group of claims being worked by the Rice brothers and W. D. Fisk, 8 miles north of Globe. The ore occurs as a 2-ft. vein in diabase, and consists of native silver, hornsilver, and a mixture of copper and silver glance. At the Iron Cap Copper Co. the general manager, F. A. Woodward, has been authorized to proceed with development, and driving will be started west on the 800-ft. level of the Williams shaft.

Globe, July 13.

Mohave County

At the Tom Reed mine the clean-up for the month yielded a bar worth $79,000. The electric hoist is now in operation and the mill capacity is being increased. The Gold Road is producing a $20,000 bar at each weekly clean-up. The new machinery for the addition to the mill is expected within two months, and the water supply is now sufficient for a 500-ton mill. W. H. Hall is operating the Mocking Bird, in the Weaver district, and has developed a good quality of $15 to $80 ore. The mill is expected to be in operation soon.

Pinal County

(Special Correspondence.)—The Lake Superior & Arizona Mining & Smelting Co. has given an option on its property to the American Smelting & Refining Co. The holdings consist of 17 claims adjoining the claims of the Magma Copper Co. at Superior, 30 miles west of Globe. The A. S. & R. Co. is given until October 20 to unwater and examine the mine, after which, should it so elect, it is given two years in which to develop the mine and make the payments. The purchasing company has the choice of making total payments of $400,000 cash and two-fifths of the authorized capital stock of the company which it shall organize to operate the mine, or, under an alternate plan, of $800,000 cash if it elects to purchase the property at the end of one year or $1,000,000 cash at the end of two years. F. W. Hoar, of Globe, represents Lake Superior & Arizona company, and J. Kruttschnitt, Jr., representing the A. S. & R. Co., has gone to Superior to make preparations for unwatering the mine. The property is opened by an inclined shaft 1300 ft. deep and has about four miles of drifts. There is a considerable amount of oxidized ore exposed, averaging about 4% copper, and $50,000 worth of higher-grade ore was shipped from one stope, but it is upon the possibility of opening up sulphide ores at depth that the future of the mine depends. Sulphides were beginning to appear at the bottom of the shaft when the mine closed down, on account of lack of funds, three years ago.

Florence, July 13.

Negotiations are being made for the sale of the Mammoth mine to the American Vanadium Co. The property was formerly a rich one, but has not been worked for over ten years.

Santa Cruz County

M. P. Freeman, of Tucson, has bonded the Black Diamond and Isabel properties, in the Santa Rita mountains, to Fred Challman, of Bisbee. Shipments of good ore carrying lead, silver, and copper are being made to El Paso. James Harrington, of Bisbee, has leased the property of John Allen and Ed. Castañeda, in the Sheedy district, and is shipping ore to El Paso. At the Elephant Head property an air-compressor has been installed, and work on a 1500-ft. adit will be started at once. The Border Mines Co. has found good ore in the Austerlitz property and has a 3-stamp mill at work on $5 to $20 ore, and is shipping two to three tons of concentrate, worth $80 to $100 per ton, per day to El Paso.

Yavapai County

(Special Correspondence.)—The Swansea smelter will

blow in in a few days, after some months of inactivity due to financial difficulties. About five carloads of ore per day will be shipped to Swansea from the Bluebell mine, and an equal amount shipped to the Humboldt smelter from the Swansea mines, as each needs the other's ore for fluxing purposes. The Yuma-Warrior Mining Co. has acquired the old Harqua Hala property and will immediately begin development. A. J. Pickerell reports that the adit on the Tillie-Karbuck group on Slate creek is in 2000 ft. and has cut a number of good ore-shoots. The new machinery on the Commercial Mining Co.'s property in Copper basin is in place and will be ready to run in a few days.

Prescott, July 13.

Yuma County

Work has started at the Horn mines, in the Turtle mountains, southeast of Parker, which were recently taken over by W. A. Clark. J. W. Fink, manager for the D. & W. Mining Co., has recommended to the shareholders that a mill should be built. Five levels have been opened, to a depth of 700 ft., and 3500 ft. of underground work has been done. Rich ore has been found on the Fortuna group and development is in progress. It is reported that Frank Bowers has sold his potash claims, near Blythe Junction, for a large sum.

CALIFORNIA

Calaveras County

(Special Correspondence.)—A new shoot of quartz has been intersected by the prospect winze at the Cross mine. The find was made at an approximate depth of 1000 ft. Ore conditions are stated to be improving at the Gold Cliff. Both these properties are controlled by the Utica Mining Co. A winze has been started at the Angels mine and will probably be sunk to a depth of 200 ft. Fair-grade ore is reported. Development of the shoot recently found on the 900-ft. level of the Lightner is progressing steadily. The orebody is reported widening, with ore of milling grade. It is understood that the shaft will be sunk to a depth of 2000 ft. before systematic stoping is commenced. The starting of the mill at the Smyth has been delayed by the burning out of a transformer. Free gold and sulphides are showing as the wide vein is opened. The North Star management is driving drifts to prospect the southern portion of the property. Unwatering of the Reiner gravel mine is progressing, and it is expected to clear the workings within ten days. Sinking will be resumed and drifts extended to the centre of the channel. San Francisco people are interested. Placer mining in the vicinity of San Andreas is active. Work has recently been resumed at the Reed, Chapman, and Cassinelli properties, and plans are under way for reopening the Lloyd. A new shaft is being sunk at the Reed, and good gravel is said to be showing in the Chapman workings. It is rumored the Penn Mining Co. may experiment with a new process for smelter-smoke control at Campo Seco in addition to continuing tests with the Thiogen process. The Calaveras Copper Co. is increasing the force of miners at its Copperopolis mines, and it is expected the smelter will be blown in before the end of August. The company reports a large tonnage of excellent grade ore developed. The deposits have been proved to a depth exceeding 600 feet.

Angels Camp, July 13.

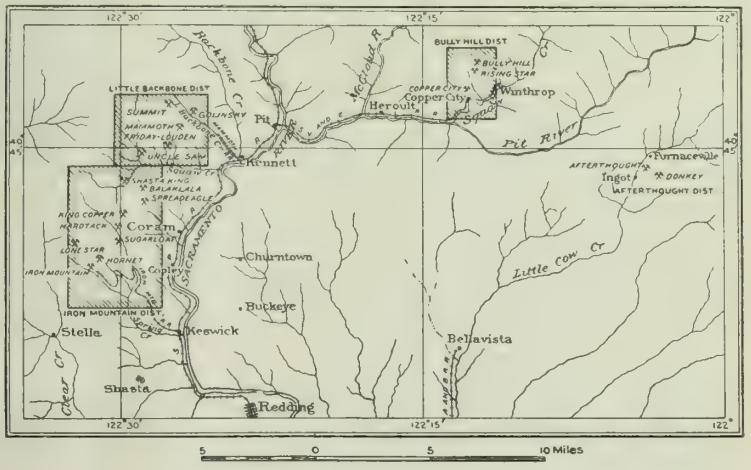
Modoc County

(Special Correspondence.)—A 2-ft. ore-shoot, assaying $18 to $125 per ton, is reported showing in the surface workings of the Gold Shore. The work is in charge of Fred Bell, formerly with the Goldfield Jumbo Mining Co. The Ft. Bidwell Con. Mines Co. has overhauled its 10-stamp mill and made arrangements for Pierce amalgamators and Wilfley concentrators. It is understood that a cyanide plant is also planned. Sampling of the old workings is progressing, and plans include the sinking of the shaft to a vertical depth of 400 ft. About 30 miners will be employed before the end of July, according to present plans. This company has developed a fair reserve of milling ore in the Mountain View and Sugar Pine claims and controls an extensive acreage. Detroit and Los Angeles people are interested. It is stated that $50,000 is available for preliminary operations. Four sets of lessees are preparing to start work on the Big Four. Several surface discoveries of promise have been made. Fitful falls of snow have somewhat interfered with work in the district, particularly on the northern slopes.

Ft. Bidwell, July 12.

Shasta County

The Afterthought Copper Co. has purchased the Anderson-Bella Vista railroad from the Terry Lumber Co. and is now completing a survey for the extension of the road to its smelter at Ingot. The new railroad company will be known as the California, Shasta & Eastern Railway Co., and location surveys are completed for the first six miles above Bella Vista. The surveyors are now making the necessary corrections and completing their surveys for the upper six miles preparatory to accepting bids. At the mine the company has only a small force of men at work keeping the mine in repair and doing a small amount of development work. The construction of the road and a suitable reduction plant for the recovery of zinc, copper, gold, and silver are most important at present, as there is enough ore already developed to last for several years with a 300 or 400-ton daily capacity. At the smelter three or four men are at work developing a process for the recovery of metals. This has been developed beyond any doubt as to the advisability of adapting it to the treatment of the ores. As only two or three patents have been secured on this process, and several more are planned, it is kept private for the present. The company expects to install a 25 or 50-ton unit, in the near future, having tested the process out on only a 100-lb. capacity basis.



PART OF SHASTA COUNTY.

W. J. Moulton is superintendent. The mill at the Cleveland, near Downieville, is being overhauled and arrangements made for production. The property is held under bond by Nevada people. Activities have recommenced at the City of Six quartz property, which is under bond to J. W. Henderson of Fresno. The Hewitt brothers have started a 5-stamp mill on their property near Gibsonville. The vein is reported about 20 ft. wide, with streaks of good milling quartz opened.

Forest, July 13.

COLORADO

Clear Creek County

(Special Correspondence.)—A streak of ore 5 in. wide has been uncovered on the La Plata vein on Democrat mountain that mills 281 oz. silver and 16% lead. Shipments have been started. Joseph Broad is the owner. The American Mines Syndicate, operating on Columbia mountain, is moving the Sigafoos boring machine from the Georgetown adit to its own property. It is stated that the Kelly adit mill will be brought into commission during the next two weeks. The machinery is being repaired and placed in condition to effect a higher saving than formerly. Ore will be treated from the New Boston mine on Democrat mountain. An average of 16 tons is being shipped daily from the Santiago mine in the East Argentine district. D. H. Burlingame is manager.

Georgetown, July 9.

Jefferson County

At the Colorado School of Mines a new 14-ft. Littrow spectrograph has been purchased, at a cost of $1500, through the Vinson Walsh research fund. This fund was given by the late Thomas F. Walsh for the determination and study of rare metals in ores. Because of its sensitiveness the spectrograph has been used to detect adulterations and many cases of poisoning. It has been used to a limited extent to study the flames from steel and copper converters as a means of gauging the different stages in the process. There is still a large opportunity for investigation in this direction. Through the Vinson Walsh research fund this department has already been equipped with all the necessary apparatus to determine radioactive metals. With the new specially constructed spectrograph the school is in a position to cover fully the entire rare metal field.

Lake County (Leadville)

The tonnage produced at Leadville during June was about the same as preceding months, 60,000 tons. There was a slight decline in production by lessees on account of surface water. This trouble has now abated, and the output should be larger during July. The dead-work at the Chrysolite, Fryer hill, is nearly completed, so that shipments of ore, which averages better than 30%, will be increased. Lessees on the south end of the Discovery are down to the 300-ft. level and have opened a pocket of high-grade 'lead sand.' Lessees in the Ella Beelar adit have found a good vein, 1800 ft. from the portal, which assays $40 to $50 per ton. The Anderson adit, on Prospect mountain, is now in over 500 ft. W. B. Anderson is manager.

San Juan County

The blacksmith shop of the Silver Lake caught fire recently, and before the fire could be extinguished the mine terminal of the tramway was destroyed, with a loss estimated at from $30,000 to $40,000. Shipments of ore during June were as follows: Sunnyside, 600 tons; Iowa-Tiger, 175; Silver Lake, 825; Gold Tunnel, 175; Golden Eagle, 25; Pride of West, 25; Bonner, 25; S. E. & M. Co., 25; Gold King, 1250; a total of 3125 tons.

IDAHO

Blaine County

The Independence M. Co. has obtained an injunction against the Wenatchee M. Co. to restrain the latter from interfering with the operation of the Independence mine and mill. At the Climax five men are now at work.

Idaho County

The clean-up at the Golden Scale placer has been completed, 32,000 cubic yards of gravel having been moved. A race has been cut to the old channel, which was found to be higher on the hillside than was expected. Where found it is 30 ft. deep and the gravel all shows colors. The company is now in shape to begin operation next spring without any dead work being necessary. Work on the 7-mile ditch, to take water from the East fork of the American river, is well under way.

Shoshone County

Earnings of the Federal M. & S. Co. for the first 9 months of the fiscal year are $633,700. Dividends are now being paid at the rate of 6%. The company is producing about 4000 tons of lead per month. The Tamarack & Custer Consolidated M. Co. has been formed to take over the Tamarack & Chesapeak and the Custer mining companies. The capital is $2,000,000 and 25,000 shares will be placed on the market. Both properties will be worked through the Tamarack adit. The lower adit at the Lucky Calumet has cut the vein and it is reported that the management will at once proceed with the construction of a 100-ton mill, to be later increased to 500 tons by 100-ton additions. The Bullion M. Co. expects to start shipping soon. J. H. Taylor is manager. The Alice mine has shut down. Work has been resumed at the Surprise. Otto Nordquist is superintendent.

MONTANA

Madison County

The Copperville group of quartz claims on Peterson creek have been sold by E. C. Hosmer for $50,000 to H. A. Bowman, who represents Butte interests. The ore assays 8 to 17% copper and as high as 800 oz. silver per ton. A mill will probably be erected as soon as sufficient ore has been blocked out. A road is being constructed from the railway 8 miles up Ramshorn gulch to the Bedford mine. The Walters Tunnel Co., which is developing the Bedford, will build ore-bins at the railway and a sawmill at the mine. Large quantities of lead-silver ore are said to be blocked out in the property. W. Walker and M. Johnson are working the Betsy Baker and Gold Coin and have developed large amounts of gold ore of milling grade.

Silverbow County

(Special Correspondence.)—An option on the Macarona, Montgomery, Altona, the Colleen Bawn, the Amazon, and the Park City claims, situated southeast of the city, has been given to A. B. Wolvin, president of the Butte & Superior company, for the sum of $170,000. The claims belong to what is known as the Brundy estate, and in order that the agreement might be made, permission had to be secured from the District Court. With the delivery of the option agreement, Mr. Wolvin paid $1000, and is to pay $4000 in ninety days, $5000 in six months, $75,000 in one year, and the balance, $90,000, in eighteen months. The Brundy properties have undergone some development work, but have never shown any rich ore, so far as can be ascertained. Some years ago, when the claims were under option to New York capitalists, J. Parke Channing spent considerable time making an examination of the property, but what his opinion of the claims was, never could be ascertained. However, some time afterward the New York capitalists withdrew from operating the property and the option went by default, it having been stated that a controversy arose which could not be adjusted. It is understood that the Guggenheim interests are back of Mr. Wolvin in the matter of this option, but this is only surmised.

Butte, July 13.

It is reported that the Tuolumne will not declare any dividend in August. The company is shipping 200 tons per day, chiefly from the 1600 and 1800-ft. levels. The Snowball vein in the North Butte has been found to be

richer on the 2400-ft. level than on the 2200, the vein being 7 ft. wide and carrying 10% copper.

NEVADA

Lyon County

The Mason Valley smelter made a record run on July 6, smelting 817 tons in 24 hours, in its 400-ton furnace. The ore received at the smelter during the week ended July 4 was as follows: From the Nevada-Douglas Copper Co.'s mine at Ludwig, 2580 tons; from the Mason Valley Mines Co.'s mine at Mason, 2249 tons; from miscellaneous mines, 734 tons. Shipments of copper matte from Thompson for the same period amounted to 10 carloads. The Yerington Copper has resumed shipments. A new compressor is to be installed soon. The drift on the Malachite has almost reached the orebody. A 2-compartment shaft is being sunk on the McConnell property and has reached a depth of 30 ft. in ore averaging 6% copper. The Yerington Mountain Copper Co. will begin ore shipment in the near future.

Nye County

The new main shaft at the Tonopah Extension has reached a depth of 350 ft. The east drift from the 501 stope has a full face of $30 ore and development work elsewhere in the mine has added greatly to the known ore reserve. At the

TONOPAH, NEVADA.

Montana Tonopah 888 tons of ore was milled last week, with a 94% recovery. The clean-up for June yielded 3901½ lb. of bullion, valued at $45,840 and 34.7 tons of concentrate from 4645 tons of ore. The clean-up at the MacNamara for the 15 days preceding July 9, yielded 886 lb. of bullion, valued at $10,450. The mill is now treating 67 tons per day. The Golden Anchor shaft of the Tonopah merger has reached a depth of 985 ft., and a station is being cut from a drift which will be driven to the vein.

White Pine County

The coroner's jury has returned a verdict of death by accidental explosion in the case of the ten men killed by the explosion of the three boxes of 40% dynamite at the Copper Flat pit of the Nevada Con. on July 7. The men were loading a hole in the ordinary way when the powder on the surface exploded, and all were instantly killed. The powder in the hole, and in a nearby one which had already been loaded did not explode. No reason can be assigned for the explosion. High-grade ore has been found on the Morris No. 1 claim of the Giroux Con. Ore from the Taylor dump is being shipped to the smelter. Development is progressing at the Coppermines Co., and arrangements are being made for the installation of a gasoline hoist. Good results are reported from the drilling on the 1245-ft. level of the Boston Ely. Recent development work shows the Emma vein to be 72 ft. wide. The adit of the Smokey Development Co. is in 100 ft., and has a like distance to go before reaching the orebodies disclosed by drilling. The Lead King has several carloads of ore ready to ship, which is reported to contain 80% lead.

NEW MEXICO

Grant County

The Silver King mine, in the Central mining district, has been leased to J. T. Jones and B. P. Keel. The vein is reported to be 5 ft. wide at a depth of 25 ft. and to assay $6.10 gold, 2 oz. silver, and 30% lead.

OREGON

Josephine County

It is reported that the funds have been secured for the construction of a railroad from Grants Pass 52 miles up the Applegate river to the mines of the Blue Ledge district. E. M. Chester is the representative of the interests concerned. The Soule mine has been purchased by J. D. Densmore, H. McBride, and D. G. Dreger, of Salem. Arrangements are being made for the reopening of the property, which has not been worked in five years. The mining men of the district have sent 3½ tons of ore samples to the Mining Congress, held at Yreka this week. L. E. Crouch has begun suit for $100,000 damages against several Ohio people for alleged misrepresentation as to the solvency of the Almeda M. Co. The court has discharged the receiver, R. S. Tucker, who was recently appointed. The Alton mine, near Wolf Creek, has let a contract for a 100-ft. extension of the present adit.

UTAH

The following Utah companies have declared dividends during the first six months of the year:

Bingham-New Haven	$ 45,724
Cliff	30,000
Colorado	60,000
Daly-Judge	45,000
Daly West	135,000
Iron Blossom	170,000
Opohongo	17,978
United States common	351,010
United States preferred	850,576
Utah Consolidated	150,000
Utah Copper	3,750,000
Total	$5,605,288

Summit County

The Ontario mill is well advanced, and it is hoped to have the reconstructed mill in operation. The mine is ready for the increased output, and the old stope fillings are already being hoisted to the surface. At the New York Bonanza two shipments of ore have been made, and a third is ready; a total of 90 tons, which yields a net return of $10 to $12 per ton. M. J. McGill is manager. In the Ontario adit three shifts are at work cutting a station on the 2100-ft. level of the Daly West, and as soon as it is completed stoping will begin. Shipments have been as follows: Silver King, 593 tons; Daly-Judge, 451; Daly West, 198; Sam Hair, 9 tons.

CANADA

British Columbia

It is stated that a new company will be formed to take over the Red Cliff Mining Co. and to acquire a controlling interest in the Tyee Copper Co. It is reported that M. K. Rodgers is negotiating for the Big Missouri group of 16 claims, owned by Dan Lindeberg. The Granby Con. has bonded the Doyle group, on Observation Inlet, for the alleged sum of $100,000. During the summer $20,000 will be spent on development. Work has begun on the 2000-ton smelting plant. Shipments of blister copper from the Granby for the first week of July amounted to 435,000 lb. N. McLeod Curran, who recently purchased the Northern Terminus, is developing the property. Rich gold ore has been found 18 miles from Stewart on ground belonging to Dan Lindeberg. The Nickel Plate has two diamond-drills at work and extensive development is being carried on.

The fourth dividend of the Standard Silver-Lead M. Co. in the Slocan district has been declared and amounts to $50,000. The total to date, according to the *Spokesman-Review*, is $175,000, giving the property the best record of any mine in the Northwest. The mine has been in operation twenty months and has expended $150,000 for machinery.

ONTARIO

(Special Correspondence.)—At the Nipissing hydraulicking operations have exposed an extension of vein No. 92, carrying from 1 to 2 in. of high-grade ore, and two other veins. The output of ore for June was valued at approximately $225,162. The high-grade mill during that month treated 181 tons of ore and the bullion shipments were 326,278 oz. of a value of $198,824. The principal ore production was from vein No. 73. A 1-in. stringer has been found running at right angles to this vein on the second level, which assays 1500 oz. per ton. At the Provincial a deep bed of conglomerate has been found underlying the slate at the 350-ft. level. So far the best veins of this mine have been found to occur in the conglomerate, and the shaft will be sunk farther in the hope of finding other deposits. The Crown Reserve has declared its regular quarterly dividend of 2% and a monthly bonus of 3%, making total returns to shareholders of 250% of the capitalization. The Dominion Reduction Co. has been organized, with D. N. Steindler as president and Eugene Steindler as secretary-treasurer, to take over and operate the Nova Scotia mill, which is being altered so as to secure increased concentration for the treatment of the conglomerate ores. The Gould Consolidated, which holds a lease of 120 acres from the Peterson Lake, has made an agreement with the Porcupine Syndicate, Ltd., under which the latter will operate the mine. The Porcupine Syndicate will continue development at the 100-ft. level, where several veins have been found which are apparently extensions of Nipissing deposits, and will sink to a lower level. The Cobalt Majestic Co., which is in liquidation, is paying its creditors in full, and the shareholders may also receive a dividend, as some of its claims are likely to bring good prices. Good progress is being made in the construction of the Elk Lake branch of the Temiskaming & Northern Ontario railway on which 400 men are working. Eleven miles of grading has been completed and the rails will be laid as soon as the steel can be secured. The line is expected to be completed by the end of the year.

Cobalt, July 10.

MEXICO

SONORA

(Special Correspondence.)—The Tigre Mining Co., S. A., reports the returns for June as follows:

Estimated realizable value of:		
Bullion produced	$64,877	
Concentrate produced (244 tons)	57,932	
Shipping ore produced (110 tons)	27,010	
		$149,819
Sundry profits		3,517
		$153,336
Less:		
Mining, including development	$20,469	
Milling	33,468	
General expense	3,139	
Marketing	28,517	
		85,593
		$ 67,743
Kansas City expenses, including interest on bonds		3,146
Estimated profit		$ 64,597

The mills crushed 5676 tons of dry ore during the month, and the cyanide plant treated 5439 tons of tailing from the two mills, and 2081 tons from the old tailing dumps, an average of slightly over 250 tons per day. A total of 267 ft. of development work was done during the month. To obtain the exact amount realized during the month, complete smelter and refinery returns would have to be obtained, involving a delay of two months. Experience in the past has been that the returns from the mine are within 1% of the final returns.

Yzabal, July 5.

James Lewis & Son's Copper Report

A further advance in the price of standard copper of £3 per ton has taken place during the first half of June—from £76 2s. 6d. to £79 2s. 6d. for cash. Up to £79 2s. 6d. was paid on June 6, from which there was a recession to £77 15s. 0d. on June 14, due to extensive liquidation to secure profits. This fall was recovered June 17, the closing prices being £79 2s. 6d. cash and £79 15s. 0d. three months. Sales amounted to about 40,000 tons. The statistical position continues very strong, and consumers are threatened with a serious scarcity of refined copper, aggravated by a continuance of the strikes at two of the largest American refining works and the rapid diminution of the stocks held on this side of the Atlantic as well as of those held by American refiners. Electrolytic copper has been sold freely up to £80 15s. 0d. per ton c.i.f., and from warehouse here, American producers being fully sold for delivery up to September.

Statistics show an increased import into Europe from the United States of 21,702 tons, but from other countries a decrease of 13,448 tons. The consumption of Europe is 19,080 tons larger than during the same period last year, but the exports have fallen off 5387 tons. The fact that the consumption of England is 7482 tons less shows the reduced stocks held by English manufacturers, in view of the general admission that both the copper and steel trades have been and are exceptionally active this year. American consumption has increased 23,504 tons. The reduction in European and American stocks for the five months of this year has been 34,654 tons, and on June 1 they were 89,454 tons less than at the same date last year.

Stocks have decreased 955 tons, and the visible supply 2505 tons during the first two weeks of June.

Imports to June 17 were 4429 tons and deliveries 3506 tons less than last year. These latter included 4000 tons shipped to the United States, as against 7900 tons last year. The arrivals in England and France for the first half of June were 11,976 tons, and the deliveries 12,385 tons. The arrivals at Liverpool and in Swansea from the United States were 1427 tons of bars, 300 tons of plates, and 20 tons of matte, equal to about 1725 tons fine; in London 200 and in France 4350 tons fine. The arrivals of Chile in Liverpool and Swansea were 1258 tons and the deliveries 1057 tons, and from other countries 3195 and 3259 tons fine, respectively.

The Chile charters for the first half of June were advised as 2900 tons, including 1925 tons to the United States.

STOCKS OF COPPER (TONS FINE)

	1912			
Chilian in—	Jan. 1.	May 1.	June 3.	June 17.
Liverpool and Swansea.	4,225	5,203	4,943	5,144
France	714	778	784	749
American in—				
Liverpool and Swansea.	12,939	8,215	5,890	4,946
France	4,033	4,690	3,933	4,658
Sundries in—				
Liverpool and Swansea.	786	1,148	503	489
London and Newcastle..	6,462	5,060	4,565	4,378
Birmingham	346	850	516	446
France	507	567	542	507
English in—				
Liverpool and S. Wales.	17,346	14,210	14,212	14,162
Total in England and France	47,358	40,721	35,888	35,479
Sundries in—				
Germany and Holland..	13,400	10,121	8,002	7,456
Total European stocks.	60,758	50,842	43,890	42,935
Afloat—				
From Chile to Europe..	1,575	2,050	1,800	1,450
From Australia	8,350	7,000	6,900	5,700
Total visible supply..	70,683	59,892	52,590	50,085

Personal

Professional men are invited to send news of their engagements and travels. Such news is interesting to friends.

T. T. Read is in Nevada.

J. A. Burgess was here Monday.

C. W. Morse was in San Francisco.

F. J. Siebert is on his way to Alaska.

James G. Berryhill was in San Francisco.

C. C. Broadwater has gone to Grass Valley.

W. H. Storms has gone to northern California.

Sumner S. Smith now has his headquarters at Nome.

Charles Janin is expected from Nome early in August.

M. L. Requa was orator of the day at Juneau on the Fourth.

Alexander P. Rogers is in California on professional business.

J. M. Boutwell passed through San Francisco during the week.

Newton Cleaveland is leaving for Dawson and Alaska next week.

C. M. Derby, of the Natomas Consolidated, has gone to Oregon on his vacation.

P. N. Moore returned to San Francisco from Los Angeles and has gone to Alaska.

Gerhardt Ulrich has left New Zealand for London, where he expects to arrive about September 1.

Charles C. Selbie sailed today on the *Persia* to take a position with the Chosen Mining Co., Yeng Byen, Korea.

E. A. Wall has returned to Salt Lake City from Washington, D. C., where he underwent treatment for his eyes.

George A. Packard has been examining the Nevada-Dougias mine, and was in San Francisco during the week.

E. J. Carlyle is now in charge of the smelter of the Famatina company, Chilecito, Province La Rioja, Argentina.

G. L. Sheldon expects to sail from Seattle on July 27 for Katalla, expecting to return to Ely, Nevada, within two months.

Cecil Brock has resigned his position with the Cerro de Pasco M. Co., to take over the management of the Santa Clara group of mines at Morococha, Peru.

Obituary

J. B. Carter died on July 7 at Moores Flat. Mr. Carter, who was 81 years of age, went to Nevada county in the early days of the gold excitement in California, and remained in the district through its varied ups and downs. For many years he was postmaster at Moores Flat, and his crossing the divide lessens the roll of the pioneers.

Samuel Uren recently died at his home in Grass Valley. He was born at Cambourne, Cornwall, in 1851, and in 1873 married Celia Warren, at Swansea, Wales. In 1880 they came to California and settled at Sierra City, where Mr. Uren was employed as a millman for 27 years, moving to Grass Valley in 1907. An expert millman and a good citizen, his loss is much mourned. He leaves a widow, two daughters, and two sons.

R. B. Nickerson, who died suddenly of heart disease at Livermore, California, Monday, was well known for his work in the Mother Lode and other California regions. He had but recently returned from a year in western Ontario, where he had been in charge of the Mikado mine, in which he and friends were interested. Mr. Nickerson was 49 years old, a genial, likable, and capable mine manager who did his work well and incidentally found time occasionally to contribute to the literature of his profession.

Market Reports

LOCAL METAL PRICES

San Francisco July 18.

Antimony	11—11¼c	Quicksilver (flask)	$43
Electrolytic Copper	17¾—18c	Tin	50—51¼c
Pig Lead	5.00—5.95c	Spelter	8—8¼c

Zinc dust, 1400 lb. casks, per 100 lb., small lots $9.50—9.75; large $7.50—8.50

METAL PRICES

(By wire from New York.)

NEW YORK, July 18.—Copper continues quiet. Consumers are well supplied and are holding off for lower prices. The recent break in prices and talk of hidden surplus has stiffened the courage of consumers. Lead is firm and good business is being done. Spelter is also firm and consumption is excellent.

Average daily prices for the past week, in cents per pound, based on wholesale transactions, standard brands, are given below.

Date.	Electrolytic Copper.	Lead.	Spelter.	Silver, per oz.
July 11	16.68	4.75	7.15	60⅜
" 12	16.75	4.75	7.15	60¼
" 13	16.75	4.75	7.15	60¼
" 14	Sunday.	No market.		
" 5	16.95	4.75	7.18	60¼
" 16	16.95	4.75	7.18	60¼
" 17	16.98	4.75	7.18	60⅝

LONDON QUOTATIONS

(By cable, through the courtesy of C. S. Burton & Co., New York.)

	July 18.
Camp Bird Ltd	$ 6½
El Oro	3⅝
Esperanza	6⅝
Oroville Dredging	1⅜
Santa Gertrudis	7⅛
Tomboy	6⅛

COPPER SHARES—BOSTON

(By courtesy of J. C. Wilson, Mills Building.)

	Closing prices, July 18.		Closing Prices July 18.
Adventure	$ 7½	Mohawk	$ 68
Allouez	45½	North Butte	30¾
Calumet & Arizona	74¾	Old Dominion	56
Calumet & Hecla	520	Osceola	116
Centennial	23½	Quincy	89
Copper Range	57½	Shannon	16⅜
Daly West	5	Superior & Boston	1¼
Franklin	11¼	Tamarack	40
Granby	52¾	Trinity	5¾
Greene Cananea, ctf.	9⅞	Utah Con	11
Isle-Royale	35½	Victoria	3¼
La Salle	7	Winona	5½
Mass Copper	6¾	Wolverine	109

NEVADA STOCKS

(By courtesy of San Francisco Stock Exchange.)

San Francisco, July 18.

Atlanta	$ .23	Mayflower	$ .02
Belcher	.50	Mexican	2.80
Belmont	9.35	Midway	.53
B. & B.	.08	Montana-Tonopah	2.50
Booth	.09	Nevada Hills	2.00
Chollar	.11	Ophir	1.00
Combination Fraction	.14	Pittsburg Silver Peak	1.05
Con. Virginia	.37	Round Mountain	.40
Florence	1.02	Savage	.11
Goldfield Con.	3.95	Tonopah Extension	2.20
Gould & Curry	.01	Tonopah of Nevada	6.50
Jim Butler	.62	Union	.58
Jumbo Extension	.37	Vernal	.12
MacNamara	.22	West End	1.65

MINING STOCK QUOTATIONS—NEW YORK

(By wire from C. S. Burton & Co., New York.)

	Closing Prices. July 18.		Closing Prices. July 18.
Amalgamated Copper	$ 83⅛	Miami Copper	$ 28⅛
A. S. & R. Co.	83½	Mines Co. of America	3
Braden Copper	7	Nevada Con	20¼
B. C. Copper Co.	5¾	Nipissing	7⅝
Chino	31⅛	Ohio Copper	¼
First National	2	Ray Con	20⅞
Giroux	4⅞	Tenn. Copper	42¼
Goldfield Con.	4	Tonopah Belmont	9¼
Greene-Cananea	9⅞	Tonopah Ex.	2⅛
Hollinger	12⅜	Tonopah Mining	6¾
Inspiration	18¾	Trinity	6
Kerr Lake	2⅞	Tuolumne Copper	3½
La Rose	3⅛	Utah Copper	61⅜
Mason Valley	13⅜	West End	1⅝
McKinley-Darragh	1¾	Yukon Gold	2⅞

Concentrates

Most of these are in reply to questions received by mail. Our readers are invited to ask questions and give information dealing with the practice of mining, milling, and smelting.

ZINC-DUST used for precipitation of the gold-bearing solution at the Goldfield Con. plant amounts to 0.385 lb. of zinc-dust per ounce of fine gold precipitated. The total cost of precipitation is 7.3c. per ton of ore treated.

DANAITE is a cobaltiferous variety of arsenopyrite which contains 4 to 10% of cobalt, thus graduating toward glaucodot (CoFe)AsS. It occurs in the United States at Franconia, New Hampshire, where it is associated with calcopyrite in gneiss.

BLUE-LINE prints require so much skill in manipulation that it is not usually practicable for engineers to attempt to make them, as it is very difficult to get the white background clear. Prints with brown lines on a white ground can be made by the use of special papers, and in the larger cities the dealers in drawing supplies will usually make black-line or blue-line prints to order at a moderate price.

QUICKSILVER fed into the batteries of the Ready Bullion stamp-mill of the Alaska United amounts to a little more than 1/6 oz. of quicksilver per ton crushed, and small amounts were further used in dressing the plates, on vanners, and in cleaning the amalgam; the total being a little more than 1/5 oz. per ton crushed. This corresponds to 3½ oz. quicksilver per ounce of free gold recovered. The amalgam had an average value of $5.87 per ounce and yielded a bullion worth $18.50 per ounce.

SAMPLES of gas under pressure from an oil well can be taken by the use of a cloth funnel, made by folding and sewing any strong, closely woven cloth in the form of a cornucopia. The larger end of this funnel should be large enough to encompass the gas pipe from which the sample is to be taken. The smaller end, or apex, of the funnel should be securely tied about one end of a flexible rubber tube one or two feet long and ¼ to ½ in. diameter. If there is a gas-jet at the well, one end of the rubber tube may be attached directly to the jet. The sample is then collected in a bottle in the usual way.

NICKEL deposits of China are, through the reorganization of the government and the building of railroads, becoming more of an economic possibility. Nickel is believed to occur in southwestern China in fairly considerable amounts, since the Chinese have from time immemorial smelted mixtures of tin, lead, zinc, copper, and nickel ores, forming natural alloys of variable composition which approximate German silver. The Chinese call this 'pai-t'ung' or white copper, and it is used extensively in the manufacture of candlesticks and other household objects. In spite of its general use, comparatively little is known of the source of the nickel ores, since they occur in southwestern China, where only recently has it been possible to carry on extensive exploration on account of the difficulties of travel and the hostility of the native tribes. Within the last few years railroads have been built through this area and considerable foreign trade is being carried on, but so far apparently no attention has been paid to the nickel deposits. Duclos, the mining engineer who accompanied the Mission Lyonaise, reported that he found nickel ores occurring associated with copper in a couple of placers in Yunnan and Ssu-chuan. The ores must be comparatively rich, otherwise the Chinese would never have worked them by their native methods, since they ordinarily do not work copper ores which are lower in grade than 15%. Just at present the output is not important, but it is interesting and may have a good deal of economic possibilities.

Decisions Relating to Mining

Specially reported for the MINING AND SCIENTIFIC PRESS.

INDEMNITY LANDS—MISTAKE OF SECRETARY OF INTERIOR

A due selection by a railroad company of public lands free from other claims and within the indemnity limits of its grant, vests in the selector a right to the land against all third persons attempting thereafter to initiate a claim to the selected lands under any of the general land laws. When the Secretary of the Interior makes a rejection of an indemnity selection through fraud or mistake of law or fact, if the wrong be not corrected by him of his own initiative by a revocation of the order, then since mandamus will not lie to enforce a reversal of this ruling, the aggrieved party can only await the time when the United States shall have parted the title and then begin his action to have the patentee declared his trustee.

Southern Pacific Railroad Co. *v.* George L. Arnold, 43 California Decisions, 582. May 28, 1912.

OIL LEASE—CONSTRUCTION OF TERMS

A lease made by the Osage Indian Nation to an oil company recited that no wells should be drilled upon cultivated inclosures in the Reservation. Subsequent to the execution of the lease, certain Indians inclosed and proceeded to cultivate certain Reservation lands which had not previously been under cultivation. The oil company attempted to sink wells upon such inclosures, claiming that it had a right to do so, the lands being uninclosed and not cultivated at the time the lease was made. It was held, however, that the term 'cultivated inclosure' related to those made after as well as those made before the lease was executed, and that the persons first initiating proceedings to work the uncultivated land would be protected.

Barnsdall Oil Co. *v.* Leahy *et al.*, (Oklahoma) 195 Federal, 731. April 1, 1912.

JURISDICTION OF LAND DEPARTMENT IN ALASKA

Certain lode-mining claimants filed an adverse claim in the matter of the Katalla company's application for a soldiers' additional homestead patent to lands in Alaska, asserting as the basis of their claim that the lands in question were, in part at least, mineral in character, conflicted with claimants' lode claims, and were within the limits of a national forest. The Commissioner of the General Land Office held that the Land Department has jurisdiction to determine the mineral or non-mineral character of the land in Alaska, that conflicts between mineral and non-mineral claimants should not be treated as 'adverse claims,' to be decided by courts of law, but are more properly 'protests,' the hearing of which is strictly within the jurisdiction of the Land Department. Accordingly, the Land Department is under no obligation to suspend proceedings pending the final decision of quiet title suits, instituted in this case by both parties, and the mineral claimants were ordered to prosecute their contest against the issuance of patent to the Katalla company under penalty of having the case dropped from the files of the Department. The Secretary of the Interior approved the foregoing ruling, with a modification to the effect that the *prima facie* validity of the Katalla company's application should first be determined before ordering a hearing on the protest.

Low *et al. v.* Katalla Company, (Land Department) 40 Land Decisions, 534. Jan. 15, 1912.

Dividends

The Tonopah-Belmont paid a dividend of 25c. per share on July 1.

The United Verde Copper Co. paid a dividend of 75c. per share on July 3. This is the fifth dividend this year.

The La Rose Consolidated has declared a 2½% dividend, payable July 20. This makes a total of 42% dividends paid by this company.

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EDITORIAL

WE have the pleasure of announcing that Mr. M. W. von Bernewitz, recently with the Associated Northern Blocks, and the Associated Gold Mines, Ltd., has joined the San Francisco staff of the *Mining and Scientific Press*. As our Kalgoorlie correspondent and a writer on metallurgical and mining topics, Mr. von Bernewitz is already well known to our readers, and they will, we are sure, be glad to know that his time will hereafter be devoted exclusively to editorial work.

RIGHTS of the oil men in the lands withdrawn by presidential order in 1909, are at last to be tested in the courts through a friendly suit instituted by the Attorney-General. This is the only sensible method of determining the matter.

NOT wishing to detract attention, but every square foot of Canada having, we understand, been 'presented' to the Canadian Mining & Exploration Company, we merely remark that the charter of the company does not forbid investment south of the line.

AUSTRALASIAN engineers recently visited Cobar in connection with the annual meeting of the Australasian Institute of Mining Engineers. One of the interesting features of the meeting was the presidential address delivered by Mr. H. C. Bellinger. His many friends in this country will, we are sure, be glad to read the abstract printed on another page.

SO many inquiries have come to us regarding the International Society of Mining Accountants, recently formed in Detroit, that we take this occasion to say that Mr. W. H. Charlton, 46 Hooker avenue, Detroit, is the secretary of the organization and will gladly answer inquiries as to its scope and purpose. Standardization of mine accounts has been much discussed by engineers, and is is to be hoped the accountants will take up the matter and bring it to some definite conclusion. We wish the new society success in full measure.

THE recently announced investment by Mr. Charles M. Schwab and associates in the Loretta mine, aside from its interest as promising the development of a new large copper producer for California, is worthy of note as illustrating two important phases of present-day mining; first, the length of time and amount of labor required to develop a prospect into a mine; second, the vast outlay of money required to change a developed mine into a producer, especially when the property is low-grade, and large quantities of ore must be handled on a narrow margin. The future of mining undoubtedly will be along the lines of other industries. Men and companies with strong financial backing and with modern business methods will replace the prospector and individual owner. The romantic vision of the miner with gold-pan and burro, searching the hills for a flood of sudden wealth, will fade away, to be replaced by a picture of cold commercial transactions leading slowly but surely to ultimate gain. The spectacular side of mining

will be the loser, but the industry in the end will rest on a firmer basis, one which will invite conservative attention and investment.

AMONG minor results of the revolution in Mexico was the interruption of the work of the Mexican Institute of Mining and Metallurgy. Not even a quorum attended the annual meeting, and matters came to a standstill. Fortunately this but served to call needed attention to the excellent work of the Institute and under guidance of a committee consisting of Messrs. J. B. Empson, P. A. Babb, J. M. Nicol, and G. A. Denny, a vigorous campaign has resulted in putting the organization on a good financial basis and assuring an early resumption of the publication.

ECUADOR is the least known and least developed of the South American countries facing the Pacific, despite its rich mineral resources. One reason is that Guayaquil, the principal seaport, has a well deserved reputation for unhealthfulness that unjustly condemns the whole country to foreigners. It is now announced that the city is to be entirely reconstructed, and when it shall have become as sanitary as Panama and Havana, the region back of it, easily reached by railroad, will attract many tourists, and so come eventually to be developed. We present this week an outline of the geology of the country which indicates a wide region in which the opportunity for finding gold is excellent. At present the only important gold mine belongs to the South American Development Company, an American corporation, for which Mr. John W. Mercer is manager. While little information has been made public, it is known that the veins in the andesite, worked by this company, have paid well. There are many old placers in various parts of the country, and in the unsettled provinces, where as yet the Indians interfere with prospecting, there is virgin ground.

Railroad Mineral Lands

Mineral lands and railroad grants are a perennial source of trouble throughout the West. The cry for rapid development led, some years ago, to generous allotments of land to companies that would undertake to build transportation lines. Haste bred carelessness, and, too, a quarter of a century ago neither in public nor private life was it as customary to defer to the expert as now. With rare exceptions it was not the intention of Congress to give to the railroad companies any mineral lands other than those containing iron and coal. Such lands were given on the basis that these minerals were needed in the construction and operation of railroads, though we do not remember of any blast-furnace having been erected on the public land to make pig iron for a railroad. However, the exception was on a par with the general rule permitting a settler to cut timber from public land for the purpose of building his home, and no great harm resulted from it. The whole policy, though, was one designed to bring settlers upon the land and increase the farming population, rather than to parcel out the national wealth. Unfortunately, in a number of cases the grants went to promoters who failed, and considerable areas of public land passed to private corporations, a very different thing from passing to individual settlers, without any substantial improvement in transportation facilities. More serious still was the fact that in the rush there was no adequate study and classification of the land. In individual cases there was even rank dishonesty, but in general it is fair to impute the mistakes to haste and lack of knowledge. When Mr. Hoke Smith was Secretary of Interior the custom was introduced of writing into the patents the words of the original grant excepting 'mineral lands,' and the force of this exception is still in dispute. It is held, on the one hand, that the companies accepted thereby a limited patent, and that the same force that made the patent valid also made the exception binding. On the other hand, it is contended that specific patents were given to specific pieces of land, and that, in the absence of evidence of fraud, the classification made by the Government by the act of giving patent, became binding upon itself. Furthermore, it is not in accord with sound public policy to disturb titles except in case of real necessity. Subordinate courts have given conflicting decisions, but certain phases of the contention have never been passed upon by the United States Supreme Court. There seems little question that if 'mineral in the land' had been specified, the exception would be binding, but how 'mineral land' is to be construed is less certain. The equities in these cases are by no means all on one side. In the instance of oil lands it is worth remembering that the oil is principally valuable for fuel and that the original grant contemplated giving the railroads coal lands, coal being then the only known fuel of importance.

The Government is now contesting the right of the Southern Pacific Railroad Company to oil lands in the San Joaquin valley, though in this case the allegation of fraud enters into the matter. In the case of the railroad laws in southern Oregon and northern California, the case if taken into the courts, will determine the main question as to the force of the excepting clause in the patents. At the meeting last week at Yreka of the Southern Oregon and Northern California Miners Convention, a vigorous demand was made for action by the Government in contest of the railroad titles. This was all the more interesting since careful plans had been made to smother any such discussion. Naturally our sympathies in this case are with the miners. We should like to see the great mineral region to the north opened to vigorous prospecting. The situation has worked out to substantial injustice, and the railroad undoubtedly holds lands which Congress never intended to give. This is not sufficient reason for taking them away if they legally belong to the present holders, but if there is a cloud on the title it is to the interest of everyone to have the matter promptly and fully presented to the courts and fairly determined. In the meantime we are glad to note that by order of the Secretary of Interior all future applications for patents under grants are to be held until the Geological Survey shall have examined and classified the lands. This will not altogether preclude mistakes, but the best available information will be utilized, and it is better to go slowly than to run into endless litigation.

Excursions of the Institute

One of the enjoyable and interesting features of the work of the American Institute of Mining Engineers has been the excursions that have been arranged as incidents to certain of the meetings. In its wanderings, the Institute has held meetings from Germany to Japan, and from Panama to Dawson. Not to delve too far into ancient history, the principal excursions of the last six years have been as follows: London, 1906; Toronto, 1907; Chattanooga, 1908; Spokane, 1909; Canal Zone, 1910; San Francisco and Japan, 1911. The excursions have been uniformly well arranged and well conducted; participation in them has been both pleasant and profitable, and many strong friendships have been formed at the same time that professional solidarity has been greatly augmented by these journeys in company. In early days when railway transportation and other concessions were freely given, the expense to each member of the party was materially less than on a private journey. In recent years it has been higher, but averaging neither greatly more nor less than the same per-

sons would probably have paid in traveling alone.

For many years the Institute refused to fix any permanent headquarters, and its office was wherever the secretary lived; its home was wherever a group of members got together. The first excursions were strictly incidental to the meetings. The latter were generally held in the East where distances were small. It is interesting to note that, of the first thirty-three meetings, only one was held west of the Mississippi—the eleventh, which was at St. Louis in 1874. It was not until eleven years after the Institute was founded that a meeting was held west of the Great Plains, Denver in 1882 being the first of the mountain cities to entertain the Institute. So long as the journey to and from the Institute meetings occupied but a few hours, and excursions during the meeting were to nearby points, the arrangements were simple. Such friends as could, arranged to travel together, but there were no special trains and no elaborate receptions. When meetings came to be held frequently in widely separated cities, it became customary to organize formal parties to make the journey from the East to the meeting point and return. At first negotiations were conducted with one of the tourist agencies to care for these parties, but these negotiations came to nothing, we are informed, because of the unwillingness of the agency to make a sufficiently flexible arrangement. With a widely scattered membership, it was necessary to provide for those who might wish to join or drop out en route. To carry on the business properly it was also necessary to contract in advance for transportation, sleeping-cars, supplies, and hotels, and this involved a financial responsibility that it was considered unwise for the Institute to assume. Accordingly, the business fell to some private individual, usually the assistant secretary, who assumed the risk, did the work, and took what profit, if any, resulted. The work was well done, and the excursions have been eminently successful. The announcements have not always been as clear as was desirable, and there has been some misunderstanding of the conditions. Many members have assumed that the excursions were conducted as a part of the work, if not of the business, of the Institute, and that the officer in charge labored more in the spirit of accommodation of his fellow-members than for any personal profit. The fact that intending participants were required to pay considerable sums in advance was commonly supposed to sufficiently guarantee him against loss; especially since there was no express agreement to return any of this money in case the member found it impossible to attend. As a matter of fact, such prepayments have sometimes been returned and sometimes not. There has never been any public statement of the finances of these trips, though the amount of money involved has run into thousands of dollars, and by the public at large as well as many if not most members, they were considered Institute affairs. Whether there was ever any loss is not known; certainly none has been mentioned. That there was profit in certain cases is, on the contrary, well known. In the case of the excursion of 1911, conducted by the secretary, the accounts were audited, at his request, by a special committee of the Council, which reported that the profit was not unreasonable, taking into view the risk, the work, and the loss of salary while participating in the excursion.

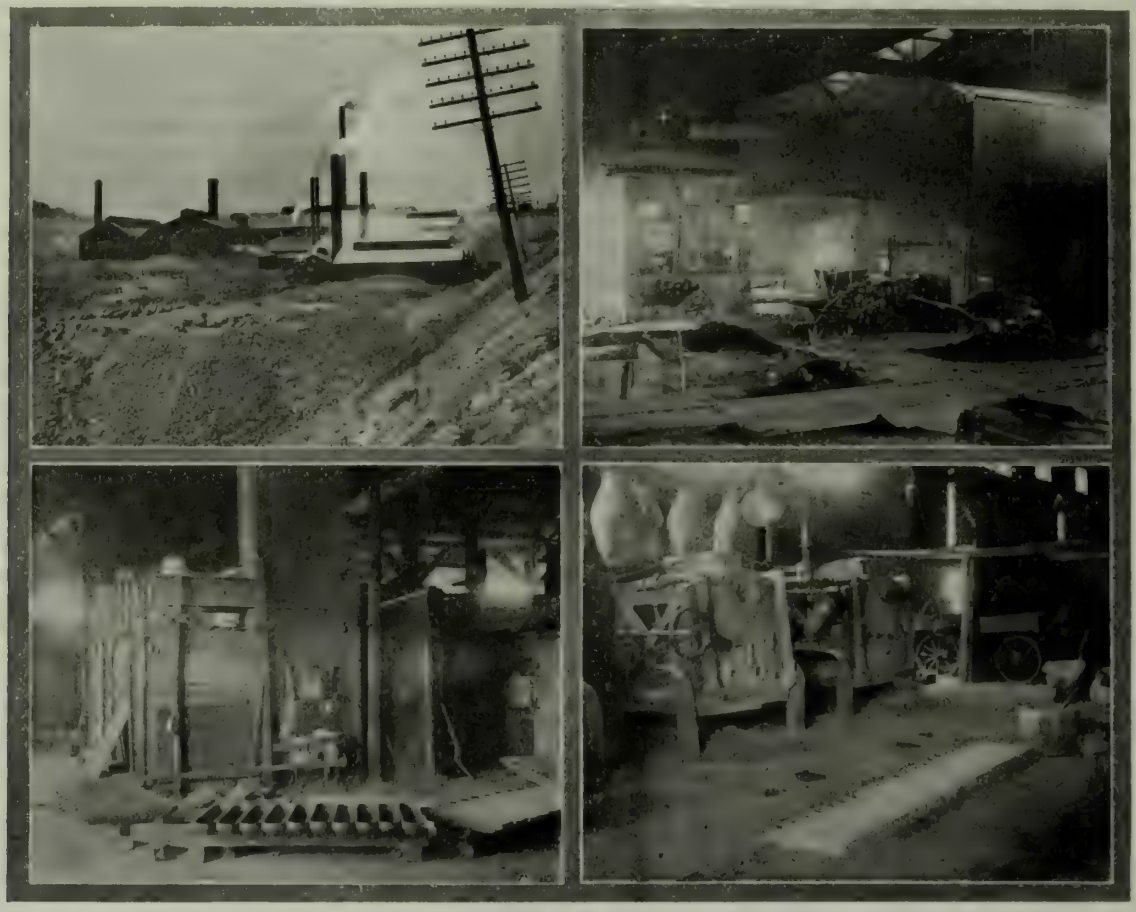
The Committee of Five which has been investigating the affairs of the Institute, has commented at some length upon the excursions. They point out that, despite the fact that as business affairs the excursions were privately conducted, and that they have presumably been a source of personal profit to those in charge, the Institute itself has shouldered considerable expense in this connection. Since 1904 this has averaged nearly $1000 per year, and covers the expense of assistants especially employed in connection with the excursions, in addition to incidental expenses of postage and for circulars, some of which has fallen on the Institute. No one doubts the propriety of the Institute assuming the expenses of the secretary in attending its meetings, and the more he travels around and meets his fellow-members the better they will be pleased; the committee points out, however, that in certain cases as many as three persons were taken on these excursions, charging expenses and salary to the Institute, and some of them, at least, at the same time participated in the profits of the trip. This circumstance illustrates how difficult and unsatisfactory the present arrangement is. Another feature that has invited adverse comment is that, since the profit to the manager depended upon the number participating, invitations have been extended rather widely. Of the total number taking part in the excursion it has happened that only a minority were actually members of the Institute. This works out badly, since such parties are always entertained as members of the Institute. Mines and works are open to them, and possibly special rates are conceded, that would not be given to a personally conducted party of ordinary tourists. The Institute has been uniformly fortunate in its guests, but local committees have at times been embarrassed by the number of non-technical excursionists, and the tendency to overemphasize the social features of the affair has undoubtedly been intensified.

For all these reasons the committee recommends that for the present the Institute abandon the policy of making long excursions, and that when they be resumed their business management be entirely divorced from the Institute. While sympathizing strongly with the attitude of the committee, we are not prepared to entirely endorse either recommendation. It is probably just as well not to plan a long trip this or perhaps next year, but we do believe that the excursions to various parts of this and other countries are a proper form of activity for the Institute, and that they can be so conducted as to eliminate the few features that have been criticized without risking the loss of their main good features—the opportunity for members of the Institute, and perhaps the members of their immediate families, to get well acquainted with other members and other regions than those that they constantly see. Desirable as local sections are, they can not be substituted for the broad acquaintance that the excursions make possible. That relatively few participate is less of an objection than it seems, since in the aggregate a considerable number do actually join each excursion and local members all along the route have the opportunity of meeting the whole party. What is needed is a different organization of the business end of the excursion. The manager should be guaranteed against loss and paid reasonably for his services, but it should not be so much of an object to him to enroll participants as would lead to making the guest list unduly large. While it should go without saying that no officer of the Institute should be in a position to make money out of his fellow-members by virtue of his position as an officer, the Institute itself can not escape responsibility for the excursions if they take place at all. Rightly or wrongly, they will be considered Institute affairs, as we believe they should be, and the Institute will be held accountable for their conduct. People who entertained these parties have always supposed they were extending a courtesy to the Institute, and doubtless they will continue to do so. The excursions should, we think, be continued, and should be more closely identified with the Institute, subject in fact to the control of the Council, instead of being further divorced from it and made sources of personal profit or loss.

The Pennsylvania Smelting Company Plant

By S. L. Goodale and H. C. Ray

This smelter occupies a plot of about fifteen acres at Carnegie, Pa., on the Pittsburg, Cincinnatti, Chicago & St. Louis railway, eight miles west of Pittsburg, the general office of the company being at the latter place. It was built by former employees of the Pennsylvania Lead company, which was a pioneer in the smelting and refining of lead silver ores, but which was dismantled at the formation of the American Smelting & Refining Co. The plant has been enlarged from time to time as business increased, so that the arrangement is not so convenient as could be made in a plant all designed at one time. This lack of a general plan is not very serious, however, because the tonnage treated is high grade and not so large in amount as in Western plants.



GENERAL VIEW OF SMELTER.
SOFTENING FURNACE.

BLAST-FURNACE FEED FLOOR.
TILTING FURNACE.

The smelting of high-grade lead and silver ores constitutes most of the work of the plant. For the smelting of sulphide lead ore, the method known as iron reduction is in use. An amount of metallic iron sufficient to take up all sulphur present as matte is added to the blast-furnace charges. The sulphur is then eliminated by roasting the matte thus formed, which is essentially an iron matte, as copper is usually present to only a very small extent. The roasted matte is used to partly supply the fluxing requirements of a later charge. The metallic iron is added in the form of the cheapest scrap obtainable, such as tin-plate trimmings and other material not usable in the steel mills, but as good or even better than any in this connection. Details of the blast-furnace construction are given below.

For the smelting of extremely rich silver ores, a special reverberatory furnace method is employed. All the silver-lead bullion is desilverized by the Parkes process, after the usual softening, and the silver refined by cupelling. The ultimate products of the smelter are fine silver, high-grade desilverized lead, and antimonial lead as a by-product. High-grade assayers' test lead and litharge are produced. The supply of ores comes from widely separated districts, and varies greatly in character from time to time. Silver ore is obtained from the West and from the Cobalt district of Ontario, only the richer ores of the latter district being treated, and being classed as 'high' and 'medium' grade. In addition to ores, various lead-bearing industrial by-products or wastes are treated.

Gas, coal, and coke are the fuels used. Natural gas, costing about 20c. per thousand cu. ft., is used for retorting, assaying, and lighting. Coal, obtained not more than two miles distant, is used for power, and for most of the metallurgical heating except in the blast-furnaces. Coke is produced in four beehive ovens, situated on the feed-floor level and near the main switch from the railroad. For each charge in each oven, 48 hours is required, this length of burning resulting in a satisfactory coke. A coking plant at a lead smelter is unique, although common in the case of iron blast-furnaces. No mechanical appliances for handling coal to the ovens or coke from them are provided; because for such a small number of ovens wheelbarrows are cheaper.

There are two rectangular, water-jacketed blast-furnaces, 36 by 108 in. at the tuyeres. Each side is made up of six cast-iron jackets, each 17 in. wide and 49 in. high. There are six 3-in. tuyeres on each side of the furnace. The jackets measure 20 in. from the bottom to the bosh-line,

and the bosh is rather flat. There is no end-bosh. The furnace end is closed by two cast jackets, each 23½ in. wide at the bottom and tuyeres, and 30 in. wide at the top. The opening for the slag spout is 14 by 14 in., and only the opening in one end of the furnace is in use. The water-jackets are held together by bolting them through lugs cast on the plates, the cracks between being tightly luted with fireclay. The bustle pipe is 15 in. diam. and encircles the furnace; blast is led from it by canvas pipes terminating at the tuyeres in sheet-metal pipes simply thrust into the tuyere openings in each jacket. The blast-pressure is about 16 oz. The jackets rest directly on the brickwork of the crucible, which is bound by a heavy steel plate with butt-riveted joints. The crucible is elliptical in plan, large enough to contain the lead well on either side. The brick shaft above the jackets is supported by steel channels, resting on cast iron posts, 7 ft. 6 in. high at each corner.

The charging doors for one furnace are two in number; one on one side, occupying about half the length of the furnace, and the other on the opposite end, occupying practically the whole end. The charging-doors for the second furnace are on the sides and diagonally opposite each other. The doors are simply sheet metal pieces resting against the furnace, and raised for charging by chains with a counter-weight. As the furnaces are small, the charge is easily spread evenly through these charge openings, which are placed in the unusual positions for convenience of access on the charge floor. Horizontal flues lead the gases to a down-take just outside the building, which accommodates both furnaces. From that point the gas goes through an underground flue of small size to the regular dust flues, in which dust is dropped mainly by frequent alteration of the direction of flow of the current of gas. The total length of the flues is approximately 500 feet.

The charges are wheeled in barrows from the bins or the stock or coke yard to the furnaces, each barrow load being weighed on a platform scale. The coke and stock yards are just outside the building on the feed floor level, and the bins in a line in the building, the most distant bin being probably within a hundred feet of the furnace, so that transportation of charges to the furnace is a simple matter and relatively inexpensive. The bedding system is not used, and, in fact, the ore storage capacity is somewhat limited.

The furnace charge varies greatly from time to time, because of the large number of materials smelted, and their diversified composition. Of coke, 12 to 15% is used, the amount being kept near the higher figure most of the time. The amount of lead on the charge is variable, and ranges from 10 to 20%, the latter proportion being reached when there are large quantities of drosses, old litharge, etc., to be worked up. The slag is maintained at about the following composition: SiO_2, 32%; FeO, 34%; CaO plus MgO, 17 per cent.

The products of the blast-furnaces are a lead bullion, a nickel-cobalt speiss, an iron matte, and the slag. The bullion overflows from the siphon tap into a collecting iron pot, and from there is ladled into molds by a workman, who also attends to keeping the tuyeres open. The ordinary run of bullion contains from 80 to 800 oz. of silver, and little or no gold. The speiss, matte, and slag are tapped together intermittently into small slag-pots which are run, as soon as cool enough to move, to a settling furnace about 150 ft. distant. The top crust is broken and the liquid material is poured into the settler. The slag shells are broken and re-smelted as usual.

The settler is a small single-chamber—that is, with no bridge-wall—reverberatory furnace fired with natural gas. It is 10 ft. long and 6 ft. wide outside, with walls 1 ft. thick. The bottom is a sheet steel box, resting on rails, in which the hearth proper is built up of brick set in clay, and with a final lining of clay and sand tamped in over the brick. All the refining, melting, and softening furnaces are provided with a similar steel under-pan to prevent any lead that may penetrate the brickwork from being lost in the earth. The settling furnace is tied together with rails for braces by means of round iron tie-rods. The slag, matte, and speiss are poured in the top through a hole that is covered except when pouring. The top of the settler is on the level of the tapping-floor of the blast-furnaces; and the separated products are wheeled from the settler on a level about 5 ft. lower out to the dump, where the pots are left to cool off. There are three tap holes in the front side of the settler; one at the level of the hearth; another, the matte tap, 10 in. higher; the third, the slag tap, 3 in. above the matte tap.

In operation, the settler is heated prior to charging, and when at the full heat is filled with slag, etc., as it comes from the furnace, until filled above the level of the slag tap-hole. The bath quickly settles, the slag rising to the top, and below that, matte, speiss, and, at the bottom, any lead that may have been entrained. Slag is drawn from the settler intermittently until matte shows at the slag tap-hole, when the matte is drawn from the lower hole until slag shows. The slag is then sufficiently free from matte and speiss to be thrown over the dump. The pots drawn from the matte tap contain matte and speiss, which separate well in the pot, and when cool are broken apart. Slags from the melting of extra rich charges are smelted again in some low-grade clean-up run. The speiss contains silver, and is desilverized by re-smelting. At present the desilverized speiss is otherwise a waste product. The re-smelted speiss consists mainly of iron, but contains up to 1% of cobalt and nickel, the former predominating. It is low in other metals of value.

The matte is crushed to ¼ inch in an 8 by 10 Blake crusher placed on the lower level of the plant, close to the blast-furnaces and in the same building. It is then roasted in hand-rabbled reverberatory furnaces, the sulphur being reduced to about 4 to 6%. The roasted matte is used in the blast-furnaces as iron flux, copper accumulating so slowly that it is only at intervals that matte is made sufficiently rich to be sold for its copper content. There are three roasting furnaces, placed in a separate building near the blast-furnaces. They have a hearth area of 40 by 14 ft., with 12-in. walls; and a firebox or grate area of 7 ft. 4 in. by 4 ft., and are of the ordinary hand-rabbled type. The fuel is a local long-flame coal. No ore is roasted in regular operations.

The lead from the blast-furnaces is softened in reverberatory furnaces having a hearth area of 9 by 12 ft., with 4 by 6-ft. grate area. There is a water-cooled under-pan of steel plate construction, lined with brick to form the hearth. The softening occupies from twelve to twenty-four hours, the bath having to be skimmed several times because of the antimony present. The soft lead is run direct to the large kettle of the desilverizing set of three kettles. This kettle is cast iron, 7 ft. 7 in. top diameter, and of shallow bowl shape, with a firebox directly underneath, using coal for the heating. The lead bath is given three or more zincings, each addition of zinc being skimmed before the next is added. Agitation is accomplished with a steam jet. The first, and sometimes the second, crust goes to the retorts after being thoroughly drained of lead. The last, and sometimes the second, crust is saved for the subsequent first zincing of another lot. The disposition of the intermediate crust depends on its richness. The two smaller kettles of the zincing set are 3 ft. 10 in. and 3 ft. diam., respectively, heated as is the large one. The retorting is done in a Faber du Faur gas-fired retort furnace, of which a view is shown. One charge amounts to about 1000 lb., and there is usually left in the retort after driving off the zinc some 800 lb. of rich lead, called 'retort riches.' The retorting occupies five hours, and the zinc recovered is used over again. The retort riches are then poured into molds and are later cupelled as described below.

The desilverized lead from the large zincing pot is then run into a final softening furnace. The zinc and other impurities are slagged off or burned out, and the purified lead run from the furnace by an iron pipe with a swivel joint just outside the furnace. The valve and this joint are kept hot by a small gas jet. The stream of lead is conveniently run to a series of molds set in a semi-circle about the front

of the furnace. The smelter has a duplicate equipment of the softening and desilverizing furnaces or pots. Antimonial skims from the softening are saved up until sufficient has accumulated for a hard run. A considerable amount of this hard lead is made, as there is a strong demand for it.

The retort riches and other rich lead are cupelled in English cupelling furnaces. The tests are roughly elliptical, built up on a cast-iron plate inside a heavy rim or ring, open at one point in front for a pouring spout, this opening being bridged by a casting. The plate is supported at the back by stirrups resting on a rod and at the front is hung by chains from a triplex chain-block so as to regulate the pouring. The test is made up with a lining of cement and ground fire-brick, tamped to shape, and with a pouring spout at the front side. An air-blast strikes across the surface of the bath from the rear, thus driving the litharge as it forms toward the spout, and during the operation the litharge is run off continually, except for the time occupied in changing the pots to receive it or when charging additional lead. This litharge is re-smelted. The test is covered or roofed over with a fixed firebrick arch built with a slope to direct the heat against the bath.

The silver from the cupel is run into a granulating tank through which a rapid stream of water flows during granulating. The silver is then melted in one of the Faber du Faur furnaces and cast into bricks weighing about 1100 oz. One cupelling furnace is reserved for the making of C. P. or silver-free litharge, and is run in exactly the same manner as the above, except that pure lead is used in the charge. This litharge is then ground dry, in a ball-mill, and then sacked or put up in barrels for shipment. Test lead is made by pouring the melted lead into an iron cylinder in the bottom of which are two holes of about $^{1}/_{16}$ in. diam. The lead running through these small holes is struck by a blast of compressed air and granulated, being caught in an iron-lined box. This treatment gives a high percentage yield of the lead in a suitable condition for the uses to which test lead is to be put. The test lead is necessarily screened to remove all oversize.

Report of the Committee of Five

Below is presented a summary of the report of the Committee of Five, consisting of J. F. Kemp, C. R. Corning, George C. Stone, W. H. Nichols, Jr., and A. R. Ledoux, appointed at the February meeting of the American Institute of Mining Engineers to consider the affairs of the latter and the proposed amendments.

1. The Institute has been running behind $2000 per year in ordinary net income, and $7884 more if the land should be paid for in equal annual instalments plus interest.

2. Prior to this year, the technical, social, and business affairs have been practically under a one-man management. This is generally undesirable, and has become impossible in a society of our present size and diversified activities, and should be changed.

3. The publications have been admirable and of high standing, and we would deprecate any change in type, printing, paper, or other literary characteristics, and we suggest that each year, in the Year Book or other prominent part of the publications, all three fundamental documents underlying the Institute be published—not only, as heretofore, the Constitution and the By-laws, but the Certificate of Incorporation as well; but we believe that the cost can be materially reduced by reductions and adjustments, even in addition to those which the Directors and Council have inaugurated in 1912, so that a saving of over $5000 can be effected in this line.

4. We have indicated in the body of the report other savings in expense through greater efficiency, prompt adherence to office hours, and otherwise.

5. The Committee has given in detail its views and its reasons for recommending the legalizing of the office of Secretary Emeritus, and will later, as part of the proposed changes in the Constitution and By-Laws, point out the steps necessary to that end.

6. The putting into effect of recommendations as to a reduction of salaries of Secretary and the retired Secretary, if continued, and of editorial expense with other economies elsewhere suggested, we believe would bring down the deficit very largely, or entirely eliminate it. We believe, in brief, in cutting all expenses and all operations likely to involve such, to the absolutely necessary minimum to make the budget of the Institute, all financial obligations of whatever nature included, balance.

7. We advise that the Annual Meeting, which has now been adjourned until October, shall take up and carefully consider suggested alterations in the Constitution, that such of them as meet the approval of the membership may be put into effect at the Annual Meeting of 1913.

8. We urge the Board of Directors likewise to inaugurate, as soon as possible, amendments in the By-Laws, so that responsibility shall be distributed and not placed upon one individual, and to put into effect still further improvements in addition to those already inaugurated by the Directors.

9. We recommend the copyrighting of all papers accepted and printed.

10. We advise that delinquent members be dropped after twelve months' delinquency.

11. We recommend that the election of life members be limited to 5 per cent of the actual membership, and that the receipts from life memberships be set apart toward the accumulation of a fund for the liquidation of the mortgage and interest thereon, and not turned into the general fund of the Institute to meet ordinary expenses, and that after the indebtedness be lifted they be invested in trust funds and the interest thereon used to meet the Institute's obligations to its life memberships.

12. We suggest for serious consideration the postponement of the publication of the 'Emmons Volume' unless the Directors and Council are satisfied that there will be such a demand for it as immediately to meet the first expense of, say, $2100, which we understand will be payable next fall.

Finally, we wish to express our absolute confidence in the continued value of the Institute to all of its members; our conviction of the possibility of its greater efficiency, until its publications become indispensable to the profession and membership a coveted honor. We urge the present membership to increased interest and coöperation, so that as soon as possible proposed constitutional changes may be intelligently discussed and properly authorized, and we record our fullest confidence in the Board of Directors and Council as at present existing, which have already initiated many important changes in methods and have continued to great advantage their efforts since the last Annual Meeting. Due credit should be given to those of our members who have consented and who shall consent to accept offices whose duties are and will be no sinecure, if our recommendations are adopted. The membership should keep itself informed as to the affairs of their society, and by attendance and discussion at meetings and otherwise, inquire and criticize and be assured to their satisfaction that the business, both technical and financial, is conducted by modern methods and in a manner to insure prosperity.

Summing up, therefore, concerning the specific questions entrusted to us for consideration, we recommend:

(*a*) That the vote on the constitutional amendment to change the name of the Institute be kept open for careful consideration and decision in 1913.

(*b*) We recommend a negative vote upon the amendment proposed last February authorizing an increase in dues, believing that the economies proposed, some of which are already in effect, will not only do away with the deficit, but provide an adequate income, possibly even providing sufficient funds to liquidate the mortgage.

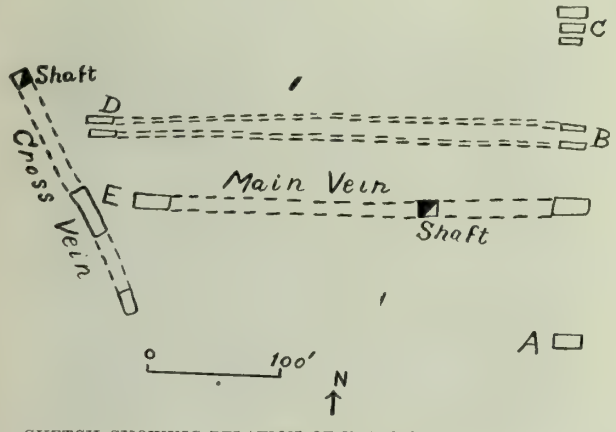
(*c*) We recommend a negative vote on the proposal to reclassify retroactively the present membership, leaving any reclassification of membership for a more careful consideration later on.

The South Belt at Rossland, B.C.

By C. A. Stewart

The mineral output of Rossland, British Columbia, comes entirely from a group of veins lying north of the town, among which the Le Roi, Centre Star, the War Eagle, and the Josie are the most important. Despite the success of these properties and the widespread mineralization in the district, little or no attempt has been made in late years to open up other mines, largely because the district has not yet recovered from the loss of confidence resulting from unscrupulous promotion in its early days. In view of this fact, it is interesting to note that attention is now being given to a series of claims south of the town known as the 'South Belt.' A discussion of these deposits may well be preceded by a summary of the geology of the whole camp.

This district has been mapped by Messrs. Brock and Young of the Geological Survey of Canada. The oldest formation is the Mt. Roberts series of quartzites and slates of Carboniferous age. This has been intruded by a complex series of Carboniferous and Tertiary eruptives, of which monzonite and augite porphyry are the most important, both in areal extent and in their relation to the ores. Basic dikes are numerous and are often asso-



SKETCH SHOWING RELATION OF VEINS ON THE RICHMOND PROPERTY, ROSSLAND.

ciated with the veins. So extensive has been the intrusive activity, that the quartzites and slate are cut up irregularly, and often form island-like masses in the greater areas of igneous rocks. The veins now being worked north of the town are the result of replacement along a series of small crevices in either the monzonite or the augite porphyry. The ore minerals are pyrite, pyrrhotite, chalcopyrite, and occasional arsenopyrite, and the gold seems to occur most abundantly with the chalcopyrite. Extreme variations in width are common, and often a mere stringer of sulphides that would attract no attention elsewhere will be followed long distances and found to open out into wide and rich deposits. The geological features affecting this variation have not yet been determined. There is practically no oxidized zone in the district, and secondary sulphides are not important.

The South Belt properties are about two miles south of the present producing mines, and include both prospects long idle and newly discovered croppings. They differ from the veins north of the town in having quartzite for wall-rock in several instances, and in containing galena with high silver content. Particular attention is being paid to the Richmond and Bluebird properties, both of which are in the quartzite, and preparations are being made to do active work on them during the summer. While the Bluebird veins were discovered several years ago, the Richmond is a comparatively new prospect, and a detailed description of it will serve to illustrate the general occurrence.

As shown on the accompanying sketch, veins have been found, and a cross-vein approximately N. 40° W. and a dip 70° N. have been exposed by trenches for several hundred and two test-shafts have been sunk. A summary of occurrences as exposed by these shallow workings follows, the results of the assays being those kindly given me by Mr. Coulter of Rossland. All of the veins are of the replacement type, the gangue being the unreplaced remnants of dense quartzite. At *A* there is a 3-ft. vein of pyrite and chalcopyrite assaying from $2.50 to $4 in gold. The 'main vein' at the shaft, which is not over 30 ft. deep, shows 4 ft. of ore—pyrite, pyrrhotite, chalcopyrite, and galena. The last-named mineral is irregularly distributed, and where it is present silver to the amount of 20 to over 100 oz. per ton has been found. The gold in galena-free portions varies from $3 to $4 per ton. North of the main vein, at *B*, are two narrow pyritic stringers, not over a foot wide. At *D* these showed $12 in gold. At *C* is a series of three veins of pyrrhotite and pyrite which have been regarded as the continuation of the Bluebird vein, but there is at present no geological basis for such a belief. The cross-vein at *E* is about three feet wide and is largely pyrite and chalcopyrite. The shaft on this vein is down 30 ft., and from it a cross-cut is said to have been run for 27 ft. without reaching either wall, and a high gold content is reported. At the time of my visit, in the early spring, the shaft was flooded, and I was unable to verify this statement.

Three-quarters of a mile northeast of the Richmond is the Bluebird, on which more underground work has been done. Galena is an important ore-mineral on this property, and a high silver content has been reported. Near the Bluebird are several idle properties, the dumps of which show much galena and some sphalerite.

In connection with these South Belt veins two geological problems arise: (1) the explanation of the presence of the galena which is so much more abundant here than in the north, and (2) the probable effect of the quartzite on the permanence of the veins. I am not inclined to regard the galena as the result of any form of surface alteration, and I do not believe that its occurrence will be directly related to depth. Its distribution is likely to be as irregular along the strike as on the dip, and only further exploration will settle the question of its abundance. Surface indications, however, give reason to believe that lead-silver ores are a more important factor in the South Belt than in the north. According to the generally accepted theories of ore deposition, the dense quartzite would be a less favorable place for replacement veins than the basic igneous rocks of the district. General theories, however, must be abandoned when in conflict with facts, and it cannot be denied that at the Bluebird and the Richmond the quartzite has been replaced extensively enough to warrant further exploration. The brittle quartzite seems to have been broken into a series of closely spaced, parallel cracks, along which the ore-bearing solutions have come, eating out into the rock and replacing it. It must also be remembered that views in regard to replacement are undergoing a change, and that new discoveries are constantly showing extensive replacement under conditions formerly regarded as unfavorable. The fissuring at the Richmond seems to be independent of the bedding or the joint systems of the quartzite, and to be the result of the same forces that produced the veins to the north.

Experience in the older mines of the district should be considered by those having to do with further work on the South Belt. These properties at present are only prospects, and exploration should be undertaken with the expectation that lean stringers and bonanzas will alternate here as in the north of the camp. In fact, the value of the ore may be even more irregular than in the older mines, for the composition of the quartzite will vary from bed to bed, and may have an influence on the width and richness of the veins.

The Associated Mill, Manhattan

By J. C. Kennedy

The Associated mill at Manhattan, Nevada, is owned by the Manhattan Associated Milling Co., of which John G. Kirchen is president. The mill was designed and erected under the supervision of Charles Kirchen, who is general manager for the company; R. W. Marston, formerly of the Tonopah Extension mill, is superintendent. Construction was begun late in November 1911. The usual, or greater than usual, number of delays occurred in getting in machinery and construction material during the winter season, but the mill started running April 1, 1912, the day set. Less than the usual amount of trouble occurred on starting the mill, which speaks well for the experience and skill of L. A. Blackwell, the millwright and foreman in charge of construction and installation of machinery.

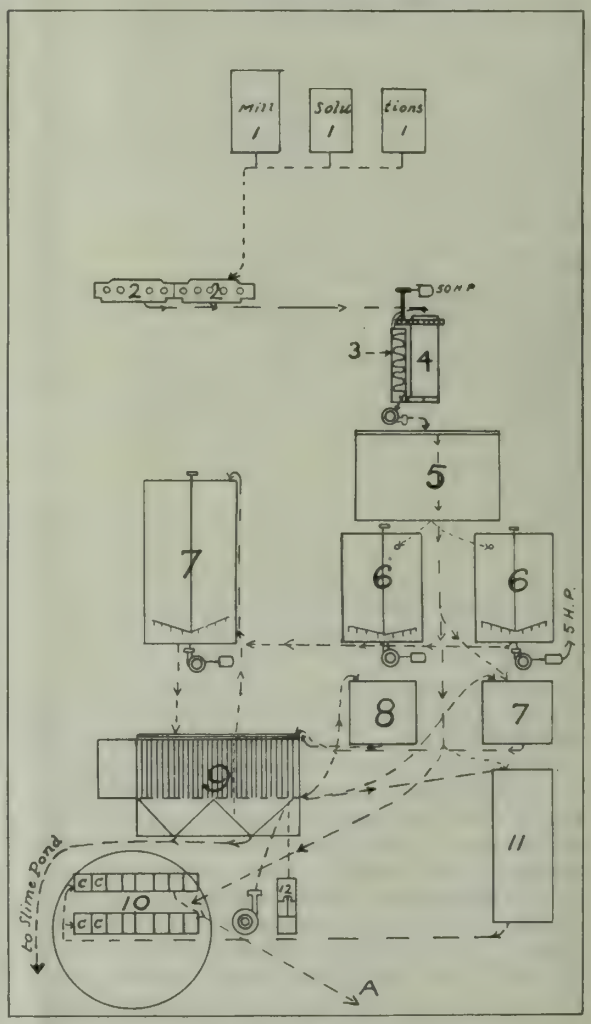
The principal stockholders of the owning company are interested in the nearby White Cap, Steffner Consolidated, and Mushett leases. The mill is so situated with reference to the leases mentioned, as well as the Kendall & Douglas, on the Manhattan Consolidated, the Swanson lease on the Earl, and the Bath Bros. leases on Litigation Merger and Earl, and the workings of the Manhattan Amalgamated Mining Co., that the output of all these leases and properties can easily be sent directly to the main upper sampling floor of the mill. So far, ore from the Steffner and the Mushett leases has been trammed to the mill, while that from the White Cap has been brought in large ore-wagons, mainly on a down-hill grade. Ore-bins delivering to cars on the tram track are erected outside of mill for different lots of ore. The mill is designed for general custom work in the district in addition to milling these ores, and for that purpose a fairly complete automatic sampling system has been installed. Ores will be bought and paid for in small or large lots after sampling and assay. This is a new departure in custom milling in the district which is pleasing and beneficial to sellers of small lots of ore, and contributes toward lower milling costs by avoiding delays for frequent clean-ups and consequent waste of time and labor. It is said that unusually low milling rates for this section are offered to owners of small lots of low-grade ore. So far the mill has had an abundant supply of ore from two or three of the leases, and this seems to be the outlook for the immediate future.

Fresh water for the mill is collected in a 20 by 16-ft. wooden tank, placed at such an elevation above the mill as to give a pressure of about 75 lb. at the filter floor for discharging the cake. This water comes mainly from workings of the Steffner and White Cap leases. Owing to the light winter rainfall, the water supply is rather short at present; but as the greatest depth yet attained at either lease is only about 200 ft., no anxiety exists for the future. In a well in the gulch below the mill, water is collected from the drainage of the tailing ponds and pumped to the mill to reinforce supply. Other sources of supply are easily available.

The ores of the White Cap, Steffner Consolidated, and, to a less extent, that from the properties and leases farther west on the mineral zone, while apparently fully oxidized, are refractory. The White Cap ore only yields on the plate about $1 per ton from ore $50 or higher in value, and the Steffner ore not much more. Much of the gold is in a very fine state, coated in some manner which would indicate the necessity of fine grinding. A recently discovered ore-shoot in the Mushett lease, however, carries much coarse native gold in reticulated and crystalline forms. The White Cap ore contains a small amount of cinnabar and other sulphides. The Steffner ore contains sulphides of antimony and arsenic. These sulphides have so far not proved objectionable as cyanicides.

There are two steel storage tanks, 9 by 14, and a wooden tank, 12 by 16 ft. The solution is kept at a strength of about 1.5 lb. KCN per ton. The main upper or sample floor of the mill is provided with steel plates for coning and quartering down large samples. The southeast corner of this floor is partitioned off as a room for crushing, pulverizing, and otherwise preparing samples for assay. The assay laboratory itself is in the office building a short distance from the mill. The ore is first weighed and then dumped about 4 ft. to mouth of crusher, with no intervening grizzly. The crusher is of the Foster type. With the ores so far handled, which have a considerable percentage of friable and earthy matter, the capacity of the crusher is fully 50 tons in an 8-hour shift.

The travel of ore and solutions through mill are shown by the accompanying flow sheet. The crushed ore is raised

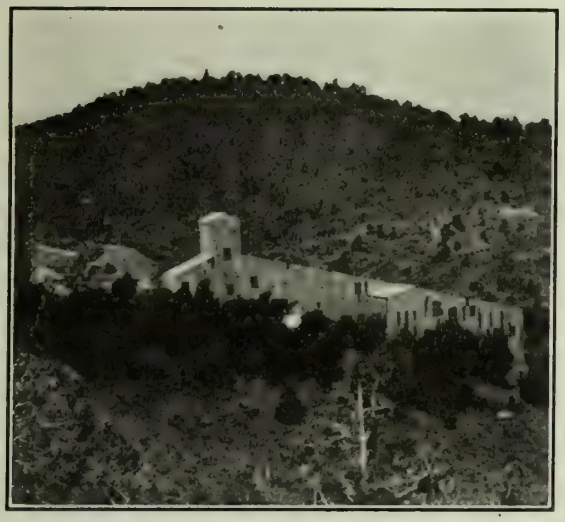


FLOW-SHEET, ASSOCIATED MILL, MANHATTAN.

by an elevator to an automatic sampler of the Vezin type, which cuts out a 1/20 sample, the reject falling directly into a flat-bottomed ore-bin of 80 tons capacity. The sample passes to a set of rolls, thence to a second Vezin sampler, which takes out 1/10 for a final sample, which falls into a receptacle in a locked compartment at the end of battery bin. The reject falls directly on sampler floor, is transported in cars, dropped through the crusher when not in motion, elevated, and dropped into the battery-bin. Crusher, elevator, rolls, and sampler are driven by a 30-hp. motor. The ore is discharged from the bin through the usual rack and pinion gates to suspended Challenge feeders to the mortars of a 10-stamp Hendy mill, driven by a 30-hp. motor. The

stamps weigh 1050 lb., with from 7 to 7½-in. drop at the rate of 100 drops per minute. The mortars are of the narrow quick-discharge type. Battery posts are large, and the concrete battery foundation and battery-frame are of the strongest and most substantial construction. All foundations in the mill are of concrete and of good size. Screens of 30 mesh or finer are used. The Tyler top-cap No. 50 is used for some ores, and the No. 273 for harder ores.

The pulp goes to a 30-in. by 15-ft. Akins classifier placed adjacent and parallel to the tube-mill and set on a slope of 2½ in. to the foot. The tube-mill is 4½ by 16 ft., with scoop feed, and is driven at 25 revolutions per minute by a 50-hp. motor. The discharge from the tube-mill goes to the classifier and the sand is returned to the tube-mill, thus forming a closed circuit; all the material traveling around the circuit until brought to such a fineness that it passes off in the overflow from the classifier. The tube-mill is provided with the Komata liner, which is rare and recent in Nevada, its previous use, so far as I know, being confined to the Goldfield Consolidated and Tonopah Extension mills. One of its features of merit is that it has a larger effective inside diameter for a given outside diameter, compared with silex blocks or other lining. Another is that the inside diameter varies less during its life, making the peripheral speed more constant, an important consideration. It is claimed that a less depth of loading with pebbles is required, the practice in New Zealand being to keep the top load of pebbles 5 to 7 in. below the axis of rotation. It is also quickly put in and removed, keeps its place, and wears well. It is being introduced in this country by F. C. Brown, and seems to be giving satisfaction.



ASSOCIATED MILL, WITH THE STEFFNER, MUSKETT, KENDALL AMALGAMATED, AND EARL MINES IN THE BACKGROUND.

All the lime required to neutralize the acidity of ore and keep up the protective alkalinity in the agitator is introduced into the classifier. This, so far, has been about 7 lb. per ton. Overflow slime from classifier is pumped by a 4 by 18-in. Byron Jackson centrifugal pump to a 10 by 20-ft. Dorr thickener, settler, and dewaterer. A 5-hp. motor drives the classifier, pump, and thickener. The overflow solution from the thickener flows to the gold-solution tank. Should it not be high enough in gold content it can be diverted either to the weak-solution tank or the barren-solution sump-tank under the zinc-boxes. The thickened pulp flows by gravity to one of two tanks 16 by 20 ft., fitted with the Trent agitator. At this point enough KCN is introduced to bring the strength of the solution up to about 2 lb. per ton. Some of the ores, notably the White Cap, settle rather badly, but an attempt is made to keep the specific gravity of the slime in agitators at about 1.2. Of this slime, 65 to 70% will pass 200 mesh. The slime solution in each tank is kept in circulation by a Campbell & Kelly centrifugal pump run by a 5-hp. motor. The usual period of agitation in each tank is 16 to 24 hours.

The Trent agitator is well known, but as it seems to be very effective and dispenses with the installation and operating costs of compressed air required in the Pachuca tank system, a brief mention will be made. The slime is drawn from the top of the tank and forced by the pump through a central pipe at the bottom. This central pipe has four pipes radiating from it, each fitted with jet-pipes directed toward the bottom of the tank. The reaction of the discharging slime through these nozzles causes the arms to revolve at sufficient speed to give good agitation. Air is admitted into the suction of the pump and is forced through the slime charge, giving a well-disseminated aeration. Air is automatically trapped beneath an inverted hemispherical covering which surrounds the step-bearing, so that no solid or liquid matter can reach the bearing, making the friction not greater than if it were in the open air and not submerged.

From each agitating-tank, when agitation is completed, the slime is pumped to an 18 by 26-ft. pulp-storage tank, also fitted with a Trent agitator, by which agitation is continued to preserve homogeneity. From this tank the slime goes to a Butters filter-box, immediately below, which contains 45 leaves, 5 by 10 ft., with two hopper bottoms, and with the usual acid-treatment vat at one end. The slime enters the box through a large pipe, fitted with nozzles, which shoot the slime some distance out over the top of the frames. Adjacent to and on same level as the filter-box floor are two tanks, 10 by 16 ft., one containing weak solution and the other wash water. The cycle of operations is about the same as usual. One wash with weak solution and one with water are given when the vacuum is on, all except part of the water wash going to the gold-solution tank. In practice in this mill the cycle from commencing to load to the final discharge of the cake is longer than usual. With a ¾-in. cake the filter handles about 12 tons of dry slime at each cycle. The handles and levers of all the valves are conveniently arranged on the filter-floor, and all those for diverting slime, weak solution, and wash water in the desired direction are placed compactly in small space at one corner of the filter-box.

From the gold tank the gold solution goes to two steel zinc-boxes, each with 7 compartments, 3 ft. square and 30 in. deep, having hopper bottoms covered with screens to retain short zinc. The two head compartments in each box are filled with excelsior for clarifying purposes. These boxes are placed immediately above a large sump-tank, into which the barren solution falls. Adjacent to this tank and on the lowest floor of the mill are a Goulds 4-in. wet-vacuum pump, 40 r.p.m., and a Meese & Gottfried Butters 6-in. centrifugal slime and solution pump.

The mill has an addition at the lowest level containing a boiler for steam-heating the mill and solutions when necessary. It also contains an Ostermoor pipe-cutting and threading machine, and other tools. One end of this addition is partitioned off and fitted with cement floor for clean-up, drying, and bullion room. All short motor belts in the mill are of the metal link-belt pattern. The frame of the mill building is anchored to concrete block foundations extending into bedrock; the sides and roof are covered with galvanized corrugated iron. The absence of vibrations about battery and in all parts of the mill is especially noticeable. The capacity of the mill is 50 to 60 tons per day; nearer the latter figure on present ores. The capacity of lower part of mill for almost every class of ore is considerably greater than that of the upper, unless agitating and filtering operations are unduly prolonged, thus giving considerable elasticity to the treatment of different kinds of ores.

CALIFORNIA'S sea exports of petroleum and refined products for June were 20,150,449 gallons, valued at $617,150. Crude and residuum were 297,962 barrels, valued at $218,751. The importations were 896,000 gallons of benzine from Peru, valued at $58,401. The production amounted to 7,327,830 bbl., and the total amount in storage June 30 was 44,919,262 barrels.

Sketch of the Geology of Ecuador

By W. A. Wolf

*The Eastern range of the Ecuadorian Andes includes representatives of the most ancient known rocks, the Coast on the west the most modern sedimentary formation, and the inter-Andean country with the Western range, a combination of plutonia and volcanic rock. Of the latter the first predominates in the Southern, the second in the Northern half. While neither zone excludes altogether the formations of the others, the general divisions listed below are easily recognized as is shown by the accompanying map.

1. Gneiss and crystalline schists—(Archean).
2. Cretaceous formations—(Mesozoic).
3. Tertiary formations—(Cenozoic).
4. Quaternary or 'diluvial'—(Psychozoic).
5. Alluvial or modern—(Psychozoic).

With the sediments and between them are volcanic and plutonic rocks, the relative ages of which are determined from the sedimentary formations with which they are found in relation. In Ecuador three large groups may be distinguished:

1. Granites and syenites found connected with the gneiss and crystalline schists.

2. Greenstones and porphyritic rocks found in connection with the Cretaceous formations and for the greater part of Mesozoic origin.

3. Volcanic rocks, which are characteristic of the Quaternary and recent beds, although some seem to date from the Tertiary period.

Gneiss and Crystalline Schists.—In general the Ecuadorian Andes consists of 'Laurentian' rocks, including gneiss, schist, and slate of a crystalline texture. The petrographical character of these rocks has been changed by chemical metamorphism since their original formation. The main elevation of the Ecuadorian Andes is relatively modern, later than the Cretaceous and probably occurred in the Tertiary period. The principal framework of the Andes has been subjected to changes from Archean times to the present day, causing many alterations, both chemical and structural. The main agency of change has been the eruptive rocks, which thrust themselves through the strata. The later rocks of aqueous origin overlie them so that their area of outcrop is limited. The surface exposure of the gneiss and crystalline schists extend through all of the Eastern range with its Eastern slopes from the Peruvian to the Colombian boundary. In the province of Loja gneiss and schist are prominently developed and descend by the Western slopes to the deep inter-Andean valleys.

Granites and Syenites.—True granite is found in but few places. It is sometimes found intercalated with gneiss and micaceous schist, but in these cases it is frequently difficult to distinguish from a gneiss badly developed. Syenite is found more frequently than granite but under similar circumstances, and never is extensive. Like the granite found with the gneiss, the syenite is in close relation with the amphibole schists, this relation without doubt being genetic. Mica characterizes the granite and the gneiss, as hornblende marks the syenite and the hornblende schists. Diorite in the province of Loja is found as dikes in the granite and syenite.

Cretaceous Formations.—The geological scale is not fully represented in Ecuador, the Paleozoic and the first two periods of the Mesozoic being wanting. No trace has been found of any formations of these periods. Wherever contacts of Archean rocks with others have been found, formations of Cretaceous or younger age rest upon the Archean. In Colombia and Peru Jurassic and even older rocks are found, and it is possible that they may be yet discovered in the deeper synclines covered with later strata or in some region not yet studied. According to deep artesian well borings, the Cretaceous formation of the coast near Guayaquil appear to rest directly on the crystalline schists and granites. The boundaries of the Cretaceous are ill-defined as it is hard to determine the age of certain strata. Fossils are almost entirely wanting. In the majority of cases it is necessary to classify the rocks by analogy and by comparison with similar rocks in other countries. In the inter-Andean country the Cretaceous is not extensive, being covered in many places by volcanic material. In the Western cordillera it is highly developed. The beds of the Cretaceous are irregular and have been uplifted and folded. They are not found in their original position. The dip is mainly toward the West, and the strike is that of the cordillera.

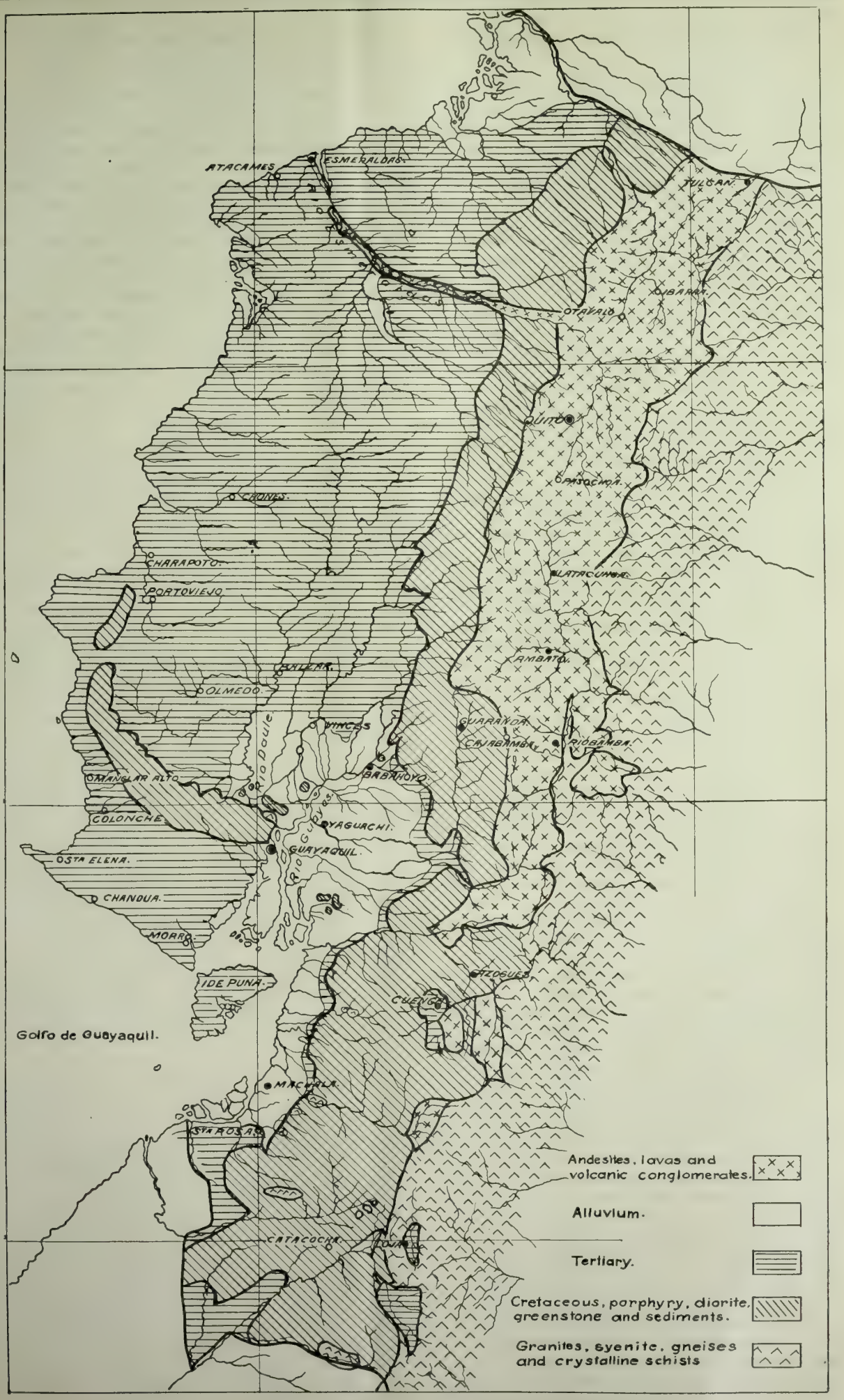
Greenstones and Porphyritic Rocks.—These are found chiefly in the Southern provinces of the Republic. In the Northern part they are deeply hidden below volcanic rocks. Andesite, containing veins of gold quartz, is found in the Southern provinces.

Tertiary Formations.—There are two distinct developments of the rocks of this period. Along the coast they consist of marine deposits, and in some depressions of the inter-Andean country they are lacustrine deposits.

Quaternary and Modern Formations.—Commonly the alluvial deposits are the direct continuation of the Quaternary, without notable change either in material or deposition. In these cases it would be arbitrary to fix the limits between them. It is possible, however, to distinguish marine and alluvial deposits. The marine deposits are limited to the shore belt and have a large superficial extension. The alluvial are found in all parts of the Republic but are local, being found in the valleys and over small plains. The common volcanic rocks are of Quaternary and modern age, and many lake and river deposits are made up of volcanic material.

Occurrence of Gold.—Quartz veins are found in the schist, gneiss, and slate formations, generally without associated minerals, though sometimes oxides of iron or manganese occur. No auriferous quartz is found in these formations. The relative poverty of the veins in the primitive formation and in crystalline rocks is striking. At Gualaceo, far across the Eastern range, gold-bearing quartz veins are reported. In silver the veins are as deficient as in gold. Notwithstanding the poverty of the veins the Eastern cordillera is an auriferous district because of the placers. Nearly all of the rivers have their source in the crystalline rocks. The majority of the gold-bearing streams have their source in the Eastern watershed from the Loja province to the province of Imbabura, because on that side the schists reach their highest development. On the Western side the gold washings are only in those provinces in which the schistose formations extend to the deep depressions of the Andes. They are richest in the province of Cuenca. It is not to be doubted that the gold found, originated in the schistose formations, because the streams carry it in larger quantities and larger grains while traversing them and as soon as they enter other formations, the gold content diminishes and the grains are smaller until it altogether disappears. The tributaries of the Napo, Santiago, and other great rivers are gold-bearing in their upper courses and barren below. In the streams of the province of Azuay gold has been deposited at a distance from the upper courses but within the schistose formations, and for this reason neither the Gualaceo or Paute river contains gold to repay washing. Gold is disseminated through the crystalline schists and which furnished the gold of the placers. Auriferous quartz veins are found in the andesite in the Southern part of the Republic.

*Taken from 'Geografia y Geologia' by Tedore Wolf.



SKETCH MAP OF GEOLOGY OF ECUADOR (AFTER TEDORE WOLF).

The Rand Mines, Limited

JOHANNESBURG CORRESPONDENCE

During early June most of the adjourned annual company meetings were held and, seeing that the year 1911 was scarcely a satisfactory one as far as shareholders were concerned, some interesting explanations were looked for. The statement of the managing director of the Crown Mines as to why results there did not come up to expectations has already been published, and, with the exception of the great excess of capital expenditure over the engineer's estimates, may be considered as on the whole satisfactory. Perhaps the most interesting meeting was that of the Rand Mines, Ltd., where the chairman gave the usual review of the disappointments and successes of the past year. The Rand Mines-Eckstein group controls or holds shares in nearly every concern of any value throughout the whole extent of the Rand, so that its experience applies more or less to the whole Rand gold-mining industry. Its interests cover some of the best outcrop mines and, with one or two exceptions, the whole of the deep-level mines of any pronounced value. Being admittedly the most progressive group on the Rand, the review of its doings is always interesting.

At the Rand Mines meeting the chairman stated that during the year more deep-level areas had been acquired beyond the Grahamstown dike to the dip of the Robinson Deep. As this is in the richest portion of the Central Rand, and in a neighboring concern belonging to the Rand Mines the lower levels are showing improved content, the action does not throw much light on the interesting question as to whether the Rand banket reefs become generally impoverished in depth, nor does it give as much encouragement as would the adoption of a policy of active development in the ground belonging to the Rand Mines Deep, to the immediate dip of the Jupiter and Simmer Deep properties.

The Rose Deep, Village Deep, and the Modderfontein properties all did well during the year, but at the Ferreira Deep, City Deep, and Geldenhuis Deep the results did not by any means come up to expectations. It was explained that at the Ferreira Deep the profits had been decreased, owing to the operations being handicapped during the past two years by the "great pressure exerted by the overlying strata." Now this great pressure at the Ferreira Deep would have not been so noticeable had mining operations been conducted in a proper manner; in fact, it would have not been noticed at all, as the depth at the Ferreira Deep where the troubles occurred is only about 2000 ft. However, it has been found necessary to flush over half a million tons of sand into the stopes, at a cost approaching a shilling per ton, and the process is not yet completed. The sand filling cost does not equal the losses incurred by damages to property and shafts, not to mention loss of profits, but the filling has saved the mine, and it would seem probable that in a comparatively short time, and with a better system of mining, all troubles due to subsidence should be over. At the Geldenhuis Deep, also controlled by the Rand Mines, Ltd., a similar experience was had, and sand-filling to protect the shafts and railway had to be resorted to, but in this case the position has been aggravated by decreasing content and increasing costs, necessitating a change in the management, as in the Ferreira Deep, with the object of obtaining better and more economical mining.

The chairman was careful to announce, in regard to the East Rand Proprietary Mines, in which during the year the Rand Mines, Ltd., acquired an important interest, that the Rand Mines does not control, but he considered "the present management good, and so long as the development values continue favorable as they have done hitherto, there is every reason to expect good results, while, further, there was no doubt that the backward swing of the pendulum went too far." That was a satisfactory assurance, so far as it went, but the stockholders appear to require far more reassuring statements about the management and development prospects before they put up prices to their old level. Although the Rand Mines, Ltd., does not control the East Rand Proprietary property, it is to some extent responsible for the present management, and stockholders will want to know why the gold recovered at the East Rand Proprietary Mines has lately been a full pennyweight in excess of the average assay value of the ore reserves. At the Village Deep, an important mine controlled by the Rand Mines, Ltd., the manager has been instructed to keep the grade of ore mined at the average value of the ore reserves, and stockholders cannot understand the need of a different policy at the East Rand. If the present East Rand management is good, why should a check be placed on a similar practice to a much smaller extent at the Village Deep mine? The stockholders also want to know something more definite about the development values. In the annual report of the superintending engineer, only about a third of the total ore standing developed in the mines was shown to be profitable, and apparently the deeper sections of the property were developing in a manner not altogether satisfactory. It was the appearance of this report that made the "pendulum swing back" so far. Some of the stockholders in the East Rand are not so certain that the management is as good as represented at the meeting of the Rand Mines, Ltd. The report of the superintending engineer for 1911 indicated an ore reserve of 6,716,605 tons of an average value of 6.9 dwt. and intimated that the aim would be to eliminate, as far as possible, from mining operations, all ore of an unprofitable grade and to mill such ore as would approximate the value of the ore reserve. The former policy appears to have been carried out with a vengeance during the last few months, but the intention to mill ore of the average value of the ore reserve has been entirely overlooked in the scramble for profits. These are some of the points the stockholders of the East Rand Proprietary Mines would have been glad to have explained by the chairman of the Rand Mines, Ltd.

As to the power troubles experienced on the Rand during the past year, the chairman announced that an ample supply of electric power was anticipated in September, but that it will be from 12 to 18 months before the full supply of compressed air would be furnished. As a compromise and recompense for past losses, the Rand Mines, Ltd., has accepted £33,000 from the Power company. The chairman pointed out that a number of improvements had been effected during the year in the metallurgical practice at the mines, among them being more efficient tube-milling, classification, and the adoption of the Butters filters. The Rand Mines has in operation Butters filters capable of handling 85,000 tons of slime per month, at a cost ranging, according to tonnage and conditions, from 2.6d. to 4d. per ton, while the total extraction at the New Modderfontein and Robinson mines has been brought up to 97 per cent.

In concluding, the chairman dealt with the future of the leading properties belonging to the Rand Mines, Ltd., but did not touch in detail on the future of the Rand. The Rand Mines, Ltd., holds an 8-mile stretch of the best deep-level country in the Central Rand, and the lives of the deep mines in this area are not determined by the present dip boundaries of the existing properties. Probably no new company will be formed to incur the enormous capital expenditure and the risks that would have to be incurred in sinking to vertical depths of 7000 ft. or more. So long as the veins continue profitable in this central and richest portion of the Witwatersrand, they would be followed in depth by the existing deep-level mines. At the Village Deep mine the grade of the ore between 3500 and 4000 ft. vertical was better on the whole than that in the same mine between 2000 and 3000 ft., while at the City Deep excellent ore is found at vertical depths varying from 2400 to 3350 ft. No limit can yet be determined regarding the life of the Witwatersrand.

Manganese Deposits of the Caucasus

By Frederic W. Cauldwell

*The manganese deposits of the Caucasus are among the richest in the world. The principal mines are situated at Tchiatouri, in the Government of Kotais, about 190 versts (126 miles) from the Black Sea ports of Batum and Poti. The exploitation of the Tchiatouri mines began in 1878, but remained on a very limited scale until 1885, when the Trans-Caucasian railway was constructed.

The ore is shipped to England, Germany, the United States, France, and Belgium, and in smaller quantities to other countries. England, Germany, and the United States are the best customers. The total export of the ore from Batum and Poti during 1908 and 1911 was:

	1908 (tons).	1911 (tons).
Poti	366,600	442,460
Batum	8,160	129,233
Total	374,760	571,693

The increase of the shipments from Batum during 1911 is attributed to the heavier cost of loading ore at Poti, owing to the levying, in 1910, of a duty of one-half kopek per pood (0.2575c. per 36.112 lb.) on ore exported from that port. Manganese shippers at Batum loaded several steamers with full cargoes during the first two months of the current year, and there is every reason to assume that the exports from Batum in 1912 will equal, if not surpass, those of 1911. About 15 or 20% of the manganese exported is washed ore.

Manganese ore declared for export to the United States through the consulate at Batum amounted in 1910 to 28,490 tons, of a value of $259,898. In 1911 the export amounted to 19,685 tons, with a declared value of $197,737. These figures represent but a part of the ore from the Caucasus that was imported into the United States. Much of the ore sent to European countries is eventually transshipped and finds its way to the United States. Three full shiploads are sent, on an average, each year direct from Batum and Poti to the United States in chartered vessels. The ore exported through the ports of Batum and Poti generally contains 48 to 52% of metallic manganese (Mn), while concentrate obtained from washing the granular ore and used for chemical purposes (glass-making) is shipped containing 81 to 90% of manganese dioxide (MnO_2).

The mines at Tchiatouri lie in a region of horizontal sedimentary formations, divided into two principal parts by the Kvirili river. These are again crossed by numerous branches of the river, and the whole region is thus divided into seven plateaus: on the right side of the Kvirili river, Rgani, Sedergani, Mguemevi, Darkveti; on the left side, Perevissi, Choucrouti, Itkhrvisi. The total area covered by these mines is about 126 square versts (about 55 square miles), of which 100 square versts (44 square miles) contain good ore.

The outcrops of the ore are about 1000 ft. higher than the Kvirili river. The ore lies in a horizontal bed between limestone below and sandstone above. Besides solid benches the ore also occurs in granules (oölitic form) mixed with sandstone. The richest ore has been found in the plateaus of Mguemevi, Sedergani, and Choucrouti; Rgani plateau yields rich concentrating ore. According to calculations of Russian geologists, the Tchiatouri mines contain about 1,070,000,000 tons of ore, estimated to be sufficient to supply Europe and the United States for at least half a century, especially as the Tchiatouri ore is of high quality. As already mentioned, the ore lies in horizontal layers, and consequently the mines can be worked easily and at the same time over great areas by means of tunnels (galleries) and by using picks and shovels.

*From a consular report.

The mines are owned by a large number of Georgian peasants, who are without capital or knowledge of mining. Until recently, with few exceptions, the mines have been worked in a most primitive way, and as a result only about two-thirds of the ore has been recovered. Within the last six years various foreign firms have bought up some of the larger plots and have started mining by more modern methods. The lump ore is separated by hand from the sandstone; only the ore occurring in granules is concentrated in washing plants. In washing, the granular ore can be concentrated up to 60% of metal or 90% of peroxide of manganese (MnO_2), but these percentages are above the average for the district.

The ore is transported to the railroad at Tchiatouri in two-wheeled ox-carts or by pack-horses, and over bad roads, for distances varying from 2 to 5 versts (1.324 to 3.31 miles), at a cost of 2 to 3 kopeks per pood (1.03 to 1.545c. per 36.112 lb.). The position of the mines is favorable for mechanical transportation of ore, especially by wire ropeways, but on account of lack of capital such methods have begun to be employed only lately and as yet are used by but a few firms.

From Tchiatouri the ore is carried on the Tchiatouri railway, a 25-mile narrow-gauge branch of the main line, to Sharopan. At Sharopan it is transferred into the cars of the Trans-Caucasian railway and shipped to either Batum or Poti. The freight rate from Tchiatouri to these ports is 70.23 rubles ($36.17) per car of 750 poods (about 12.1 long tons) of ore, which is 9.37 kopeks per pood (4.826c. per 36.112 lb.). This rate includes all expenses of trans-shipment at Sharopan and three-fourths kopek to the Manganese Producers' Association. The greater part of this freight rate is for the distance from Tchiatouri to Sharopan, namely, 5½ kopeks (2.8325c.) for a distance of 38 versts (25 miles). The remainder of the freight rate, amounting to 3.87 kopeks, is paid for the distance of 162 versts (107 miles) from Sharopan to Batum or Poti. The best business in manganese would therefore seem to be done by the Tchiatouri branch of the state railway. The cost of building this short line was 1,500,000 rubles ($772,500).

As most of the mine-owners are Georgian peasants with little capital, the trade in the ore has been principally in the hands of commissionaires working with the assistance of banks, which charge 8 to 9% interest. Of late considerable German capital has been invested in the mines, and much of the unworked land is now in the hands of foreign capitalists. A very important part of the manganese business for the exporter is to have at his disposal a number of well situated platforms at Tchiatouri, connected with a siding of the railroad, where stock for shipment can be stored. The Tchiatouri railroad can furnish 400 cars per day at the utmost, and these are divided among the proprietors of platforms at a ratio of 1 car for every 20,000 poods of ore kept in stock. Therefore, the greater the quantity of ore in stock the larger is the number of cars allotted to the shipper. At times of heavy shipments from Tchiatouri these rules are strictly followed by the railroad, while in slack times owners of small stocks can obtain as many cars as are free.

The advantage of keeping heavy stocks and having good platforms at Tchiatouri are: (1) The owner of these stocks can always obtain a correspondingly large number of cars. (2) When he is expecting to load a steamer at Batum or Poti it is not necessary to accumulate beforehand a large stock of ore on the docks at these ports, but he can hold his shipments at Tchiatouri and forward in time to load directly on board ship from constantly arriving cars. The shipper can thus reduce expense of interest on the railway freight; and the ore being handled but once at the docks, loading on board ship is cheaper. It needs but a glance, therefore, to see that next to the possession of mines, the control at Tchiatouri of suitable platforms of great capacity is one of the most important questions with which the trade has to deal.

The ore is put aboard steamers at Batum and Poti by

laborers, who carry it in small baskets holding about 4 poods (144 lb.) over wooden runways erected from the dock to the steamer. In this way, and with a sufficient number of laborers, 400 to 800 tons of ore is loaded per day. If the ore is handled direct from arriving railroad cars, the cost of loading into the hold of the steamer is ½ kopek (about ¼c.) per pood; but if the ore is loaded from the docks, upon which it has previously been discharged from railroad cars, the cost is ¾ kopek. About six years ago there was constructed at Poti an elaborate elevator for loading the ore on board ship mechanically, but up to the present time this elevator has not come into general use. To pay for this improvement a charge of ½ kopek per pood has been recently placed by Poti on all ore going from that port. The result has been to divert shipments to Batum.

The Manganese Producers' Association, of which mention has been made, levies a tax of ¾ kopek per pood on all ore sent by rail from Tchiatouri. It is given the right by the Government to levy up to 2 kopeks per pood. The income derived from this tax is set apart for bettering conditions about the mines. The managing council of the association is elected at an annual meeting of manganese producers and exporters, at which apparently the voting regulations are such as to give the small dealers an overwhelming majority. As capital becomes more and more necessary to carry on deeper mining, the tendency is for the small producers to disappear, but they are still sufficiently numerous to be able to elect a council in sympathy with their views, and are urging the council to expend the proceeds of the tax to assist them to compete with the larger capitalists. They point out that some of the larger capitalists, having installed mechanical transportation of ore from the mines to the railway platforms, have an advantage over those who are still obliged to use bullock carts. The small producers are urging the council to expend 1,000,000 rubles ($515,000) for mechanical means of transport which shall be at the disposal of all producers.

The council has also under consideration new plans for the supply of water to the mines, for housing workingmen, and other improvements which are to be carried on from the funds procured from the tax. Altering the present branch line between Sharopan and Tchiatouri to a broad gauge has been under recent consideration by the state railway engineers. Such improvement would eliminate the necessity for trans-shipping the ore from the trucks of the narrow-gauge line to the trucks of the main line at Sharopan. Exporters are urging a reduction of the railway rates that will bring the rate on the Tchiatouri branch line down to something like the normal rate for such service.

A feature of the manganese industry during 1911 was the marked increase in the quantity of ore washed at and about the mines, to the great discomfort of the population using the waters of the Kvirili river for domestic purposes. Most of the washing plants have been erected on the banks of the Kvirili or its tributaries, and the tailing from these plants has polluted its waters to such an extent that complaint was made to the viceroy. The Manganese Producers' Association has devised a plan which seems likely to meet the exigencies of the case. It is proposed to construct a large dam in the valley of the Kvirili river below Tchiatouri, at which slime from the washing plant will be arrested. The water would there be purified and the overflow from the dam would be utilized for generating the electric current required for lighting the village of Tchiatouri, for electrifying the Sharopan-Tchiatouri branch railway, and for converting manganese waste sediment into ferromanganese in electric furnaces. It is estimated that the washing plants now in course of construction, when completed, will have a daily capacity of about 2613 tons of ore averaging approximately 53% metallic manganese in the dry state and make 1460 tons of tailing containing 30% mineral to waste in washing the first-named quantity of ore.

Alumina in Slags

By H. C. Bellinger

*During the past two years a number of highly interesting articles on the action of alumina in slags have appeared in the technical journals. These have been written by well known metallurgists, who have advanced theories and drawn conclusions of a definite character, which undoubtedly have faithfully represented the action of alumina under the different circumstances attending the smelting operations leading to their convictions. Having had a somewhat varied experience in the treatment of ores containing alumina, I feel that some of the conclusions arrived at are apt to be to a great extent misleading.

It will be interesting here to quote the opinions of various authors and metallurgists on the action of alumina. A great diversity of opinion exists among our chief metallurgists, and the reason for this, after all, is easily understood when we consider the erratic action of this element. We will take as a first example the ores from the Rossland district, British Columbia. With reference to the orebodies, I can best quote from J. F. Kemp, who states as follows: "The orebodies exist at or near the contact of gabbro and porphyry, the extent of the mineralized zone being about four miles long by one mile wide. The contact is not abrupt, but the gabbro passes gradually into augite, porphyrites, and diabases, seldom more than one mile wide and brecciated." The gangue matter analyzed approximately as follows: Al_2O_3, 14 to 18%; CaO, 10 to 12%; K_2O,Na_2O, 2 to 3%; SiO_2, 40 to 46 per cent.

The first metallurgist who attemped to smelt these ores arrived at the conclusion that the alumina should be calculated as an acid, and found on this assumption that a certain percentage of limestone was required. The furnace was blown in, but the campaign abruptly terminated at the end of two hours by the freezing up of the furnace. The metallurgist concluded that the alumina was more active than he had first considered, and therefore increased the percentage of limestone, with the same disastrous results. The company then decided to call in another metallurgist, who took an entirely different view of the alumina. He assumed that the part of the alumina which was in combination with silica would continue to perform the function of a base, while the remainder would probably assume the opposite rôle, which happened in this case to be equivalent to eliminating the alumina entirely from the calculation. A change was made upon this assumption, and no difficulty whatever was experienced, the result being in every way highly satisfactory. No practical alteration was made in the composition of the charge for some years, the regularity of the ore making this unnecessary. While in this particular instance the alumina appears to have played no prominent part in the formation of the slag, at the smelters at Butte, Montana, where the economic conditions demand the formation of a slag ranging from 45 to 50% SiO_2, the alumina definitely assumed the rôle of a base, as the following analysis will testify:

	Per cent.		Per cent.
SiO_2	45.4	CaO	18.5
FeO	24.0	Al_2O_3	7.9

It will be seen that here 24.2 oxygen units are contained in the acid, while the base units give 10.62 units of oxygen, the result being a true bi-silicate slag. If the alumina be included on the acid side, the ratio is 2.6 to 1. A similar substance is shown in the Northport slags of the following composition:

	Per cent.		Per cent.
SiO_2	43.5	MgO	4.5
FeO	20.0	Al_2O_3	14.5
CaO	16.0		

*Excerpt from an address before the Australasian Institute of Mining Engineers.

Here there are 23.3 units of oxygen in the silica and 10.81 base units in the FeO, CaO, and MgO, while 6.75 units are included in the alumina. If the latter be taken as acid, the acid ratio is 2.8 to 1. The following slag represents a two-weeks run at the Britannia plant, Vancouver island:

	Per cent.		Per cent.
SiO_2	50.4	CaO	22.22
FeO	20.5	Al_2O_3	6.5

Here there are 26.88 acid units of oxygen in the slag, and only 10.7 in the base. Including the alumina as a base, the oxygen ratio approximates the bi-silicate, while including it as an acid the ratio would be 3 to 1, which is beyond reason.

Again, at Croftin, British Columbia, I was engaged in the smelting of ore containing barite with an average of 40 to 50% barium sulphate. These ores also contained from 8 to 9% zinc. On account of the low formation point of the slag resulting from this ore, it was necessary to add both silica and alumina before the furnaces could be made to run satisfactorily. The slags ranged from 5 to 12.2% alumina, and the action of alumina here was most confusing. The aim at this, as well as at other plants, was to utilize, so far as possible, the base units, and the object, therefore, was to crowd as much silica upon the charge as possible. All of the slags resulting from the various mixtures made were commercial, and ran in a highly satisfactory manner. Still I found that in some cases the alumina apparently acted as an acid, while in the other cases similar assumption would clearly have resulted in an impossible slag, since the result would have been a ratio of 2.7 of acid to 1 of base. Neglecting the alumina, the ratio is 1.91 to 1, closely approximating a bi-silicate type.

Then, again, at Cobar there are anomalies, as the following figures will testify:

NEUTRAL ALUMINA (PER CENT)

Cu	FeO	SiO_2	Al_2O_3	CaO
0.2	49.2	41.4	5.8	1.0
	2	5⅓	46.6	2
	9/98.4			
			348	
	10.93	2070	348	
	28	138	232	7/2.0
	11.21		2.7028	0.28
		2 22.08		
		11.04		

ACID ALUMINA (PER CENT)

Cu	FeO	SiO_2	Al_2O_3	CaO
0.3	51.4	39.2	6.5	0.6
	2	5⅓	466	0.2
	9/1028	1960	390	7/12
	11.42	130	390	0.17
	0.17		260	
	11.59	20.90	3.0290	
		3.02		
		2/23.92		
		11.96		

In the cases above enumerated the alumina acted in various ways—acid, base, and neutral.

From the foregoing figures and extracts it is obvious that the function of alumina still remains in a decidedly unsatisfactory state of uncertainty. I have operated plants where the slags seem to have placed beyond all doubt the definite action of alumina in one or other of the various allocated rôles. But from diversified experience it is plain that it is necessary to look beyond the mere chemical analysis of the ore in order to evolve a reasonable and definite process of action for alumina. Take, for instance, the porphyries with the large influence of the feldspars in evidence, and certain combinations exist for the silicates of alumina and other bases. The feldspars constitute an extensive list of minerals with a wide range of composition, from orthoclase with 18.4% Al_2O_3 and 16.9% K_2O, to anorthite with 36.7% Al_2O_3 and 20.1% CaO. Both these feldspars, physically and chemically, in their behavior under similar treatment, are widely divergent. Thus on through the various metasilicates and orthosilicates to the hydrosilicates, conditions vary physically and chemically with widely different genetic laws. The range of oxygen ratios varies from less than one to one in the subsilicates to four to one in the disilicates. Considering the many conditions of combination in aluminous compounds, and noting the definite changes in the action of the alumina in sympathy with variations in such combinations, it becomes quite possible that under similar furnace conditions the compounds may be reasonably expected to adopt rôles suited to their peculiar forms. Many engineers have, for instance, found under certain conditions that by calculating the alumina soluble in acids on the acid side, and treating the insoluble alumina either as base or as an independent elementary magma, they have attained excellent results. Though Peters says that this method has no scientific foundation, it is interesting to note that it has been a success in some cases, and the reason for this success may in the future be reduced to a scientific basis. At Cobar a series of experiments is being made. While the outcome of these may not alter the present status of alumina, it is hoped that the information secured will be of some value.

Gold and Tin Production of Seward Peninsula

The gold produced in Seward Peninsula, Alaska, for 1911 had a value of $3,100,000, which was a decrease of about $400,000 compared with the figures for 1910. This falling off, according to P. S. Smith, of the U. S. Geological Survey, is attributable to three main causes—first, a decrease in the amount of winter mining; second, a general decrease in mining operations, except dredging; and third, the handling of low-grade material. All these causes may be referred more or less directly to the exhaustion of the known rich bonanzas before enterprises have been established capable of handling cheaply the large amounts of low-grade material which are known to exist in the peninsula. From this statement it may be inferred that at some future time the gold production of the Seward Peninsula will materially increase.

Although practically all the mineral production has been derived from gold placers, interest has been renewed in the tin deposits, and a production of nearly 100 tons of concentrate, worth about $50,000, is reported from the tin placers on Buck creek. Not only has dredging for placer tin been carried on, but certain lode tin mines near York have been reopened under the superintendence of a competent mining engineer. It is understood that the company intends to ship the tin concentrate to Seattle, where it will be smelted.

The Silver Market

Samuel Montagu & Co. reports that the market has become unsettled, not, however, before prices broke recent records. On June 22 the quotation for cash touched 28 9/16d., the highest for that delivery since October 12, 1907, while that for two months, 28 11/16d., on the same day, was the highest for forward delivery since October 23, 1907. These prices were maintained on June 23, but since then quotations crumbled ⅛d. per day until June 29, when a small reaction of 1/16d. occurred.

Electrical Factor of Safety

The United States Bureau of Mines has issued Technical Paper No. 19, written by H. H. Clark, on 'The Factor of Safety in Mine Electrical Installation.' The paper calls attention to the fact that wherever the service conditions are indeterminate or variable, engineers are accustomed to use factors of safety in their designs, especially in those cases where the protection of human life is a consideration. The author believes that a similar factor of safety should be used in connection with the electrical equipment of mines. To quote from the paper: "The safety of operation of electrical mining equipment is an engineering problem that involves the element of human life and that is influenced by conditions and events that cannot always be foreseen. The successful solution of the problem will, therefore, depend largely upon the factor of safety that is considered in the selection, installation, and maintenance of such equipment." Mr. Clark classifies the electrical accidents that may occur in mines, and enumerates the principal sources of danger incident to the use of electricity underground. The conditions surrounding electrical equipment in mines are compared to similar conditions above ground and the requirements of mining work which present difficulties in the way of maintaining electrical apparatus in perfect conditions are noted. The effect of roof falls, dampness, dust, and acid water are mentioned. The temporary character of underground work limits the economical investment in electrical equipment and its installation. Mr. Clark does not regard the safeguarding of mine electrical equipment as a simple problem, and states that there is no general formula for its solution. It is suggested, however, that a logical first step would be to remove contributory causes by placing lights and erecting guards at particularly dangerous points, and by selecting apparatus especially designed to offset the effect of dampness and dust. He says: "The problem of safeguarding may be divested of some of its vagueness and put in concrete form by considering that if the electric current can be kept where it belongs—in the conductors designed to carry it—it cannot give shocks, set fires, or ignite gas, dust, or explosives. Electricity becomes actively dangerous only when it breaks away from its proper channels in stray currents or as sparks and arcs." The paper lays stress upon the importance of first-class installation at the outset and frequent inspection of equipment after it is in place. Mr. Clark considers that a competent electrician is needed to insure the safest and most efficient operation of mine electrical equipment, and dwells upon the responsibilities and requirements of such a position.

Framing Shaft Sets

By Tom McCormac

There are three aids to fast work in framing shaft sets: an accurate set of templates, corresponding to the system of framing in use; a boring machine; and a big cross-cut saw, 7 or even 7½ ft. long.

The templates can be quickly made out of any light board, and they may be faced at each end, if desired, with galvanized iron or heavy tin. They save a lot of time in measuring, they prevent mistakes in framing, and above all, they are accurate. When it is remembered that an ordinary miner will miss, in measuring a 9-ft. distance with a square, the correct measurement by ⅜ in., even this last point has its value. Using the templates, any variation in the size of the timber is instantly seen, and the required allowance in framing is marked. This does away with 'sizing' each timber; a needless refinement.

The boring machine, which can be purchased for a few dollars, insures the holes for the hanging-rods being straight; this in turn insures the set to hang in its place when the rods are tightened, and reduces the labor in blocking the set to its place in the shaft. It also saves its cost quickly in the reduction of labor in the boring of holes. It takes an appreciable part of the time of a shift to bore the holes in a set of timbers with a brace and ship-auger, as there seems a strange coincidence in the finding of knots just where it is necessary to bore the holes.

The big saw is, however, the greatest help. In the hands of two men who have had a little practice it does rapid and accurate work. In starting the saw it is generally advisable to use a guide, which can be either a small block lightly nailed against the mark on top of the timber, or a short piece of heavy timber placed against the mark to be sawed. Either will steady the heavy saw until the cut is started. Not only may the big saw be used to cut the timbers to the proper length, but it may also be used to make the necessary framing cuts.

After the stick of timber has been cut, squarely, to the proper length and all the framing cuts finished with the big saw, each end is finished with the adz, slick, and plane. In the frequent case of a knot occurring at the end, the ripsaw will give better results than will the adz, although in ordinary wood the adz is the faster tool to use.

There is no high degree of skill required in the framing of shaft sets if the standard methods of framing be adhered to. W. H. Storms has pointed out that the beveled corner has no place in the modern shaft, to which teaching I am in full agreement. It was designed to prevent the plates from splitting at this point under heavy pressure, and as it fails in that purpose, I can see no good reason for retaining it, particularly as it makes framing nearly doubly as expensive. The ordinary carpenter, in getting out a shaft set, will usually have it accurate and each joint a good fit; in a word, the set will almost invariably represent a finished job, except in one particular. Few timber framers make any effort to have the outside of the corners flush, and it is against these corners that the blocking will press. If the wall-plate is a quarter or half an inch wider than the length of the tenon of the end-plate, the blocking is going to be a little less solid than it would be were the corners flush. This, it is true, is not of great importance, but since the corners can be quickly finished evenly, by a little rough work with hand-axe or adz, it would seem to be advisable to have the work done.

Goldfields of New Zealand

The annual general meeting of the Consolidated Gold Fields of New Zealand, Ltd., was held in London on June 28. The chairman of the board of directors, Sir W. B. Perceval, made the following statement. "On the whole I think shareholders have every reason to be satisfied with the result of the year's work. The reports and accounts reveal two facts. The first is that, both as regards the mine we are working ourselves, the Wealth, and the mine we have such a large interest in, the Blackwater, the developments are of a highly satisfactory character; while as regards the Progress mine, in which, again, we have a very large interest, recent developments are also more encouraging than for some time. The other fact is that large expenditure has been incurred on development and in additions to the plant at all of the mines, and, inasmuch as the money for this outlay has been found by our company, the result is that our cash resources have been correspondingly reduced. It is true that the effect on our balance-sheet is that our carry-forward of £51,599 is largely made up of loans to our subsidiary companies; but, inasmuch as these loans are absolutely good, it does not, to my mind, give ground for unfavorable comment, and by making these loans we have enabled our subsidiary companies to do necessary work on very much better terms than could have been obtained elsewhere. We hold 93,224 shares in the Blackwater company, and it is pleasing to note that this company continues to earn good profits, and, what is more pleasing still, by the favorable nature

of the developments of the mine the intrinsic value of our share-holding has considerably increased.

"With regard to the Progress mine, we have never lost faith in this mine. We have been devoting special efforts for years past to coax the Progress to reveal the position of its dislocated orebodies, and a trained geologist, H. Norton Johnson, imported for the purpose from the United States, has been at work since October 1910, resurveying the mine and studying the vagaries of the formation. Recent developments are distinctly encouraging, and there is hope that the Progress will at no distant date resume business and again enter the dividend-paying list. We have in that company 169,943 shares.

"During the year the operations at the Wealth of Nations mine have been of an exceptionally satisfactory character. The tonnage treated was 24,968, an increase of 3605 tons over the previous year, the total value of gold recovered, including concentrate, being £50,374, or an increase of £13,989; the yield per ton being 40s. 2.21d., against 34s. 7d. for the year before, an increase in value of 5s. 7d. per ton. The working expenditure was practically the same as the previous year, but the working profit came out at £27,352, or 21s. 10d. per ton, against £16,703, or 15s. 7d. per ton, the total result being an increased working profit of £10,649, equal to 6s. 3d. per ton."

Quicksilver in the Urals

ST. PETERSBURG CORRESPONDENCE

The occurrence of cinnabar in the Urals has long been known, and in the gold sands it was quite common to find angular pieces and pebbles of cinnabar; for example, in the Bogosloff district, in the Miask gold sands, and elsewhere; and at last an original deposit of cinnabar in the Urals has been discovered. The story of the discovery is fairly interesting.

In 1904 the *staratelli* (free laborers) at the gold mines of the Verch-Isset factories on the Ayatsky estate in the district of Ekaterinburg, about 40 versts from the Neviansk factory, discovered both vein and sand gold, but of so low grade that they did not attempt to work it. In 1910 they went back to the vicinity and in the wall rock found mineral. The samples were assayed and antimony and a fair content of gold discovered. But it is expensive to separate the gold from antimony ore, and it requires special apparatus which is not at the disposal of the *staratelli*. Therefore, this deposit was once more abandoned without having been exploited.

In 1912 the Verch-Isset factory managers found that not far from the works carried out by the *staratelli Zbierevy* there was found, along with the gold, a reddish ore which volatilized on exposure to fire. Samples of this substance showed a mercury content as high as 10%. Besides mercury, there was a content of gold amounting to between 2 and 6 zolotniks per 100 poods and silver to 2 zolotniks (one pood equals 36 pounds). After this Ryuniy, the mining engineer, made an investigation. In the shafts at 2 arshines depth (1 arshine equals 2 ft. 6 in.) the vein was found to be 2 verschoks wide (1 verschok equals 1¾ in.), and at 22 arshines depth its thickness increased to 3 verschoks. By a cross-cut a second vein similar to the first was discovered. The thickness of this vein was 12 verschoks. The character of the veins does not change along their length. The cinnabar in the first vein, as in the one parallel, was in lumps between the cracks, in places forming rich pockets.

Besides these two veins a series of other thinner veins with traces of gold occur. The cinnabar is in very irregular veins showing only traces in some places, but near the edges in rich pockets. A smaller pocket was found in the northeast drift, covering 12 v. wide and about 1 a. long. The second pocket is found deeper in the shaft. In these pockets all the fragments are incrusted with cinnabar and have been christened by workmen *zembyiky* because of their bright color. Perhaps a new branch of productive industry—mercury mining—will be developed in the Urals, and it is quite possible that the discovery of the first deposit will by no means be the only one.

Coal Mines of North China

The largest coal mines in China are those of the Chinese Engineering & Mining Co., Ltd., at Tongshan and Linsi, about 75 miles northeast of Tientsin. These mines were started under Chinese administration in 1878, but were reorganized as a British corporation in 1900. The relative rights of the Chinese and foreign interests involved have been in constant dispute since that time, but have finally been settled by an agreement, of which the following details are taken from a prospectus recently issued by the British company. In the year 1906, and with the authority of the Chinese Government, a company was formed called the Grand Mining Company of Pei-yang & Lanchow (the Lanchow Mining Co.). This company was granted extensive mining rights in the Kaiping basin, notwithstanding that exclusive mining rights in the basin were claimed by the old Chinese Engineering & Mining Co., Ltd. The Lanchow Mining Co. proceeded to open and to work certain mines, but some years elapsed before the competition thus created became effective. In the year ended February 28, 1911, the Chinese Engineering & Mining Co., Ltd., with a view to meeting the competition and to forcing a settlement of the dispute respecting the rights of the two companies, began to reduce the selling price of coal, and further reductions have been made from time to time down to a recent date. It was in consequence of this reduction of the selling prices that the profits and the dividends for that year showed a decrease. Negotiations have been proceeding for a considerable time past between the two companies and between the British Government and the Chinese Government with a view to the settlement of the differences between the two companies. An arrangement has recently been concluded which has received the approval and confirmation of the Chinese Government, contained in a communication to the British minister in Pekin, dated March 18, 1912, which was acknowledged and confirmed by a despatch of the British Minister to the Chinese Government, dated March 19, 1912. These documents have been incorporated in a formal agreement, dated June 1, 1912, which has been approved by the British and Chinese governments.

Under the arrangement just concluded the business of the two companies is to be combined and worked as one business under a joint administration known as the Kailan Mining Administration. After making provision for the interest on the debenture issue, the amount required for the purpose of the sinking fund, and for a reserve for depreciation, the profits of the business up to £300,000 are divisible, 60% going to the Chinese Engineering & Mining Co., Ltd., and 40% to the Lanchow Mining Co. The profits in excess of £300,000 and the profits from any new business and shafts worked by machinery away from the present shafts are to be divided equally between the two companies. In addition to the existing mines of the two companies the Kailan Mining Administration will have control of the mining rights of the Kaiping basin, an estimated area of 100 square miles, being 20 miles long by an average of 5 miles wide.

The output and profits of the Chinese Engineering & Mining Co., Ltd., for the seven years ended February 28, 1911, were as follows:

	Output (tons).	Gross Profit.	Reserve for Depreciation.	Balance.	Dividend Rate, %.
1905 ..	876,725	£189,754	£40,000	£149,754	10
1906 ..	833,679	170,230	30,000	140,230	10
1907 ..	1,000,201	236,980	40,000	196,980	15
1908 ..	1,117,570	214,436	25,000	189,436	15
1909 ..	1,226,069	234,926	40,000	194,926	15
1910 ..	1,359,501	234,448	30,000	204,448	15
1911 ..	1,170,163	182,908	35,000	147,908	10

Discussion

Readers of the MINING AND SCIENTIFIC PRESS are invited to use this department for the discussion of technical and other matters pertaining to mining and metallurgy. The Editor welcomes the expression of views contrary to his own, believing that careful criticism is more valuable than casual compliment. Insertion of any contribution is determined by its probable interest to the readers of this journal.

Words and Their Use

The Editor:

Sir—I note that in reprinting my paper on zinc-dust tests in your issue of May 11, the word "classification" was substituted for "elutriation", while a note on your editorial page intimated that the latter word was erroneously used in the original. Permit me in self-defense to point out that my use of this word, in the sense of the separation of extremely fine material by the use of water, is entirely correct, or at least that it has the authority of Murray's new Oxford dictionary of the English language in addition to the precedent established by good technical writers for a century or more. 'Elutriation' was not used under the impression that it was synonymous with the term 'classification' as used broadly, nor with its more restricted meaning of 'hydraulic classification' as applied to crushed ore, but as hydraulic classification of very fine particles.

The fact that the Century dictionary defines "elutriate" merely as "to purify by washing; to purify generally" is scarcely sufficient to set aside the continuous usage of the word in the other sense. The Oxford dictionary gives "to decant, to strain out, to purify by straining. *In chemistry:* to separate the lighter from the heavier particles of a pulverulent mixture by washing." Thorpe's dictionary of applied chemistry agrees with the last definition. Where I have met the word in the literature of the arts, the meaning implied has generally been the separation of extremely fine particles from others less fine, rather with a view to the saving of the finer material than the cleansing of the coarser, by means of a relatively large amount of water, which is decanted either intermittently or continuously and allowed to settle. Among the materials so treated may be mentioned clay, chalk, bone ash, and various abrasives such as flour emery. In some cases, however, the object was to correct the coarse portion, and in some the removal of soluble substances was apparently contemplated.

R. H. Richards uses the word in both his recent works on ore dressing, while another writer (A. S. Cushman, I believe) has gone so far as to apply the term "air elutriation" to describe the classification by means of an air-blast of finely powdered silicates which it was undesirable to moisten, using for that purpose one of the familiar glass soil elutriators designed for use with a current of water. Of these apparatus a number of forms are in use, of which Hilgard's is a well known example.

W. J. SHARWOOD.

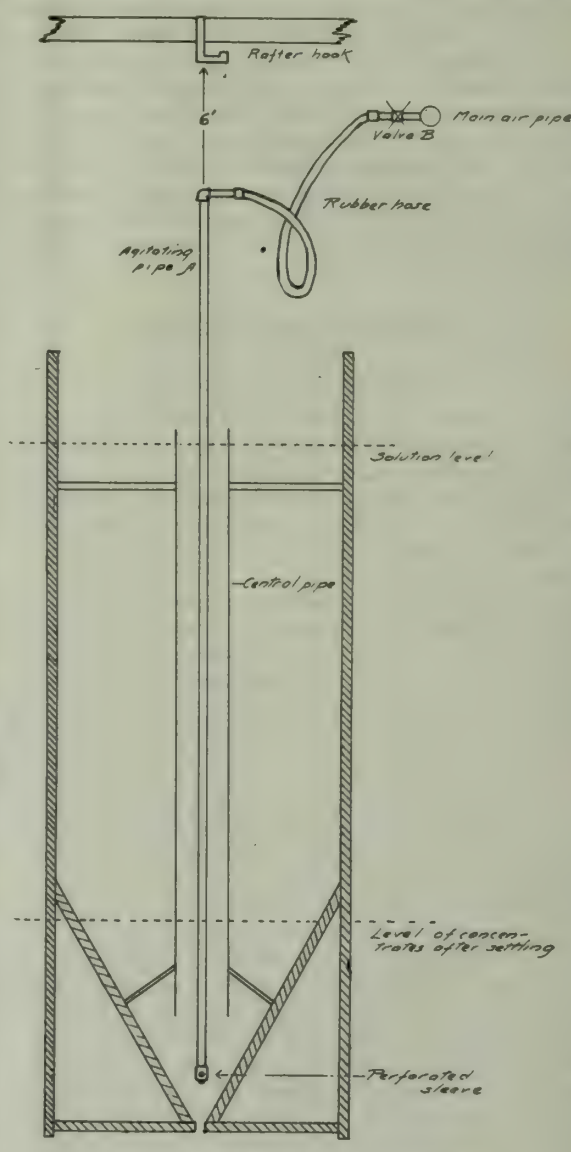
Washington, D. C., June 27.

[The citations which Mr. Sharwood adduces to buttress his use of 'elutriation' may serve as well to exemplify the reasons for refraining from its use. Riemann has defined natural science as "the attempt to comprehend nature by means of exact concepts." A word which in its technical sense is so diffuse as to mean "to decant, to strain * * * to separate by washing" is not of great service in the expression of exact concepts regarding the process involved or in conveying them to the mind of another. The operation described was exactly that of hydraulic classification, in the limiting case where only one mineral substance is present, and was best described by the word classification, which conveys a fairly precise idea to the minds of metallurgical and mining engineers. The transfer of exact concepts from one mind to another offers great difficulties at best, and authors should constantly remember the reader, while the use of exact language is often a great aid in the formulation of exact concepts as well.—EDITOR.]

Agitating Concentrate

The Editor:

Sir—At the Homestake mine at Neal, Idaho, the concentrate is slimed and treated by four to six agitations and decantings in 5 ft. 8 in. by 15-ft. Pachucas. After decanting, a great deal of trouble was met in trying to get the agitation started. The fine concentrate would settle into a cement-like mass in the cone, choke the valves, and resist all efforts to get the air up through it. Incomplete success was obtained by poking the mass with a hand agitator until it was loose enough for the air to break through, but even then the valves and central pipe were usually so clogged that good agitation would not start for hours. Various kinds of check-valves were tried on the air-inlet pipe, but none of them kept the concentrate from backing into the air-pipe when the pressure was turned off.



DEVICE FOR AGITATING CONCENTRATE.

The difficulty was overcome in this manner: a 17-ft. piece of 1-in. pipe (*A*) was fitted with a perforated sleeve and a plug at one end, and lowered, plug end down, into the Pachuca through the central pipe. The upper end was connected by 8 ft. of rubber hose to the main air-pipe. This 17-ft. pipe was raised about 6 ft. and slipped over a hook in the rafters. When it was desired to start the agitation the air was turned on (valve *B*), the pipe was lifted from the hook and dropped. The Pachuca required no further attention until the agitation was complete.

For the first five minutes after the agitating-pipe is dropped, the agitation is confined to within the central

pipe, then the weight of the agitator carries it down into the point of the cone and the whole charge is stirred. Finally, in not more than 15 minutes, there is a gush up the centre tube and good circulation is established and maintained. When the agitation is complete the agitating-pipe is lifted, hung on the rafter hook, and the air turned off. When the concentrate settles, the lower end of the agitating-pipe is above the mass, and it is impossible to choke it up.

There is a battery of four small Pachucas equipped with these agitators, and there was not a single case of clogging in six months. This agitator works clear to the bottom of the cone, thus preventing any settling, and after the circulation up the centre is once set up, there is no tendency for the air to escape up the outside of the central pipe. This scheme might be applied to larger Pachucas by operating the agitating-pipe with a chain block.

J. E. Alley.

Alta, Utah, June 30.

Life Membership in the Institute

The Editor:

Sir—In the report of the committee appointed to investigate the financial affairs of the American Institute of Mining Engineers, attention is drawn to the fact that the sums paid in for life memberships have not been reinvested to create an income to meet the expense of furnishing life members with publications. Permit me to point out that not only this feature, but the whole system of life memberships, as enforced in the Institute as well as the other national engineering societies, is totally unscientific. Until ten years ago, any member of the Institute not in arrears might become a life member upon the payment of $100, but evidently the financial disadvantage to the Institute of such an arrangement became recognized, for the sum has been increased to $150. Whether this will reimburse the Institute for the dues thus compounded depends entirely upon the age at which a member purchases a life membership. A member at the age of 21 (the earliest age at which he may join) should, according to the Institute of Actuaries annuity tables, pay $185, which must be reinvested at 4% to meet the obligations incurred in accepting his life membership. The present payment of $150 is, at 4%, only correct for an age of 40½ years; younger men pay too little and older men too much. The experience of the Institute as to the average age of the members purchasing life memberships has apparently never been made a matter of record, but it seems probable that the younger men would be the most likely to buy life memberships, as older men with any financial experience would not be slow to perceive the financial disadvantage to themselves involved. Under the present flat rate the Institute is losing money on every life membership it accepts under age 40, supposing an interest rate of 4%; or, at an interest rate of 5%, under age 29. The Equitable Life company's charge, for example, for a ten-year annuity at age 30 is $212.90, and at age 40, $185.20. With the present arrangement, any Institute member under 40 reaps a considerable advantage by buying a life membership from the Institute, while an elderly man would do better to buy an annuity of $10 per year, payable to the Institute, from a life-insurance company. What advantage the Institute derives from a life membership, beyond a guarantee that the member will not drop out, I do not clearly perceive, but it is evident that the present uniform cost of life membership is unscientific and probably a source of loss to the Institute.

Member.

San Francisco, July 19.

[The condition is not quite so bad as our correspondent suggests. Aside from what may be called 'overhead charges,' the actual annual expense per member is estimated by the Committee of Five at $3.50. If, therefore, the $100 originally charged had been invested at 4%, the extra cost involved in accepting a member would be fully met, and, in lieu of his contribution *pro rata* to the fixed charges, the Institute would have the reversion of $100 (now $150) at his death. In the long run it is difficult to see how this could work to the disadvantage of the Institute, even if it is unscientific. In the short run, as at present, there might well be too large a proportion of life members, since the above scheme contemplates a sufficient number of contributing members to fully carry the 'overhead charge.' The Committee of Five has recommended that no more life members be accepted until the proportion drops to five in a hundred, and that this proportion be thereafter maintained as a maximum. It is also recommended that money derived from this source be used for the present to retire the mortgage on the land, thereby earning 7%, and later deposited as a separate trust fund.—Editor.]

Gold and Soot

The Editor:

Sir—The condition of affairs in Adelaide, Melbourne, and Sydney reminded me of T. A. Rickard's article, under the above heading, in your journal some weeks ago. These cities, with populations of about 180,000, 580,000, and 600,000, respectively, are greatly interested in the production of gold and other metals, and are considered to be comparatively wealthy. As regards soot, it is high time the authorities took steps to minimize the nuisance. On leaving Adelaide by express and reaching the top of the hills behind the city at 5:20 p.m., a huge mantle of smoke is seen hanging over the place, produced by numerous factories and trains. Soot is continually dropping on one, which is undesirable. In the streets there are large numbers of motor cars, and the exhaust from these may be seen for some distance, showing, I should say, incomplete combustion of the petrol used. Coupled with the dust from street traffic, the air is not of the best quality.

In Melbourne smoke produced by factories, power plants, steamers, and trains hangs about all the time. The railway department has laid out rather pretty gardens at several stations, but flowers and shrubs have a dark appearance, which even heavy rains will not remove. The factories seem to vie with one another in the amount of smoke belched out of the stacks, although power-plants show better in this respect, while few factories seem to condense the exhaust from their engines. Fogs occur in Melbourne, and no doubt they are partly caused by dense smoke. I understand a movement is on foot to have all the factories shifted away from the city, although there would be huge compensations to pay, as the sugar refineries, superphosphate works, chemical works, tanneries, wool and hide warehouses are in large numbers. Taking a ride, one afternoon, in Sydney, I reached a suburb some miles out of town, and looking to the southwest, a whole line of factories could be seen pouring out smoke in quantity, so that there appeared to be a huge bank of it, like a cloud low down on the horizon. Sydney appears to have a dingy look about it, and this must be caused by rain and soot.

As Mr. Rickard remarked in his paper that the soot in London was due to incomplete combustion of coal used, so it is in the Australian cities. The waste, though not intentional, is quite serious, and reminds me of an article in *Power* some three months ago, written by a man who had visited certain factories indicating the engines, setting valves, etc., with much benefit to the owners. So it seems that a man might with profit to himself and others, give good advice on the proper combustion of coal in our cities. Power plants, as a rule, are worked with the greatest economy possible; and the engineers in charge of these works are known to be careful in this respect. A change in the method of firing, fireboxes, and perhaps the use of CO_2 recorders to check the work of firemen, might help matters somewhat.

M. W. von Bernewitz.

Sydney, June 17.

Special Correspondence

NEW YORK

LACK OF INTEREST IN MINING SHARES.—SITUATION IN METAL MARKETS.—REORGANIZATION OF MINING COMPANIES.

Both speculative and investment interest in mining concerns has been much restricted during the past week. In a general way there is little doing in the market, which is much in the doldrums. London cables tell of similar conditions prevailing in England, market review headlines reading 'Business in Mining Shares Declines Nearly to Vanishing Point.' In recent months Europe has been a heavy buyer of copper, but during the past fortnight has been almost entirely out of the market. Sellers who have not been sold well ahead have been getting under 17c., while some larger producers have been demanding 17¾c., though naturally making no sales at this figure. The copper situation is somewhat enlivened by the introduction of an element of uncertainty. The public is still trying to figure out the difference between mine production and refinery production, and the results differ widely in various calculations. The most striking feature in the copper situation has been the rooted unwillingness of the public to accept the improvement in the copper-metal market at its face value, and this has been emphasized by the vehemence with which the producers have declared themselves to have no knowledge of the sequestration of copper metal in any shape, form, or manner. Analysis of the refinery situation is pointed to as disclosing an inability to put out any increased amount of copper during the remainder of the current year. The Raritan plant of the International Smelting & Refining Co. is being enlarged, but during the process the output is somewhat curtailed. Much the same situation exists at Perth Amboy, and taking it all in all, copper producers are taking refuge behind the proposition that, regardless of the amount of blister copper that may be piled up in the stock-yards, it will be impossible for the refineries to turn out any greatly increased amount of copper in 1912. This may be somewhat comforting to the copper interest, but still leaves the public much in the dark as to the real situation of the metal. There has been a great deal of discussion concerning the recent drive made at the metal market. Whether or not the bears were acting in good faith is of minor importance. The fact is that the controlling interests in the present copper situation are the most important financial factors in the world, and are undoubtedly able to overcome the law of supply and demand if such a thing can ever be done. The silver market is becoming involved in conditions that somewhat resemble those governing the red metal. Some authorities are arguing that in the attempts of the speculators to accumulate stocks of silver in anticipation of demands to be made by both India and China, there has been created something akin to a silver surplus, and that unless speculators continue to protect their holdings by further purchases, the price of silver may be expected to remain stationary or decline. On the other hand, some of the best authorities estimate the world's consumption of new material at about 215,000,000 oz. annually, with an output of 225,000,000 oz., giving a margin of only 10,000,000 oz. for possible accumulations. From this it is contended that great importance must attach to requirements by the Oriental countries. The silver market in New York is at best only a secondary one, and while there has been some discussion from time to time regarding the possibility of speculation, there is as yet nothing that approaches an active market on this side of the water. The zinc market continues to break all previous records. This week saw a price of $61 per ton for 60% ore, which is the highest level recorded.

The reorganization of Ohio Copper is proceeding along the lines mapped out by the reorganization committee. The latter has taken a rather shrewd turn in putting an upset price of 25c. upon the outstanding stock. Undoubtedly this will induce a large percentage of the shareholders to stand the assessment of $1 per share which is asked as an alternative. The thing most needed in Ohio Copper is a report by some engineer of unquestioned standing so that the shareholders may have some idea of what they own. The Heinze control has not been noticeably beneficial or particularly frank with the shareholders, and the result of the experiments by E. A. Wall have never been given out definitely. Between the two, Ohio stockholders have had to guess as to where they stood. Giroux remains a great deal of a mystery. The property is now shipping regularly to the Steptoe smelter, but the fact that it has reached the point of production is in no way reflected in the share market. It goes without saying that no one questions the strength of the Giroux, either as to finances or operating ability, but the stockholders would greatly appreciate a frank discussion of the reasons why Giroux has 'marked time' while other properties, such as Nevada Consolidated, in the same district, have made history. Granby Consolidated has 'come back' in a most encouraging manner. In June the company mined, in round numbers, 1,900,000 lb. of copper, and closed the first half of the current year with an output of 11,035,684 lb., the first full half-year's work the company has been enabled to do since the enforced shut-down. Granby's copper costs have been materially reduced, part of the time getting below 10c. per pound during the past six months. Aided by the improvement in the metal market, Granby is now piling up a treasury surplus against the requirements in behalf of the improvements to be made at the Hidden Creek ground, upon which some $300,000 will be spent during the current year in work preliminary to the erection of a new smelter. The smelter will cost $1,250,000, and this expenditure will be met by deferring dividends rather than going to the public for money. There is to be some reorganization of the Coppermines Co., which owns a large tract of mineral ground at Ely, Nevada, adjoining the Nevada Consolidated's Ruth mine. Mr. Armstrong has long been an associate of W. B. Thompson, and was an active member of the Thompson organization during the distribution of La Rose Consolidated. He has been engaged in many other Canadian enterprises, both in Cobalt and Porcupine. The Coppermines property, which includes the old Chainman and McKinley mines, were at one time held by the Gunn-Thompson group which operates the Mason Valley. H. F. J. Knobloch and E. N. Skinner, both associates of Mr. Thompson, are directors in the present Coppermines company. If, as may be surmised, Mr. Thompson is to make the Coppermines property a producer, it will give him a still more prominent place in copper circles. He is at present the controlling factor in the Mason Valley and the Inspiration Consolidated, and is evidently aiming to get together a string of copper mines to rival the Guggenheim list of porphyries. W. B. Thompson is given credit by Wall Street for a large share in the work done by J. D. Ryan and his associates in bringing about the present copper situation, and in that connection is now in touch with the greatest financial interests there are in this country. The reorganization of the Arizona Commercial can now be regarded as complete. Charles Sumner Smith, of Boston, the head of the new company and president of the Old Dominion Copper M. & S. Co., recently bought in the property at public vendue sale for the reorganization committee, and within a short time the shareholders will receive new stock for their old holdings. E. P. Earle, president of the Nipissing Mines Co., has recently been elected a director of the Tri-Bullion S. & D. Co., which owns and operates mines at Kelly, New Mexico. Tri-Bullion has long been traded in on the New York Curb, but has aparently never been taken very seriously. Mr. Earle's interests in the Southwest are increasing. As a copper-selling agent he handles the output of the South Utah Mines & Smelters, and as he is no longer connected with the La Rose in Cobalt, he is apparently transferring his field of activity from Canada to our own Southwest.

The engraved certificates of the Canadian Mining & Exploration Co. are now being issued. This is a concern recently organized, with capital of $5,000,000, by some of the most prominent capitalists in the United States and Canada, as an exploitation company to take up new properties and examine and finance meritorious ones. The mining section of the open market in New York has been giving the larger portion of its attention recently to trading in the Tonopah issue. The recent discovery in the Tonopah Merger property is responsible for an advance in the issue to something better than $1 per share. The Tonopah Merger Co. is headed by J. G. Butler, Jr., of Youngstown, Ohio, who was the controlling factor in the promotion of Ohio Tonopah, which latter company is now out of existence. Mr. Butler is a prominent steel-mill man in the Youngstown district. The controversy between the Clark interests and the Butte & Superior Mining Co. in Butte is to be adjusted by the simple method of exploring the orebodies that may possibly be involved, and, after investigation has determined the rights of the parties, settling on a compromise basis if necessary. This manner of treating mining disputes would not ordinarily appeal to the legal fraternity, but would certainly be of immense advantage to shareholders. The talk of litigation to be brought by Mr. Clark had a somewhat depressing effect on the Butte & Superior share market, the stock declining from about $52 to something under $40, at which level it found strong support.

JOHANNESBURG, TRANSVAAL

DISAPPOINTING RESULTS OF NEW SHAFTS CUTTING THE MAIN REEF SERIES.—GOVERNMENT AREAS MORE PROMISING THAN RAND KLIPFONTEIN.

The most important recent mining event here has been the finding of the Main Reef at practically the same time by the Rand Klipfontein G. M. Co. and the North Western shaft, one of the four shafts being sunk on what are known as the Government Areas lying between the Brakpan and Geduld mines on the Far Eastern Rand. This latter ground was leased in behalf of the Consolidated Investment Co. from the Transvaal Government under somewhat novel conditions. There are no promoters' or vendors' shares, all the capital subscribed being available for capital expenditure to be incurred in opening, developing, and equipping the property, the interest of the Government being met by a share of the profits governed by a sliding scale. These Government Areas take the place of public 'pegging' of claims on the Rand, owing, it is claimed, to the fact that these deep-level areas are unsuited to small mining concerns and public pegging would probably lead to disturbances and disorderly scenes. However, the Brakpan Government Areas are considered the most valuable of these areas, but at the time they were offered, few tenders were put in, owing to the peculiar conditions and the large amount of working capital involved. For similar areas in the same neighborhood, no tenders were made when invited, as the ground was regarded as of more uncertain value than that now being developed by what are known as the State Mines. The ground occupied by the Government Areas near Brakpan was not drilled and proved by prospecting or pioneer bore-holes, as instead the reef had been proved practically on all the adjoining properties by either bore-holes or shafts. As this was the first time in the Transvaal that virgin ground had been opened without sinking preliminary bore-holes, the results were watched with all the more interest. On the Government Areas it was estimated that the Main Reef would be found somewhere between 2500 and 2600 ft. in depth, but as a matter of fact it was cut at a depth of 2395 ft., that is, a hundred feet shallower than expected, not a great differences when the surrounding circumstances are taken into consideration. The first intimation was that the reef was of good appearance and 27 in. wide. The situation of this particular shaft between Brakpan and the Modderfontein mines naturally led shareholders to expect that the reef would contain good ore, and some disappointment was felt when it was announced that the average assay worked out at 7.13 dwt. over 31 in. When everything, however, is taken into consideration, although the assay results failed to come up to popular expectations, there is not much reliance to place upon a single set of samples in such an extensive area, and after all it is equal in value to many other discoveries made in the same neighborhood. The real mining value of the reef will not be ascertained until some extensive driving has been done, and until the reef is opened any opinions formed as to its value will be necessarily premature. In such an extensive area there are bound to be considerable variations in the value of the ore, as is the case in all the neighboring properties, but there is no reason to doubt that, taken over the whole area, the reef will be found, for the most part, to carry gold in payable quantities. Naturally, therefore, some importance will be attached to the results obtained in the other three shafts, one of which at least ought soon to reach the reef, so that while the first real disclosures of the Main Reef on the Government Areas may not be considered as equal to anticipation, it is better to suspend judgment as to the ultimate value of the property, not only until the other shafts in course of sinking have reached the reef, but also until a fair amount of work has been done on the reef and its probable value thereby established.

MAP OF THE EAST RAND.

On the Rand Klipfontein property affairs are somewhat different, as this is situated some half dozen miles farther to the northeast and surrounded by properties carrying the Main Reef, but where the contents are uncertain. It is now about twenty years since the Main Reef Series was found on the farm Klipfontein at a time when comparatively little was known of the mining value of the Far Eastern Rand as Holfontein, Welgedacht, Geduld, Cloverfield, Grootvlei, Droogefontein, Daggafontein, Reitfontein, and even Brakpan were all unproved properties at that date. On Rand Klipfontein itself nearly twenty bore-holes have been put

down either to find the whereabouts of the reef or to ascertain the best portion of the property to select for mining operations, and these bore-holes have shown the reef to be of an erratic nature both as regards content and thickness. The selection of a mynpacht has therefore been attended with some difficulty, but, once selected, shaft-sinking operations were commenced. There has been some delay owing to the shaft encountering strong feeders of water, but at a depth of about 1800 ft. the Main Reef was unexpectedly cut, the width being announced at 54 in. The average assay result, however, over this width has been found to be only 2.18 dwt., although the nearest bore-hole No. 14, where the reef was found at 1886 ft. deep, showed the reef to assay 10 dwt. over 35 in., the reef just found in the shaft giving a result exactly the same as that of the thirteenth bore-hole. These results seem to confirm those generally observed along the fringe of the outcrop of the Main Reef Series in this part of the Far Eastern Rand, and on Holfontein, the adjoining farm, the highest assay obtained from the sample of the Main Reef Series was 2¾ dwt., and that over a width of 2½ in. So far the outlook for the Rand Klipfontein is unsatisfactory, and even should better results be eventually obtained it is evident that only a small proportion of the ore can be expected to prove profitable.

BLACK HILLS, SOUTH DAKOTA

Bullion Output of Deadwood Assay Office.—Company Meetings.—Leasing on the Property of the Golden Reward.

The report of the United States assay office at Deadwood shows that the bullion purchased during the six months ended June 30 had a value of $3,832,000. Adding to this the value of ore shipped to smelters outside of the Hills, and bullion marketed elsewhere, and the production of the district for the first half of 1912 will be very close to $4,000,000, which establishes a record. On this basis the production for the year should exceed $8,000,000, as the last six months of a year are usually better in the mining industry of this district than the first.

At the annual meeting of the Evans Consolidated company, held in Deadwood, July 17, the following directors were elected: D. Ellis Evans, Deadwood, president; H. Bischoff, Deadwood, vice-president and superintendent; J. L. Baker, Deadwood, secretary; Burt Rogers, Deadwood, treasurer; W. G. Giddings and J. F. Bickel, Racine, Wisconsin; A. D. Barnes, Waupaca, Wisconsin, and Neil McDonough, Deadwood. At the meeting 264,950 shares out of 350,250 shares outstanding, were represented in person and by proxy. The reports of officers showed the property to be in good shape, and practically ready for a mill. During the fiscal year of the company $12,000 was spent in development, opening ore at a number of points. The old directors were re-elected at the annual meeting of the Wasp No. 2 Mining Co., and John Gray was reappointed manager. The annual reports showed that the company had a prosperous year, the property operating steadily except for five weeks in January and February, when the severe cold weather interfered with work. The Victoria company announces that the development which has been in progress for the past year has proved the existence of sufficient ore to warrant starting the mill. One of the most important disclosures was the finding in the floor of the old workings a shoot of milling ore that has been traced for 400 ft. At other points in old workings, as well as in new work done, further orebodies have been developed. The ore occurs in the Carboniferous limestone and is an altered and silicified lime, easily treated by the cyanide process. The mill on the property is equipped for dry-crushing and leaching, having a capacity of approximately 200 tons per day. An aerial tram half a mile in length connects it with the mine, on the bluffs 600 ft. above. A spur of the C. B. & Q. railroad delivers coal to a bin above the boiler-room, and in other respects the property is well equipped for economical operation. O. N. Brown, of Deadwood, is superintendent.

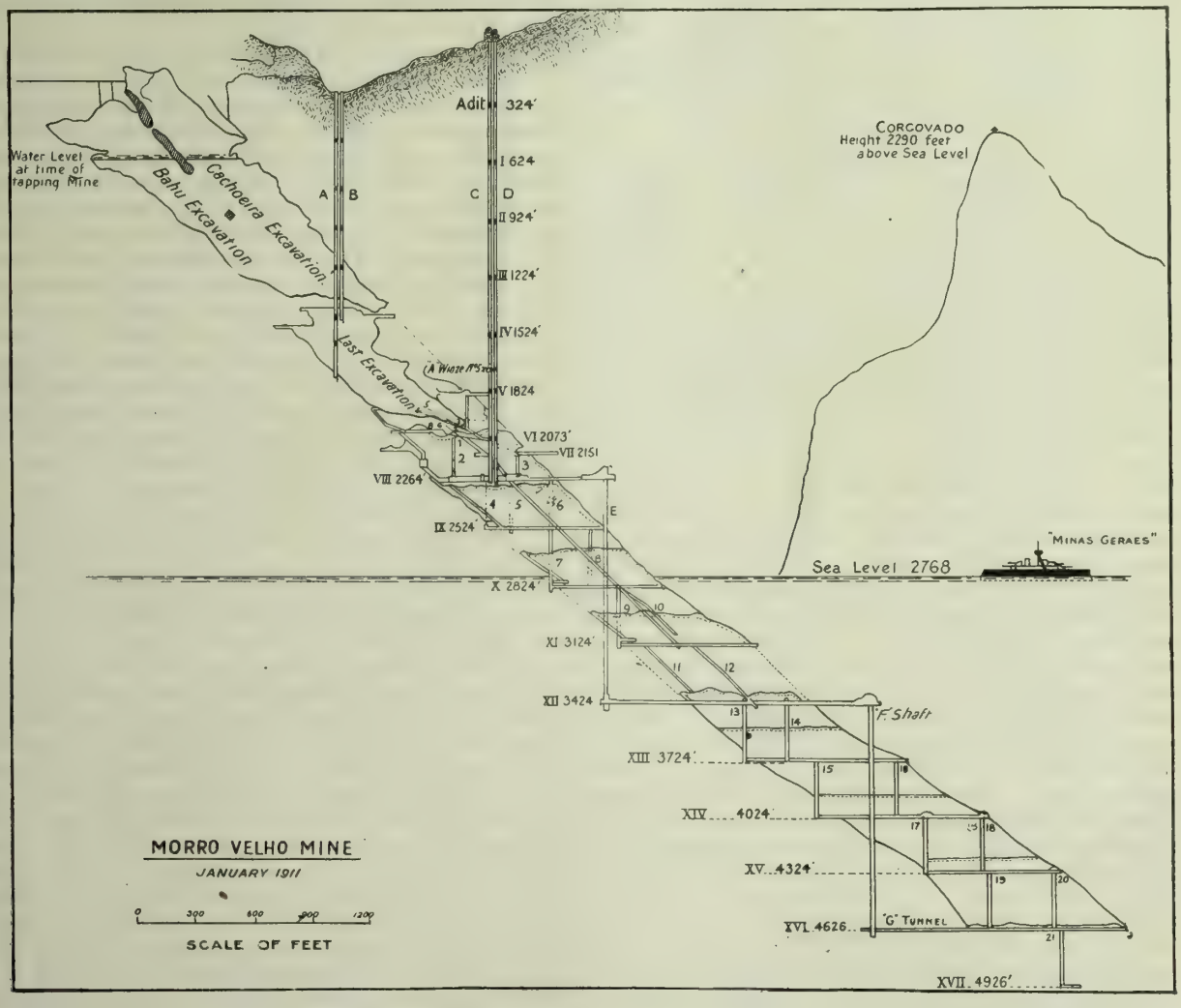
Since adopting the leasing system on a portion of its territory, the Golden Reward company has had a large number of aplications for the right to mine certain properties. The result has been that at present about half the ore-supply for the mill at Deadwood is coming from the lessees, the remainder being mined on company account. The mill is handling close to 300 tons per day. In each lease is a clause compelling the lessee to ship all of his milling-grade ore to the company's mill. Smelting grades are shipped out of the Hills. At present there are about nine or ten leases in operation (the number varies from month to month), and all of them are doing fairly well. Some of the best leases are held by Edward Manion, former superintendent of the Mogul property, who is extracting a good tonnage from the Alpha and Busco Bell mines. One property that has been reopened under the new system is the Wells Fargo, in Blacktail gulch. It is now a regular producer after having been idle for more than twelve years. The North Homestake company is developing on the 620-ft. level, cross-cutting both east and west. Up to date a total of 450 ft. of work has been done on this level, with encouraging results. When the shaft was started from the 220-ft. level it was given out that the work was planned to exploit orebodies that had been discarded in diamond-drilling. D. D. Findley is cleaning up the old Golden Reward smelter, at Deadwood, and has shipped several cars of material, which have yielded good returns. Mr. Findley has also secured the privilege of cleaning up several other plants in the Hills, and expects to remain several months. R. L. Daugherty, State Mine Inspector, has started the work of compiling data for his annual report, and has been engaged for the past few weeks in an examination of the Homestake mine at Lead. He expects to be busy until late in the fall in order to cover his territory and secure all of the information which his detailed report calls for.

LONDON

Report of the St. John del Rey.—Change from Steam to Electric Power.—Improved Method of Ventilation.

The reports issued by the company owning the St. John del Rey gold mine in Brazil are always of interest, for this is the oldest and deepest gold mine in the world. The production of gold for the year ended February 29 last was the largest obtained in any year since the company began operations in 1834. During the year, 169,310 tons of ore was raised, and after the rejection of 2% waste, 196,600 tons was sent to the 130 stamps. The total yield was £442,-142, or 45s. 10d. per ton, of which 29s. 9d. was recovered by amalgamation and 16s. 1d. by cyanidation. The working cost, including development, London expenses, and taxes in Brazil, was £301,753, or 31s. 3d. per ton. In addition, £24,794 has been transferred to capital expenditure account, £2891 paid as directors' percentage, £7615 as English income tax, £36,275 in redemption of mortgage debentures, and £4504 as interest on debentures. The preference shareholders receive the usual 10%, absorbing £10,000, and the ordinary shareholders £54,626, being at the rate of 10%. The adit, 1100 ft. long, on horizon No. 16, connecting the bottom of 'F' shaft to the top of the proposed 'G' shaft, has been completed, and the hoisting engines will be installed when the foundation is ready. The sinking of 'G' shaft will then be begun, and it should be down 600 ft. to horizon No. 18 early next year. It is intended to sink it eventually another 600 ft. to horizon No. 20, 5800 ft. below adit, or 6100 ft. below surface, provided the lode continues profitable. The present horizon No. 17 is the deepest working. The ore reserve on February 29 was estimated at over 1,000,000 tons, sufficient to keep the mill employed for five years. The change from steam to electric power is being gradually effected, and a second unit of electrical plant for the Peixe river hydro-electric station has been shipped. With the workings extending to so great a depth, the question of temperature is of urgent importance.

George Chalmers has published additional information of importance in his yearly report. During the past year, particular attention has been paid to ventilation, with results that are encouraging, and during the current year further reductions may be confidently predicted. The old Capell fan, that did duty for many years, has been replaced by new Sirocco fans, each of which is driven by a 150-hp. electric motor. One of these was started on February 20, and the air in the lower workings was immediately rendered less hot and stuffy. Mr. Chalmers' chart showing the mean temperatures during the four hot months, December to March, of 1910-11 and 1911-12, proves that the rock and air temperatures have been appreciably reduced, and next year, when the whole of the ventilation will be done by the new fans, there should be a further substantial reduction. In the chart, a line drawn through points representing the rock temperatures at horizons No. 14 and 17 when first opened, reaches horizon No. 22, 6500 ft. from surface at 117°F. On the other hand, a line through the points recording the temperatures after the introduction of ventilation in the upper levels, may be taken to represent the ultimate air temperature of the workings obtainable by the use of suitable ventilating apparatus. At 6500 ft. the temperature would be 95°F. The rock temperatures are taken at the bottom of 10-ft. holes, and those of the air in the downcast. A further improvement is being made by Mr. Chalmers for the purpose of avoiding the chilling of the workmen as they leave the mine. At present the incoming air is drawn through the adit, and when the men, leaving after the night shift, walk along the adit they face the full current of incoming air at a temperature of perhaps 50°F. lower than that of their working place. In future the air is to be drawn into the mine from the surface through shaft 'D' instead of through the adit. The continued prosperity of this mine must be grateful to Mr. Chalmers, who has been manager for so many years. About twenty-five years ago the conditions of the workings became very bad and additional capital had to be raised and a new system of mining introduced.



MORRO VELHO MINE OF THE ST. JOHN DEL REY M. CO., LTD.

JOPLIN, MISSOURI

ZINC PRICES CONTINUE TO RISE, AND NEW RECORDS ARE ESTABLISHED.—AMERICAN ZINC, LEAD & SMELTING CO. EXTENDS ITS HOLDINGS. — IMPORTANCE OF KEEPING RECORDS OF DRILLING AND DRIVING.—ZINC AND LEAD NOTES.

The highest prices for zinc ore in the history of the district prevailed the latter part of July, when 60% grades commanded as high as $60.50 per ton, meaning a settlement of from $3 to $4 more than this figure for choice lots carrying high percentages of metallic zinc. Spelter, East St. Louis quotations, likewise reached its highest record, $7.20 being paid. As a result of the high prices, coupled with the fact that metal bookings have been made up to next October at unusually high figures, great activity is noticeable in every part of the district. The highest price of previous years was $57, basis, in 1905. This year the market began strengthening early in March, and in June the then high record of $58.50, basis, was attained. During the latter part of July almost every smelting concern buying ore in the Joplin district paid as high as $58, while the majority paid $60 and $60.50.

A 40-acre lease of the J. W. Boyd land at Sarcoxie, Missouri, on which the Cameron 400-ton mill is situated, has been taken under option by the American Zinc, Lead & Smelting Co., the largest mining and smelting company

in the district. Options on 200 acres adjoining likewise have been taken by the company, and mill and ground tests are now being made. The American company, which at first confined its mining operations in this district to the thin sheet-ground zone at Prosperity, has extended its field of operations to many camps and now owns in fee or controls leases at the following places: Prosperity, Webb City, Duenweg, Joplin, Central City, Wentworth, and Sarcoxie. This company alone produces about one-tenth of the total tonnage of blende concentrate from the entire district. Extensive drilling operations in this district have virtually gone to waste because, with few exceptions, no drill records have been kept. The same applies to shaft-sinking and to driving. The need of keeping development records applies to any other mining district as well as Joplin, but it would be difficult to find a place where the keeping of records has been considered of so little importance as in Joplin and adjacent territory. High prices for ore have stimulated prospecting, and numerous leases that have been drilled and re-drilled are being prospected again. All the records of these new holes should be kept. Had the prospectors the records of previous drillers, they would be aided materially in determining the nature of their ground. Operators are just awakening to the importance of a study of geological formations in connection with their development. Knowledge of rock formations has proved of untold value in finding paying mines. As all the drilling in the district, with the exception of one company's operations, is done wtih churn-drills, it is rather difficult to keep complete records of actual clippings, but even if these cannot be preserved, logs could be retained, and these would prove valuable. It occurs frequently that operators go into abandoned ground, defray heavy pumping expenses, and waste much valuable time in trying to get ore from old drifts in which no ore ever existed. Mineral-laden dump-piles are misleading and often cause useless work in old workings that have remained idle for years and about which little can be learned because of the absence of any kind of records.

A rich body of zincblende in soft ground has been found by the Betsy Jane Mining Co., sinking a shaft on the Spencer land. Ore was found at 147 ft. and extended to 162 ft., at which level a drift is being started. The company has only meagre hoisting equipment at present. The quality of the ore is really phenomenally high, tubs of almost pure zincblende being hoisted out. The quality of the blende will run better than 63% metallic zinc. The company intends to determine first whether the orebody is as extensive as indicated by several drill-holes put down. By this time the crush pile should be big enough to warrant the construction of a mill, if the ore continues rich.

BUTTE, MONTANA

NEW OWNERS FOR THE LA FRANCE COPPER CO.—RUMORS AFFECT BUTTE & SUPERIOR STOCK.—NEW OREBODY IN THE NORTH BUTTE.

The property of the La France Copper Co. has passed into the hands of the Lincoln Trust Co. of New York, and this would seem to indicate that the reorganization plans will go into effect in a very short time. The La France Copper Co. was organized by F. Augustus Heinze, and in time Heinze and his associates negotiated a loan with the Lincoln Trust Co. for $2,000,000 on the property. The copper company having defaulted in the interest, and having made no provision for the principal, the trust company foreclosed, and a few days ago the La France company filed an answer to the suit acknowledging all the allegations contained therein and consented to an entry of judgment in favor of the trust company. A report on the Lexington mine, which is one of the properties included in the mortgage, is understood to have been favorable, and a movement was at once started to secure possession and reorganize the company and to eliminate F. A. Heinze. The property included in the mortgage consisted of the following lode claims: Lexington, Louise, Angela, Wild Pat, Atlantic, Wapalle, and Allie Brown, with millsite and buildings, improvements, and machinery. At one time all the property belonging to the La France company was said to have a value of about $10,000,000. Like other properties in this district showing high-grade zinc ore, the Lexington is a valuable property, but the question which the new company will have to face is the securing of a process that will remove the iron from the ore. The Basin Reduction Works is also the property of the La France company, but before it can be utilized for the treatment of ore, machinery will have to be purchased, as all that was of any great value was removed a considerable time ago by Mr. Heinze to the Ohio plant, while the machinery used by the Butte & Superior company when that organization had a lease on the place, was owned by it and removed to this city and placed in that company's new concentrator.

The decline in Butte & Superior stock at times during the past two weeks has put in circulation rumors which have had an influence on the market. There has been the statement, denied by Butte & Superior people, and then repeated by persons who think they have some inside information, to the effect that litigation was possible between the company and W. A. Clark, the owner of the Elm Orlu mine, which adjoins the Butte & Superior property. Then came a report to the effect that the new concentrator was not recovering anything like the amount sent out in despatches to Eastern financial papers, and another story was to the effect that Hayden, Stone & Co., who floated the bonds of the company, were selling the stock. A. B. Wolvin, president of the Butte & Superior company, who has been in the city for several weeks, when asked concerning the various rumors, denied them all. He said that the mine was in first-class condition and that the new concentrator was giving satisfaction. During the time the mill had been operated, there had been a saving of 90% of the mineral content of the ore. For the past few weeks it has been impossible to operate the concentrator to its 500-ton capacity, owing to a lack of water. At first it was thought the water from the Black Rock mine would be sufficient to supply the concentrator, but this has been found insufficient, and the deficiency has to be made up from the Butte city water system. Some changes have been in progress and at times during the day the city water-supply had to be cut off, thus necessitating a decrease in the capacity of the mill. Mr. Wolvin claims that at the rate the concentrator has been operated it has been clearly demonstrated that it will be fully up to the requirements. The new hoist is expected in a few days, and during the time it is being placed the mill will be kept in operation from ore already brought to the surface. Development on the 2400-ft. level of the Snowball vein of the North Butte company now leaves no doubt as to the richness of the orebody recently opened. The cross-cut is about 7 ft. wide and will average 8% copper with 10 oz. in silver per ton. Cross-cutting on the 2800-ft. level is still proceeding and, according to estimates, the Jessie vein ought to be intersected in about one week. The North Butte property makes an improved showing on the strength of this discovery. The mill of the Bald Butte Mining & Milling Co. has resumed operation after being closed down for nearly four years. There was some difficulty among the stockholders, and a receiver was appointed, which resulted in the sale of the property, a year ago, to Boston and New York capitalists. The mine was worked and some good ore uncovered a short time ago in new ground, the assays proving satisfactory. Sufficient ore has now been blocked out to ensure the operation of 20 stamps of the mill for some time, and the indications are that in a short time more stamps will be required. W. E. Stone, of Boston; John Rapelje, of Hopewell Junction, New York; W. M. Belcher, C. M. Newell, G. R. Chandler, and E. W. Orswell, all of Boston, are the directors of the company. W. E. Stone is president of the company, John Rapelje vice-president, and W. M. Belcher secretary and treasurer.

General Mining News

ALASKA

Copper River

The Bonanza Gold Mining Co. is planning the purchase of a 5-stamp mill for the treatment of a recently discovered orebody. A shipment of 32 sacks of ore from one of the veins cut by the adit was made to the Tacoma smelter, and returns from a mill test were $202 per ton in gold and silver. The adit has been driven 306 ft. without cutting the main vein which outcrops 187 ft. above the mouth of the adit. The management intends also to build a tramway to convey the ore a distance of 1275 ft. down to the mill-site. The new mill will be operated by water-power in the summer and by steam in the winter.

ARIZONA

Cochise County

The Montana-Tonopah Mines Co. has announced its intention of building a mill at Pearce for the treatment of ore from the Commonwealth mine. Work on the foundations will be commneced in August, and specifications for the mill are now being drawn. The plant will consist of 30 stamps, two tube-mills, and a cyanide mill. The estimated capacity is 300 tons per day, and the cost is estimated at $200,000.

Gila County

(Special Correspondence.)—The production of the Miami Copper Co. for June was 2,683,310 lb. During the month 4964 ft. of development was done. The development of the Captain orebody, which is a tongue of ore extending out from the main orebody, is about to begin. Equipment will be erected at the now dismantled Captain shaft, which will be connected with the main shaft by a drift from the main orebody on the 420-ft. level. Waste rock from development will be hoisted through the Captain shaft and ore will be trammed on the 420-ft. level to the main shaft. It is estimated that the Captain orebody contains about 3,000,000 tons of ore. A second churn-drill will soon be put to work on the northeastern part of the property, where another large body of ore, assaying from 1 to 1¾% copper, has already been proved. Exploration of the ground below the 570-ft. level is being continued by diamond-drilling. Churn-drill hole No. 2 of the South Like Oak Development Co. is over 400 ft. deep in granite. Superior & Boston has begun to ship ore from the Limestone vein and shipments from the Great Eastern vein continue. Working time of churn-drillers and their helpers at the mines of the Miami district has been reduced from 12 to 8 hours per day. Drillers will receive $5 and helpers $4 per day. The new scale went into effect July 15. It is reported that the drift on the California vein at the Copper Reef mine, near San Carlos, has passed through the fault recently encountered and entered vein-matter carrying copper, gold, and silver. Samples from the vein are being assayed.

Globe, July 20.

The output of copper by the Old Dominion mine in June was 2,130,000 lb., making a total of 12,973,000 lb. for the half year, as compared with 13,841,800 lb. in the first six months of 1911, 13,430,000 lb. in 1910, and 18,790,000 lb. in 1909. It is expected that three furnaces will be kept in operation from now on, as the amount of custom ore received is gradually increasing under the stimulus of the present high copper prices, and the mine production will probably be slightly increased. The new dust chamber for the converter plant is finished.

Graham County

The Shannon Copper Co. reports for June a production of 1,270,000 lb. of copper, as compared with 1,464,000 lb. in May. For the half-year the output was 8,516,000 lb., against 7,314,000 lb. last year. The mine earnings for the quarter ended May 31 were $222,194, and for the railroad $8851, making a total of $231,046. The new management has reduced the operating costs, has improved the smelting plant and railroad, and has retired the bonds of the company.

Maricopa County

At the Vulture mine, development has rediscovered the orebody which was cut off by a vertical fault, nearly parallel with the strike of the vein. A winze from the 750-ft. level has cut the vein and proved the displacement to be 300 ft. The first stope which was opened for the full width of the vein was 29 ft. wide. The 100-ton mill has been operating steadily since February, and the average value of the ore treated from development has increased. During June the ore treated at the mill assayed $25.85 per ton.

CALIFORNIA

Amador County

A head-frame has been erected on the Memphis mine in the Plymouth district, and it is intended to sink to 300 ft. It is proposed to increase the capital of the company, and thoroughly develop the property.

Calaveras County

Regular shipments of ore are being sent by the Calaveras Copper Co. to the Campo Seco plant of the Penn Mining Co. Another stope has been opened in rich ore. A preliminary survey is to be started for the construction of a 12-mile narrow-gauge railroad to connect this mine with the Sierra line, at Chinese Camp. This road could be built in a few months and would help to reduce costs. The smelter of the Calaveras company is well on toward completion, and one furnace may be blown in next month. One of the features of the new plant is the heating of the blast by the waste heat of the furnace, from which great economy is expected.

Inyo County

The Loretta mine, on the west side of Eureka valley, is to be developed into a producing property under the direction of John G. Kirchen, of Tonopah, who is acting for Charles M. Schwab and associates. This property was originally discovered by William Eva in December 1879, and was then located as the Neptune. The Loretta company was organized in 1896, and since then development has been carried on intermittently. The outcrop of the orebody extends across the face of the hill. The shaft was started 150 ft. lower and is now 865 ft. deep, about 1000 ft. under the apex. The width of the vein varies between 30 and 80 ft., and two narrow parallel stringers dip toward the main vein at distances of 40 and 60 ft. The shaft at its present depth has just cut through the foot-wall of the vein, and development has opened large orebodies at the 400, 550-ft., and bottom levels. In the earlier work two adits were driven in the upper part of the vein, disclosing ore about 70 ft. in width. The average value of the ore so far discovered is placed at 4 to 5% copper and about $3 in gold per ton. At intervals of 5 to 20 ft. rich streaks are found, up to 3 ft. wide, with ore as high as 50% copper. The ore is silicious, but carries some specular iron. No stoping has been done, as all work has been concentrated on the development, and blocking the ore. About 20 men have been employed at the mine. A contract recently negotiated with the Nevada-California Power Co. provides for a line from the Goldfield wires at Gilbert hill, a distance of 15 miles, to be completed in 90 days. A 100-hp. electric hoist will replace the 25-hp. distillate engine and hoist, and will provide power for further sinking. The management has the promise of $2,000,000 for development from Mr. Schwab. Several working plans have been considered. One is a railroad from Coaldale, 60 miles distant. Another calls for a method of transportation to the Southern Pacific railway in Owens valley, joining that road between Laws and Alford, and shipping ore to a smelter elsewhere. A third plan is the erection of a smelter at Oasis. The building of a smelter near the mine has not been considered, on account of the damage to vegetation from the fume. The

company at present owns claims covering an area 3000 ft. wide and over two miles long, and has planned the working of the orebodies on a large scale.

Modoc County

The first shipment from the High Grade district from the Sunshine mine yielded an average of $286 per ton at the Selby smelter.

Shasta County

A fire at the Little Nellie mine, between Keswick and Iron Mountain, on July 21, destroyed the compressor house, blacksmith-shop, and stable. The loss amounted to about $3000 and the mine will be closed until the compressor plant can be replaced. Twenty men will be thrown out of employment by the fire, the cause of which is unknown.

The last of the coke and silicious ore from the yards and bunkers of the Balaklala Con. Copper Co. at Coram has been shipped to the Mammoth smelter at Kennett, and the small force of men who have been employed in loading the ore has been discharged. The masonry about the smelter is gradually crumbling, and extensive repairs would be necessary before operation could be resumed. A part of the bell of the chimney has fallen, and the whole structure is cracked from top to bottom. Several hundred feet of the new flue built in connection with the Cottrell process has fallen, and the entire wall on the west side is in ruins. The condition of the underground workings of the mine is also considered serious, and it is believed that many caves have taken place since the suspension of operations.

Siskiyou County

(Special Correspondence.)—Arrangements have been completed for the reopening of the Black Bear quartz mine, Salmon River district. A small force is at work and a new shaft will be sunk. The property recently passed under the control of Eastern capitalists, represented by Benjamin F. Daggett. The property has been idle several years. It is claimed to have produced nearly $4,000,000. It is reported that work is to be resumed shortly at the King Solomon, of which Wayland H. Young is manager. Important developments are reported at the Foster mine, Trail Creek district. The vein ranges from 3 to 5 ft. wide, with assay returns from the ore averaging around $20 per ton. Two Huntington mills are in use, handling about 15 tons per day. Hannon & Fippon have arranged to build a pipe-line and giant on their Slide creek placers. Two ore-shoots have been opened, and will also be worked. Two giants are in commission at the Smith Parker hydraulic claim, on the South Fork of Salmon. Water facilities have been excellent this year, and a profitable and expected season is expected. A. Maltman, James Finnerty, Hugh Lambert, and A. E. Pomery report the development of a promising discovery near Gazelle. The vein has been intersected by six cross-cuts, and varies from 15 to 22 ft. in width. Assays of the ore average $6 to $8 per ton. Robert Parker announces the discovery of the old gravel channel on Kangaroo creek, after a two years' search. A giant will be placed at the beginning of the rainy season. It is estimated that the Shumway hydraulic mine, on the Forks of Salmon, yielded about $50,000 during the past year. It is one of the largest active hydraulic properties in the county. French and San Francisco capital is interested. Placer mining is active throughout the Salmon River district, while quartz deposits are claiming considerable attention. It is rumored Eastern people are negotiating for the valuable Beaudry placers, but official confirmation is still awaited.

Etna, July 19.

The Southern Oregon and Northern California Mining Congress, held at Yreka, brought its fourth semi-annual meeting to a close on July 20. A good session was held, and resolutions adopted recommending a simplified procedure governing the procuring of patents to mineral lands; commending the work of the American Mining Coongress in the legislative creation of the Bureau of Mines, and the assistance of the latter to mining; also commending the United States Geological Survey, and the Mining Bureaus of California and Oregon; reduced rates on railroads for minerals and investigation by the Interstate Commerce Commission of existing freight rates in the district; and a more liberal interpretation of mineral land laws relative to the use of timber and water. The Congress pledged itself to fight wild-cat mining schemes. Several good exhibits were shown at the Congress from various mines, and products from the Heroult electric furnace attracted general attention. The next meeting will be at Redding, in May.

COLORADO

Lake County

At the Mount Champion mine the main adit is in some 500 ft., and No. 1 about 200 ft., both being connected by a raise of 160 ft., which is in 400 ft. from the entrance to No. 4. About 50 men are employed. Work at the mill and aerial tramway is being pushed. At present all supplies are hauled to the mine by teams. The main adit of the Miller company is in 450 ft., while a second one has been driven 300 ft. The two are connected. There are said to be ten veins in the property from 5 to 10 ft. wide, and the ore milled and smelted assays high in gold and silver. Thirty-five men are employed and 1200 tons per month is mined. There is a good surface plant and aerial tramway.

San Juan County

(Special Correspondence.)—Reports from Rico, in the San Juan district, are favorable. The Rico Argentine and the Rico-Wellington group of claims, the latter owned by the Jesse Knight interests, are doing development, and are shipping ore to Salt Lake smelters. A great deal of zinky ore is being found, and it seems probable that some system of concentration will be used in order to make the handling of the low-grade ores profitable. A fire occurred on June 30 at the Silver Lake mine, near Silverton, owned by the American S. & R. Co. Practically all the mine buildings were destroyed, except the boarding house, which was saved by dynamiting smaller buildings between it and the blacksmith shop, where the fire started. The upper terminal of the tramway was destroyed, necessitating the closing of the mill. Until repairs have been made no ore can be shipped to the Durango smelter. The loss is reported at $30,000. The Eagle M. & M. Co. is developing a zinc mine near Red Cliff. The old Iron Mask mine, which was famous for its lead carbonate and silver ores during the early days of Leadville, had been found to contain an irregular body of zinc sulphide in the form of a replacement in limestone. This ore is being concentrated and shipped to Bartlesville, Oklahoma, for reduction. The company is also operating the Rocky Point mine, which is producing silicious gold ore. In the same district, the Bleak House mine is being worked for the same classes of ore found in the Iron Mask and Rocky Point. Here the zinc ore is found as a regular bed in the limestone strata, and the silver ore in vertical fissures in the quartzite formation below limestone.

Denver, July 20.

Teller County

It is intended by the El Oro company to erect a mill in Eclipse gulch. The Rex mill, known as the Homestake, may be purchased and removed. Whatever mill is built will be modeled on the lines of the Gaylord and Wild Horse plants in the district, although finer grinding may be used. The No. 2 shaft of the Portland mine is down 1588 ft. Water is expected to be encountered within a few days. From the 1600-ft. level it is intended to develop the ore now being extracted at the 1500-ft. level. The shaft will be sunk until the water is reached, and at that point, whether 1610 or 1650, laterals will be run. The present output to the Portland mill at Colorado Springs is between six and seven cars per day.

The twentieth annual convention of the Western Federation of Miners was held at Cripple Creek, beginning July 16. Charles H. Moyer, president of the union, presided, and was supported by a large majority of the delegates against an attack made by a part of the Butte delegation.

A resolution calling for a proposed minimum wage scale of $4 was voted down.

MONTANA

Madison County

The Butte-Virginia company is to start milling the ore from the Bell group of claims, near Virginia City. Ore is being hauled to the Grant mill, one mile distant from the mine, at the rate of 40 tons per day. The mill consists of a crusher, 15 stamps, vanners, and cyanide plant, driven by a motor. About 30 men will be employed at the mine and mill. F. H. Edwards is in charge of the latter.

NEVADA

Esmeralda County

Sinking has been resumed in the winze of the Goldfield-Belmont, which has yielded a considerable quantity of ore. It will be sunk to 450 ft. to enable prospecting the lode exposed in the upper levels. The pump installed, easily deals with the water in the winze. Little water was found down to 400 ft., but on extending the drift on the 350-ft. level, the dike that apparently cuts off the water in that part of the mine was penetrated.

Humboldt County

Through a cloudburst last week, 20 people were killed at Mazuma, and about $40,000 damage was done to the Seven Troughs Coalition Mines' property. It is stated that a wall of water 15 ft. high flowed down the canyon, and it was impossible to inform the residents of the former place. A concrete wall, 14 by 18 ft., around the mine tailing dump, was washed away; while part of the cyanide plant and a strong room containing over $10,000 in gold were also lost. The damage can be repaired in about 30 days. The mine was not damaged in any way.

Lyon County

(Special Correspondence.)—The McConnell mine, southeast of the Mason Valley, is shipping copper ore at the rate of 75 tons per day to the smelter at Thompson. The mine is owned and operated by Elbert & Sonne. At the smelter the esocnd blast-furnace, which has not yet been blown in, is being extended to 30 ft. by the addition of another section of jacket, in order to take care of the increased tonnage of ore which is coming to the plant. When this furnace is blown in the No. 1 furnace will be blown out and extended to 35 ft. in length. The plant is now smelting 750 to 800 tons per day, chiefly from the Nevada-Douglas, Mason Valley, and McConnell mines, though smaller shipments are being received from the Malachite, the Northern Light, and the Empire of Nevada. The Yerington Copper Co., which has been making shipments to the Thompson smelter, has arranged to ship its high-grade copper ore to the smelter at Garfield. The properties around Luning are also shipping to the Thompson smelter and the Luning Gold Mines Co. has sent out seven carloads recently, yielding about $25 per ton. It is reported that higher grade ore is now being taken out. R. B. Todd is in charge. The reasonable treatment rates of the Mason Valley smelter are proving a great stimulus to prospecting in adjacent districts.

Mason, July 22.

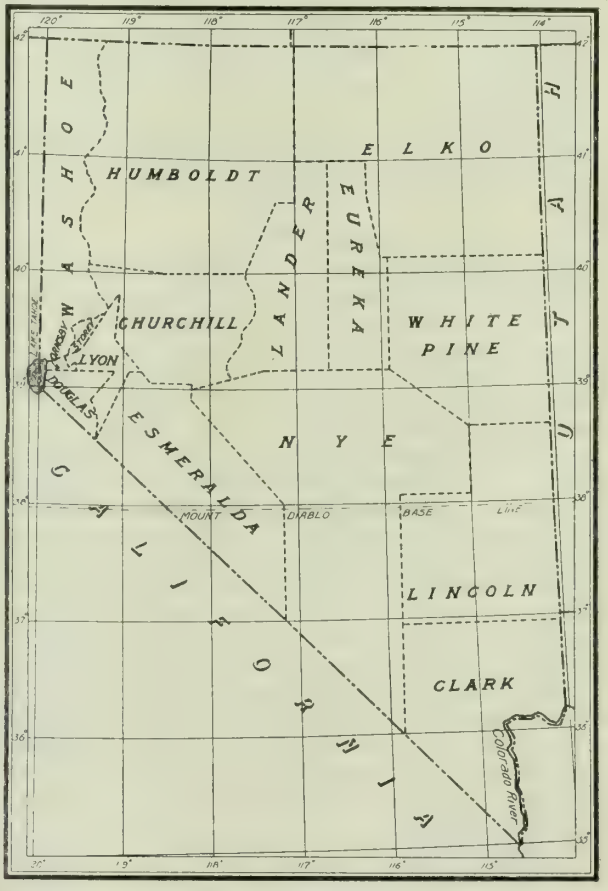
Mineral County

Twelve claims are being developed in the Luning district, and parcels sent to the smelter at Thompson have yielded about 8% copper. Transportation of ore is hindered by lack of teams. Activity is general throughout the district.

Nye County

The report for June of the Tonopah-Belmont Development Co. gives the ore milled as 7370 tons, from which 2568 oz. of gold bullion and 258,301 oz. of silver bullion were produced. The net value of the ore was $204,602, and the net profits for the month, $125,525. No ore was shipped to smelters, and the tonnage treated was less by 586 tons than in the preceding month. The company has decided to sink the main shaft to the 14th level. On the 13th level stopes are being cut out in the east drift on the Belmont vein, and the west drift on the Belmont vein is in good ore. Ore for the mill at Millers is hoisted through the Desert Queen shaft from all levels, from the 900 to the 1166-ft., inclusive, while ore for the new mill is hoisted from the 12th and 13th levels. This ore is crushed and then stored in the mill-bins, which are now nearly filled and ready for the starting of the stamps. The June report of the Tonopah Mining Co. shows that 14,551 tons was milled, with an average value of $18.95 per ton. The total output of gold and silver bullion was 259,180 oz., with a value of $210,500. In addition, 91 tons of concentrate, valued at $36,900, was shipped. The net profit for June was $151,389. Prospecting is being continued by the company, and some improvement in the value of the ore is noted, although no new orebodies have been found.

The Montana-Tonopah company has ordered another Trent agitator, which will be placed in the mill as soon



MAP OF NEVADA.

as possible. With this increased capacity of the cyanide plant, it is hoped that the efficiency of the mill will be raised and a better recovery made from the high-grade ore which is treated in the mill. The Railroad Valley company, organized in Tonopah about a year ago as the successor to the Railroad Valley Saline Co., announces that the main purpose of the company is to conduct a comprehensive search for potash-salt deposits that may exist in the buried saline residues of former lakes of the desert basin; also to acquire such deposits and establish experimentally their commercial value. If any workable deposits are acquired, they are to be sold or leased to an operating company under control of an American fertilizer concern. Tentative negotiations have already been initiated with the fertilizer companies and are subject to ratification at the proper time by the stockholders of the Railroad Valley company. Incidentally, this company proposes to develop and realize upon any agricultural or other valuable asset that may be created by its drilling operations. The directors of the company are Clyde A. Heller, president of the Tonopah-Belmont company; Max J. Brandenstein and James T. Donahue of San Francisco, and Eugene Howell, W. W. Charles, and Hugh H. Brown of Tonopah. In their an-

nouncement the directors frankly state that they regard the exploitation for potash as an attractive gamble. If successful, the company hopes to make immense and long-continued profits by transferring commercially workable properties to fertilizer interests powerful enough to establish an American industry against German competition. If the potash exploration proves a complete failure, it is believed that the value of the agricultural land, controlled by the company through the artesian water-supply proved by a 900-ft. drill-hole, will be great enough to return full value to the shareholders. The company has engaged the future services of Edward E. Free, at present special agent of the U. S. Bureau of Soils, to take charge of the exploration work. The drill-hole which at its present depth has developed several flows of artesian fresh water is expected to develop artesian salt water at a depth of 1200 to 1500 ft., and it is believed that a large tonnage of potash will be found in solution under conditions which will deliver to the surface, without any mining expense, a brine containing a commercial percentage of potassium chloride.

During a thunderstorm at Tonopah on July 20, lightning struck and damaged the MacNamara mill, causing a shut-down for a few days. A carpenter was electrocuted at the Umatilla mine.

Storey County

(Special Correspondence.)—The Ophir has begun to level off the site for the cyanide plant to treat its tailing. From the milling of the Ophir ore in the Kinkhead mill a large tonnage of tailing assaying $5 to $6 per ton has been impounded. The cyanide plant which, it is reported, will have a capacity of 100 tons per day and will comprise tube-mills, Trent agitators, and Butters filters, will be used to treat this tailing. The Mexican mill is now cyaniding 85 tons per day of ore assaying $20 to $40 per ton, at a cost of less than $2.75 per ton. The Oliver filter, which at first gave trouble from the high content of the tailing, has been modified by the addition of more sprays of wash water and is giving excellent satisfaction. The Pumping Association is installing three new 1500-gal. electric turbines at the bottom of the C. & C. shaft to replace the hydraulic elevators now in use. On the 2000-ft. level of the Julia, Whitman Symmes, the superintendent, has a diamond-drill at work searching for the dacite dike which accompanies the orebody. The Nevada Deep Mines Co. has constructed a cyanide plant on the Carson river a short distance east of Dayton. The plant is connected with the mine by a wire-rope tramway.

Virginia City, July 20.

At the Comstock mines, the Ophir company is out 430 ft. in the southwest drift of the 2500-ft. level. Nineteen cars of ore, assaying $14.42 per ton, were taken from the stopes of the 2100-ft. level. The Consolidated Virginia has its south drift started 100 ft. from the mouth of the west cross-cut, out 166 ft. in porphyry and quartz of low assay. On the 2500-ft. level of the Union Consolidated, the northeast drift is out 130 ft., and shows 15 in. of quartz, besides 30 in. of broken ground. Assays gave from $1.30 to $7.70 per ton.

At the Yellow Jacket the west cross-cut from 1100 ft. was out 142 ft. The water in the C. & C. shaft was down 293 ft. below the 2200 station; and in the Ward shaft, owing to an increase in the water in the south drift in Bullion ground, large pumps and discharge pipes have been installed. In the pump compartment of the shaft an 8-in. pump column and connections have been put in for pumping below 2100 feet.

Two new transformers have been installed in the sub-station of the Truckee River Electric Co. at Virginia City. They are necessary to supply the increase of 1200 hp. used on the new pumps at the C. & C. shaft. It is said that a new line is to connect the sub-station with the 60,000-volt line which is to supply the Thompson smelter and mines. Four different lines would be then available for Virginia City. Practically all new equipment on the mines will be electrically driven.

Last Friday the ground around the old glory hole of the Chollar mine settled and left cracks several inches wide. The ground seems to be settling toward the hole, which is some 30 or 40 ft. deep, and about 100 ft. diam. at the top. The movement is 150 ft. from the present nearest workings of the mine, and is probably due to an old stope caving in. There have been cracks on the mountain side for some years, but they have not opened much.

White Pine County

The report of the Nevada Consolidated Copper Co. for the first quarter of 1912 shows that 821,421 tons of ore was treated, producing 17,578,000 lb. of copper. The gross value of the output was $2,838,918.50. The cost of mining was $0.682 per ton, of transportation $0.264, and of reduction $1.623. The net yield for the three months was $729,087.81. During the second quarter the production was 18,092,000 lb. of copper. The Jack shaft of the Nevada Consolidated is now down 690 ft., 66 ft. having been sunk during the last 30 days, and this rate of sinking should be maintained until the 800-ft. level is reached. A little low-grade copper ore was found in sinking. From this shaft the ore found in the 500 and 800-ft. levels of the mine can be developed easily. About 100 gal. of water per minute is being pumped from the shaft.

NEW MEXICO

Socorro County

(Special Correspondence.)—A fire at the Deadwood Mines on July 5 destroyed the shaft-house and head-frame, and damaged the machinery. Work on a new structure was started at once and underground work will be resumed this week. The mill has operated largely on custom ore since the fire. A 50-hp. gasoline engine is being added to the mill power-plant. At the Socorro Mines special ore-bins have been erected for the accommodation of custom ore that will be delivered from adjacent claims. The mill is operating regularly on about 175 tons daily capacity.

Mogollon, July 19.

OREGON

Baker County

(Special Correspondence.)—The Virtue Mines Development Co. has completed the first half of its cyanide plant, and is now working on mill tailing, handling 50 tons per day. The hydro-electric power plant on Eagle river, which will supply power for operation of the Virtue mine and mill, will be in commission before October 1. It is planned to operate the mine and 20-stamp mill as soon as power is available. Full motor equipment for operating has already been received by the mininig company.

Baker, July 20.

UTAH

Salt Lake County

The production of the Utah Copper Co. for the first six months of 1912 was 53,300,000 lb. of copper as compared with 45,766,000 for a similar period in 1911, and 43,645,000 in the first half of 1910. The Utah Consolidated Mining Co. shipped 100,808 tons of copper ore and 8025 tons of lead ore in the first six months of the year. The estimated net earnings for this period were $300,000. Development work slightly increased the tonnage of lead ore in the reserves, while the reserve of copper ore was maintained.

Summit County

A decision has recently been rendered in the suit brought by the Conkling Mining Co. against the Silver King Coalition Mines Co. in favor of the defendant. The case was instituted in February 1908, when the plaintiff filed a bill in equity for title to a strip of ground, 135 ft. wide, on the western end of the Conkling claim, and by stipulation it was first determined to establish the title to this territory. If the Conkling company succeeded in establishing a title to this ground, then an accounting of the ores contained and extracted therefrom by the defendant company would have been ordered by the court, the plaintiff setting forth that ores to the value of $2,000,000 had been extracted by

the defendant company. Two defenses were set up by the Silver King Coalition Mines Co., the first being that the 135-ft. strip was not part and parcel of the Conkling claim, and if it were a part of the same the plaintiff had no right or title to the ores contained therein for the reason that the apex of the Crescent fissure vein, in which the ores occur, was in the Monroe Doctrine, Cumberland, and the Constitution claims, which were and are owned by the Silver King Coalition Mines Co. This decision is important, as it releases for prospecting and development by the Coalition company a large area of virgin ground in the Crescent vein.

WASHINGTON

Stevens County

(Special Correspondence.)—A company recently organized in Spokane under the name of the American Tungsten Consolidated Corporation, controls through options the main tungsten properties in eastern Washington. The directorate will be largely composed of Spokane capitalists, and W. Scheck will represent the German capital invested and will act as manager for the company.

Spokane, July 22.

The next meeting of the Spokane local section of the A. I. M. E. will be held at Republic, July 26 to 28. The Wallace, Idaho, meeting proved a great success, and the mine owners and Commercial Club members of Republic, who have extended a cordial invitation to the members of the Institute, hope to make this meeting equally profitable.

CANADA

British Columbia

Forty engineering crews, consisting of 800 men with teams and pack-horses, will be sent into the field from Edmonton to make preliminary surveys for the Northern Territorial Railway Co.'s line from Edmonton to tide-water at Fort Churchill on Hudson's bay. This is to be part of a system of 1450 miles, from the Hudson's Bay country to Port Essington on the Pacific coast, connecting Edmonton with Lac La Biche, Fort McMurray, and Lake Athabasca. Plans are under way to begin grading work early next season, when the laying of rails will also be carried on, and in two years, according to present calculations, the line is to be in operation from Edmonton to the shore of Lake Athabasca, opening to commercial development the vast mineral and timber wealth of Alberta's farthest north. The company will then proceed with the construction of the line in the province of Saskatchewan. The Edmonton cut-off will be built later. The line from Lake Athabasca westerly will tap the rich agricultural resources of the newest north, continuing thence to the Pacific coast.

The first lot of copper ore from the Red Cliff mine, amounting to 700 tons, has been shipped to the Ladysmith smelter. A stock of several thousand tons of ore will be accumulated there before blowing in the furnaces.

Yukon

A reduction in freight rates amounting to 10% has been announced by the White Pass & Yukon road, applying on mining machinery, fuel oil, dredge timbers, and other materials, from Skagway to Dawson. There has been recently an active discussion of freight rates, and it was announced that the closing of the Big Thing copper mine near Caribou was due to unsatisfactory rates. O. L. Dickeson, president of the road, has replied in an open letter showing that a reduction of 53% was voluntarily made on outgoing shipments, and that a similar reduction on incoming material, if made, would result in only a small saving to the mining company. It is also shown that rates are low as compared with those elsewhere. The rate on ore of the same grade from the Coeur d'Alene district to Tacoma, 431 miles, for example, is quoted as the same as the White Pass rate for 1000 miles.

COSTA RICA

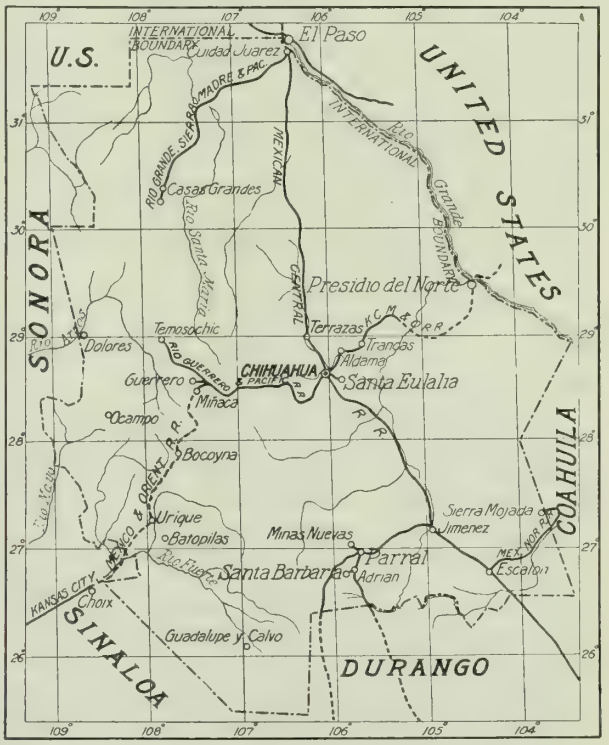
(Special Correspondence.)—The Aguacate Mines will increase the capacity of the plant from 50 to 100 tons per day. The old crusher plant consisted of ten 1300-lb. stamps. The new crusher section is completed, and all the tanks for the cyanide plant have arrived. Construction will not be pushed until the end of the rainy season in December. Negotiations are under way for the delivery of 200 hp. by the first of 1913, after which the local hydro-electric plant will be closed. Where the new plant is being built it is possible to develop 900 hp. and deliver it at the mine by a transmission line 12 miles long. In the mine the lower or seventh level, which is 220 ft. below the present workings, is expected to reach the vein soon after the first of the year. This adit is being driven large enough for electric haulage. Development is now being carried on at the fourth and fifth levels. The stopes on the fifth level are at present supplying all the ore for the mill. The average value of the ore milled in June was $16.58 per ton.

San Mateo, July 7.

MEXICO

Chihuahua

(Special Correspondence.)—In the Parral district mail and freight service has been resumed, and supplies have



MAP OF CHIHUAHUA, MEXICO.

been received by the mining companies. The El Rayo M. & D. Co., the Alvarado M. & M. Co., and the Minas Tecolotes y Anexas continued operations in spite of the revolution, but other properties shut down, and in the Guadalupe y Calvo district all the mines were closed. The El Rayo company has 400 tons of concentrate stored which will now be shipped for smelting. Passenger travel in Chihuahua is difficult, owing to the torn-up condition of the Mexican Central railroad. The Mexican Northwestern is running a passenger train daily as far south as Madera.

Santa Barbara, July 18.

The plant of the Dolores Mines Co. was recently attacked by a band of rebels, under the belief that the Federal garrison of Dolores was in the pay of the American mining company. The plant was gutted by fire with a damage of $5000.

Sonora

The Greene-Cananea Copper Co. reports for the month of June an output of 4,310,000 lb. of copper, 102,980 oz. of silver, and 533 oz. of gold. For the first half-year the copper output aggregated 22,898,000 lb., as compared with 22,220,000 lb. in the same period of 1911, while the silver output was 682,000 oz. and the gold 3372 ounces.

Personal

Professional men are invited to send news of their engagements and travels. Such news is interesting to friends.

C. M. EYE has gone to Chihuahua.

JOHN COSGRO has been in El Paso.

C. C. BROADWATER has gone to New York.

A. BURNER was at Libby, Montana, recently.

FRANKLIN LEONARD, JR., is at the St. Francis.

C. F. TOLMAN, Jr., will be in San Francisco next week.

R. S. BOTSFORD has left London for the Ural mountains.

MORRISON B. YUNG sailed for Hankow, China, on July 12.

DONALD F. IRVIN is at Pasadena, California, on a holiday trip.

H. C. BELLINGER is returning to America by way of London.

R. B. MCGINNIS has returned from a professional trip to Oregon.

R. E. CRANSTON has returned to San Francisco from Yuba county.

C. GODFREY GUNTHER was in Oregon and California during the week.

F. G. BARAGWANATH is now with the Morococha Mining Co., Morococha, Peru.

R. B. LAMB sailed by the *Laurentic* for London, July 20, to be gone about a month.

RICHARD B. STANFORD arrived at New Orleans from Spanish Honduras this week.

W. G. SHARO, LEWIS A. MERRILL, G. W. METCALFE, and C. B. SPRAGUE are in San Francisco.

EDWIN J. COLLINS has returned to Duluth from professional work in Fremont county, Wyoming.

H. A. BRANDT is now in charge of the British Columbia Copper Co.'s Lone Star mine, at Danville, Washington.

E. D. LACHMAN, formerly store manager for the Dolores Mines Co., has resigned and is now at El Paso, Texas.

H. RIES is in British Columbia investigating the clays of western Canada, and plans to be in San Francisco early in September.

A. G. KEILLER has been appointed mill superintendent at the Aguacate mines of Costa Rica, in charge of operation and new construction.

SPANGLER RICKER has resigned from the Mazapil Copper Co. and is now with the Santa Rosa Mining Co., Ltd., at Concepcion del Oro, Zacatecas, Mexico.

D. FORD MCCORMICK, formerly with the Socorro mines, Mogollon, New Mexico, has accepted the position of engineer for the Aguacate mines of Costa Rica.

ROBERT LINKLATER, employed in the construction of the mill for the Aguacate mines, is in the United States on a vacation, but will return to erect the 10-stamp mill for the Porvenir Mining Co., of Costa Rica.

H. E. OLUND has resigned his position as general superintendent for the Lake Superior & Nevada Development Co. and engaged in consulting engineering work as a member of the W. O. N. Engineering Co., at 626 San Fernando building, Los Angeles.

Obituary

WALTER GLOVER was killed by a switching engine at the Cerro de Pasco smelter, June 17. He had been in the employ of the company for three years.

W. A. NEVILLS died in San Francisco on July 11. He was born in London, Ontario, about 80 years ago, and has been a well known figure in Tuolumne county mining for over twenty years.

Market Reports

LOCAL METAL PRICES

San Francisco July 25.

Antimony	11—11½c	Quicksilver (flask)	.43
Electrolytic Copper	17¾—18c	Tin	.50—51½c
Pig Lead	5.00—5.95c	Spelter	.8—8½c

Zinc dust, 1400 lb. casks, per 100 lb., small lots $9.50—9.75; large $7.50—8.50

METAL PRICES

(By wire from New York.)

NEW YORK, July 25.—Copper is now strong and advancing in price. Lead remains quiet, and spelter firm.

Average daily prices for the past week, in cents per pound, based on wholesale transactions, standard brands, are given below.

Date.	Electrolytic Copper.	Lead.	Spelter.	Silver, per oz.
July 18	17.05	4.75	7.18	60⅝
" 19	17.15	4.73	7.18	60⅜
" 20	17.15	4.73	7.18	60¼
" 21	Sunday.	No market.		
" 22	17.33	4.73	7.18	60⅜
" 23	17.48	4.73	7.18	60⅜
" 24	17.48	4.73	7.18	60⅝

LONDON QUOTATIONS

(By cable, through the courtesy of C. S. Burton & Co., New York.)

	July 25.
Camp Bird Ltd	£ 6½
El Oro	3½
Esperanza	6¼
Oroville Dredging	1⅝
Santa Gertrudis	7½
Tomboy	6

COPPER SHARES—BOSTON

(By courtesy of J. C. Wilson, Mills Building.)

	Closing prices, July 25.		Closing Prices July 25.
Adventure	$ 8⅜	Mohawk	$ 68½
Allouez	46½	North Butte	30⅝
Calumet & Arizona	75¾	Old Dominion	56⅞
Calumet & Hecla	523	Osceola	117½
Centennial	23½	Quincy	90½
Copper Range	57⅜	Shannon	17½
Daly West	5½	Superior & Boston	1⅝
Franklin	11½	Tamarack	40½
Granby	53½	Trinity	5½
Greene Cananea, ctf.	10	Utah Con	13½
Isle-Royale	35⅝	Victoria	3¼
La Salle	6¾	Winona	6½
Mass Copper	6⅝	Wolverine	110

NEVADA STOCKS

(By courtesy of San Francisco Stock Exchange.)

San Francisco, July 25.

Atlanta	$ .31	Mexican	$2.87
Belcher	.50	Midway	.68
Belmont	9.70	Montana-Tonopah	2.50
B. & B.	.11	Nevada Hills	2.05
Booth	.09	Ophir	1.12
Chollar	.11	Pittsburg Silver Peak	1.05
Combination Fraction	.18	Round Mountain	.40
Con. Virginia	.47	Savage	.11
Florence	1.15	Tonopah Extension	2.50
Goldfield Con.	4.00	Tonopah Merger	1.37
Gould & Curry	.07	Tonopah of Nevada	6.50
Jim Butler	.70	Union	.70
Jumbo Extension	.43	Vernal	.11
MacNamara	.23	West End	1.75

MINING STOCK QUOTATIONS—NEW YORK

(By wire from C. S. Burton & Co., New York.)

	Closing Prices. July 25.		Closing Prices. July 25.
Amalgamated Copper	$ 82⅝	Miami Copper	$ 29⅜
A. S. & R. Co.	82⅜	Mines Co. of America	3⅛
Braden Copper	7⅛	Nevada Con	20⅞
B. C. Copper Co.	5½	Nipissing	7⅜
Chino	31½	Ohio Copper	⅛
First National	2	Ray Con	20⅜
Giroux	4⅛	Tenn. Copper	43½
Goldfield Con.	4	Tonopah Belmont	9⅜
Greene-Cananea	10	Tonopah Ex	2⅛
Hollinger	12	Tonopah Mining	7
Inspiration	19½	Trinity	5⅜
Kerr Lake	2⅜	Tuolumne Copper	3½
La Rose	3	Utah Copper	61½
Mason Valley	13⅛	West End	1⅜
McKinley-Darragh	1¼	Yukon Gold	3¼

Recent Publications

BULLETIN OF THE GEOLOGICAL SOCIETY OF AMERICA. Vol. 23, No. 2. 216 pp.; ill., maps, index. Washington, 1912.

THE JOURNAL OF THE CANADIAN MINING INSTITUTE, 1911. By the Secretary. 730 pp. Index, maps, ill. Montreal, Canada, 1912.

TOPOGRAPHIC AND GEOLOGIC SURVEY COMMISSION OF PENNSYLVANIA. Report No. 5. 65 pp. Index, maps, ill. Harrisburg, Pennsylvania, 1911.

THE FACTOR OF SAFETY IN MINE ELECTRICAL INSTALLATIONS. By H. H. Clark. 42 pp. Bureau of Mines Technical Paper 19. Washington, 1912.

THE CONSTITUENTS OF COAL SOLUBLE IN PHENOL. By J. C. W. Frazer and E. J. Hoffman. 20 pp. Bureau of Mines Technical Paper 5. Washington, 1912.

THE SLAGGING TYPE OF GAS PRODUCER, WITH A BRIEF REPORT OF PRELIMINARY TESTS. By C. D. Smith. 14 pp. Bureau of Mines Technical Paper 20. Washington, 1912.

THE SMOKE PROBLEM AT BOILER PLANTS, A PRELIMINARY REPORT. By D. T. Randall. 31 pp. Reprint of the U. S. Geol. Surv. Bull. 334, revised by S. B. Flagg. Bureau of Mines Tech. Paper 39. Washington, 1912.

THE STATUS OF THE GAS-PRODUCER AND OF THE INTERNAL-COMBUSTION ENGINE IN THE UTILIZATION OF FUELS. By R. H. Fernald. 42 pp. Bureau of Mines Technical Paper 9. Washington, 1912.

NOTES ON THE ANTELOPE DISTRICT, NEVADA. By F. C. Schrader. Advance chapter from Bulletin 530, 'Contributions to Economic Geology, 1911. Part I.' 14 pp. Index, map, ill. Washington, 1912.

THE MINING DISTRICTS OF THE UNITED STATES. By James M. Hill. With a Geological Introduction by Waldemar Lindgren. 309 pp. Index, maps. U. S. Geol. Surv. Bull. 507. Washington, 1912.

DIAMNOD-DRILLING AT POINT MAMAINSE, PROVINCE OF ONTARIO. By Alfred C. Lane. Introductory by Alfred W. C. Wilson. Canada Department of Mines, Bull. No. 6. 64 pp. Index, map, ill. Ottawa, 1912.

THE PRODUCTION OF ANTHRACITE COAL IN 1911. By Edward W. Parker. Advance chapter from 'Mineral Resources of the United States, Calendar Year 1911. 13 pp. Tables. U. S. Geol. Surv., Washington, 1912.

MISCELLANEOUS ANALYSES OF COAL SAMPLES FROM VARIOUS FIELDS OF THE UNITED STATES. Advance chapter from Bulletin 471, 'Contributions to Economic Geology, 1910, Part II.' U. S. Geol. Surv. Bull. 471-J. Washington, 1912.

THE PRODUCTION OF ASPHALT, RELATED BITUMENS, AND BITUMINOUS ROCK, IN 1911. By David T. Day. Advance chapter from 'Mineral Resources of the United States, Calendar Year 1911.' U. S. Geol. Surv. 21 pp. Tables. Washington, 1912.

COAL FIELDS IN MONTANA. By L. J. Pepperberg and W. R. Calvert. Advance chapter from Bulletin 471, 'Contributions to Economic Geology, 1910. Part II.' U. S. Geol. Surv. Bull. 471-E. 66 pp. Index, maps, tables. Washington, 1912.

A COMPARATIVE STUDY OF RAILWAY WAGES AND THE COST OF LIVING IN THE UNITED STATES, THE UNITED KINGDOM, AND THE PRINCIPAL COUNTRIES OF CONTINENTAL EUROPE. Bureau of Railway Economics. Bull. No. 34. 77 pp. Index, tables. Washington, 1912.

NOTES ON THE GOLD LODES OF THE CARRVILLE DISTRICT, TRINITY COUNTY, CALIFORNIA. By D. F. MacDonald. Advance chapter from Bulletin 530, 'Contributions to Economic Geology, 1911. Part I.' U. S. Geol. Surv. Bull. 530-D. 37 pp. Index, map, ill. Washington, 1912.

GOVERNMENT COAL PURCHASES UNDER SPECIFICACION, WITH ANALYSIS FOR THE FISCAL YEAR 1909-10. By G. S. Pope. With a chapter on the fuel-inspection laboratory of the Bureau of Mines, by J. D. Davis. 97 pp.; plates. Bureau of Mines, Bull. 41. Washington, 1912.

The Saurer Truck at Plumed Knight Mine

By H. T. McDONALD

On January 13, 1912, I started from New York for Tucson, Arizona, to make a 90-day test with a 6½-ton Saurer truck in hauling ore for the Pioneer Smelting Co. The truck had been shipped about 10 days before the start and was delayed, as usual, in transit. I waited four days for its arrival, and put in the time to good advantage looking over the roads and making suggestions as to their improvement. The truck arrived on January 21 and was immediately unloaded and found to be in good order. I drove it to a garage and had it supplied with oil and gasoline and made ready for an early start the next day. The truck created quite a sensation in town, and I had to listen to much comment and criticism, some of which I shall repeat.

While every one admired the sturdy construction, and said it "looked like a real truck," few had anything good to say about auto trucks. One wiseacre said, "Huh, here's another of these failures; this truck will go the way of the rest that came here." Another one said: "That's right, this part of the country is a graveyard for these things. You'll never do anything with that." Still another said: "So you think you can haul 6½ tons with that engine. Why, a big traction engine failed to pull a pound on the same road as you are going on, and several other autos fell down here in the last two years. You'll have to leave that in the junk-shop with the rest of the trucks." All this was very soothing to my nerves, but I said nothing, and was mighty glad to find the garage I had been looking for.

I left Tucson at 9:35 a.m., after doing some shopping with A. L. Waters of the Pioneer Smelting Co., and started for Camp Corwin at Shawita, about 22 miles south of Tucson.

Several more wise ones said I would have all I could do to reach Shawita, and as I traveled along I found that road conditions were all my informants had claimed and then some more. Mr. Waters led the way in his Overland and watched the performance of the truck when going thorugh the several bad 'sand washes.' A 'sand wash' is a sort of dry river bed, which in the rainy season carries a tremendous volume of water. The roads cross these 'washes' at the best part, but still there is always new sand at a depth of from 4 in. to 2 ft. The truck crossed these 'washes' with no trouble whatever, and its stock went up a notch or two. Camp Corwin was reached at 12:10. After dinner and a critical inspection of the truck by the company officials, I started for the Plumed Knight mine, 8 miles west of Camp Corwin. The roads, if I may call them such, began to grow worse, and I had my doubts as to ever hauling over three tons at any time. 'Sand washes' were numerous on this 8-mile trip, and were crossed with much difficulty. After hauling the first load of 3⅓ tons to try out the road and truck, I decided that the roads would have to be improved considerably before 6½ tons could be hauled, so a force of ten Mexicans was put at work, under my direction, to do some road building.

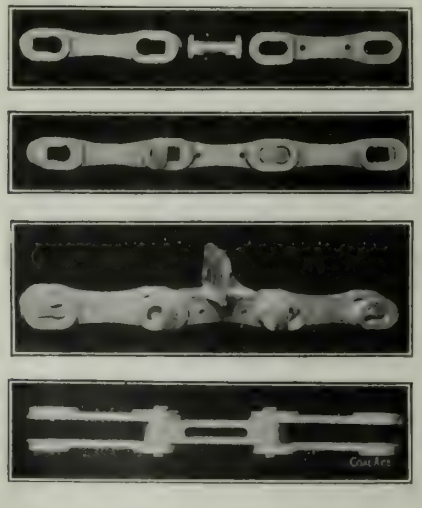
I kept on hauling small loads and kept my eye on a road gang. The sand washes were corduroyed, waste material from the mine was laid on top of that, and thus a fairly good road was started. I then began to increase the weight of loads, and by February 1 was hauling 6½ tons and making four trips daily. No trouble was experienced with the truck mechanically, but owing to the poor quality of the lubricating oil the valves would stick because the oil gummed. The gasoline also had much water in it. I drained a water-glass full about every other day from the trap and carburetor. As gasoline costs 22c. per gallon there, the superintendent said the water thus obtained could be pumped for less than that. Owing to the altitude (nearly 5000 ft.), a little difficulty was found in getting the carburetor adjusted so as to get the maximum mileage, but I soon found the proper combination

and increased the mileage from 3 per gallon to 4.9 per gallon, which I found was the best that could be done, owing to the large amount of low-gear travel that was done. Several grades in the first 2½ miles from the mine were from 8 to 20% and required one-half hour to make the distance; the remaining 5½ miles was a steady descent of about 2 or 3% over sand road and was covered in about 25 minutes.

A road scraper of wood and steel had been made for me, and it was hauled over the roads about twice a week. I soon found this too heavy to haul with a load, so it was abandoned and a new one made of two pieces of steel rail. This proved to be very successful, owing to its extremely sharp cutting edges and lightness, and in the course of a couple of weeks a nearly perfect road resulted, considering its sandy character and lack of foundation. The first month's hauling was not a very good showing, owing to the small loads and the time spent in fixing the road, and cost over $1 per ton to haul. The second month's hauling came below 90c., and the third ran down to 71.7c. per ton, as a double shift of drivers was put on and the haul increased from 24 to 41 tons per day. At the beginning of the last thirty days of the test I had the truck doing 96 miles per day on 18 or 19 gallons of gasoline and one gallon of lubricating oil. At the end of the last thirty days, April 22, our 'stand-up' qualities showed up so plainly that the trucks were accepted. I agreed to stay until May 1 to put the finishing touches to the drivers I had been instructing. The truck was equipped with Goodrich 'Wireless' tires that covered more than 7000 miles and were good for at least 3000 more. Upon being measured they were found to have worn about ⅛ in. per 1000 miles. Considering the very sharp stones in the road and the high temperature to be found there, I believe this to be remarkable.

Simplex Rivetless Chain

This chain was recently patented by Joseph L. Lee, general superintendent of the Cross Engineering Co., Carbondale, Pennsylvania, and manufacturing and selling arrangements have been entered into with the company, which is preparing to market the chain at an early date. The principle of this chain is entirely new, but simple, from which



it derives its trade name of 'Simplex.' The accompanying illustrations of links, pins, attachments, and assembled parts are to a large extent self-explanatory, but the following claims are made for this new product by the inventor and manufacturers:

This chain is interchangeable in all parts. Its parts are easily and quickly detachable, and each section can be so detached in less than a minute. The links can be released or removed by a horizontal movement of the diameter of the pin, or in the 9-in. pitch, 1⅛-in. movement, doing away with the necessity of adjustment of take-up when links or pins require renewal, or to reverse the pins for further service. It will operate over either a sprocket wheel or a traction wheel by reason of the concave shape of the links, and is also interchangeable with certain other types of rivetless chain. The chain has a wearing surface on both link and pin equivalent to standard riveted eye-bar chain, generally known as the 'Scranton' type of chain, the pins being reversible, so that after becoming worn on one side they can be reversed 180°, so presenting the unworn side for 100% additional service, and at the same time nearly restoring the chain to its original pitch.

A special feature of this chain, as well as a distinct advantage over any other type of chain, is the 'lip' shown on the outside links. When the chain is in working position, and whether in the position of passing over a sprocket or traction wheel, the double-slot space back of the pins on the centre links, forming a recess or pocket, is entirely closed. This prevents dirt or gritty material from coming in contact with the wearing surfaces, and if desired the recess or pocket may be filled with any solid lubricant, such as graphite or hard grease, and so insure the longest possible life to both link and pin at the contact points of wear and friction.

The links, being solid, have a distinct advantage over the web, or open, type of link, as there is no compression at any point on either link or pin to cause the chain parts or attachments to stick or to be disconnected with difficulty, and it is not necessary to remove the attachments to disconnect the links or pins.

The two centre links form a pocket for the insertion of the several forms of attachments required, and may be reversed 'back to back' and so used for attachments requiring side elevation or conveyance. Attachments for this chain will first be made of malleable iron to meet standard elevating and conveying requirements, and for extraordinary service certain attachments will later be made of a special tough steel. Attachments when bolted to links will, it is claimed, bear an equivalent strain as if cast in one piece. The links are to be drop-forged from 30 to 40-point carbon steel and broached to assemble to accurate pitch, and the pins are also to be drop-forged and machine-finished, and to be shop-assembled to links to insure the free working of chain parts.

It is the claim of the manufacturer that this chain will in a large measure displace several of the types of riveted chain now in use. The Cross Engineering Co. is preparing to manufacture this chain in 4-in., 6-in., and 9-in. pitch, and it is stated that the chain will be sold at no general increase in price over the standard type of drop-forged, riveted bar chain. It is the general claim that Simplex rivetless chain is more simple to assemble and disconnect than any other type of rivetless chain now in use, and that it is as easily detached as the Ewart type of detachable chain or belting.

Commercial Paragraphs

The Keystone Driller Co. has opened an office at 1629 Candler building, Atlanta, Georgia.

Martin Schwerin & Co. have opened an office at 25 Broad street, New York, as consulting engineers.

The Lima Locomotive & Machine Co. has been succeeded by a new company called the Lima Locomotive Corporation. Increased capital has been provided and the plant will be enlarged to handle from 900 to 1000 locomotives per year. Four thousand men will be employed.

The Denver Quartz Mill & Crusher Co., of Denver, Colorado, reports the following recent sales: One 50-ton plant to A. A. Taubeneck, Greenville, California; one 50-ton plant to Weaver Bros., Salina, Colorado; one 100-ton plant to Thomas B. Everett, Paramaribo, Dutch Guiana, South America. The above plants are to work on free-milling gold ore.

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EDITORIAL

PETROLEUM production in California seems likely to establish another record this year, the output for the first six months indicating a probable total for the year of 87,000,000 barrels. This is all the more striking in that no phenomenal gushers have swelled the output this year.

PRE-CAMBRIAN rocks are great storehouses of the metals, and a knowledge of their distribution has helped to the discovery of many an orebody. Mr. M. K. Rodgers has compiled a general map of North America, based largely on the work of Messrs. C. R. Van Hise and C. K. Leith, and showing in black and white the principal areas of these rocks.

BRAZIL is attracting unusual attention in the United States at present. Development of the great iron ore deposits in Minas Geraes, in which American companies are taking active part, has called attention to the possibility of developing mines of other minerals. Messrs. J. E. Bundy, Charles Benn, and S. D. Horton, experienced California prospectors, are planning to leave New York the last of August for a prospecting trip through western Brazil. A large and well equipped expedition will also leave September 5 to thoroughly test reported gold-dredging ground in the state of Goyaz, and still other things are in prospect. We published, November 4, an excellent general account of Brazil as a field for the prospector, written by Mr. A. P. Rogers, on his return from an eight months stay in the western part of the country.

CANAL tolls are being vigorously discussed at Washington. We are old-fashioned enough to believe best results will be obtained if the canal be run on the most businesslike basis. Tolls that will cover operating charges and at least contribute toward interest charges would still be sufficiently low to attract foreign traffic to Panama and allow competition with Suez. Coastwise traffic is already thoroughly protected against competition in that none but American vessels can take part. If it be desired to protect the ships against the railroads the logical means is through control of rates, exercised by the Interstate Commerce Commission. If, on the other hand, the real object is to subsidize American ships it would be more honest to vote a subsidy bill than to jeopardize good relations abroad by sharp practice.

DEATH of the Emperor of Japan removes one of the real and powerful influences for progress in the Sunrise Empire. In a land where the ruler is regarded not only as the political sovereign of the people, but as the heaven-descended head of one big family, his influence is far beyond that had by any Western ruler. The phrase, 'for the honor of the Emperor,' is no empty form, but marks a real and reverent feeling common to all Japanese. Mutsuhito, the one hundred and twenty-first Emperor, was a worthy descendant of the line which has certainly reigned since about the time the Goths thundered at the gates of Rome, and which, according to Japanese chronology, began with Jimmu Tenno in 660 B.C. Born in 1852 and

reared in the seclusion of the old palace at Kyoto, he was but 15 years old when he succeeded to the throne and, with the resignation of the Shogun, faced larger responsibilities than had any immediate ancestor. He played his part well, and to the fact that he devoted himself with discretion and wisdom to the modernization of his people, we owe the new Japan. A few mistakes on his part might well have given us instead another Korea or Siam. It was not that he did not have and follow great ministers, but that he used his influence always on the right side. In the critical conditions incident to the substitution of the modern competitive system for the ancient paternal feudalism, men bore their trials gladly and sacrificed place and fortune 'for the honor of the Emperor.' He guided his people well and the world is much in his debt.

TAMPING drill-holes is common where black powder or other low explosives are used, but with dynamite in rock there has been much dispute as to the need and value of tamping. The United States Bureau of Mines has recently studied the subject and presented its results in Technical Paper 17, written by Mr. Walter O. Snelling and Mr. Clarence Hall. Experiments were carried on by exploding shots in a homogeneous material with and without tamping, and measuring the expansion produced. The results were favorable to tamping. Incidentally it is worth recalling that the introduction of tamping charges in the Treadwell mines, on the advice of Mr. Snelling, resulted in a large saving in explosives. Studies of these and similar questions by the Bureau are yielding results of large importance to miners.

HAVING taken occasion in the past to criticize delay in the United States Geological Survey in issuing statistics, we have especial pleasure in commending the work now being done by that organization. We reprint this week figures of spelter production and consumption for the first six months of the year. These are not merely interesting in themselves, but are especially valuable in that they are the only complete figures available. The copper producers have their own statistical bureau, and the ore production at Joplin and in Wisconsin is published weekly, but hitherto it has only been possible once a year to know what the lead and zinc furnaces had been doing. Mid-year figures for spelter are good. We hope the Survey officials may find it possible to extend their work to cover quarterly or even monthly figures for both zinc and lead.

LAND laws in the United States have been novel in many particulars, and there is a widespread feeling that the times demand their general revision. Preliminary to the making of any recommendations the committee on revision of the mining law, appointed by the Mining and Metallurgical Society, has been compiling the opinions and criticisms of those competent to judge the matter. Under the active leadership of Mr. H. V. Winchell a large amount of valuable data has already been collected. Elsewhere we publish a particularly informing letter on the subject written by Mr. A. Montgomery, the accomplished State Mining Engineer for Western Australia. Such a thoughtful contribution from the outside should be especially helpful. "To see ourselves as others see us," should indeed "frae monie a blunder free us, and foolish notion."

COMPARISONS are always worth reading when made by a competent observer, and those of Mr. F. V. Stanley Low of mining practices in the United States, Australia, and Cornwall, published in *The Mining Magazine* for July are quite worth while. Although admitting that exact comparisons are impossible owing to different conditions involving the practice, Mr. Low has noted certain strong characteristics of each district visited which gave an individuality to their work. Mining in America has in many instances developed in a one-sided manner, and this may partly account for the results noted. However, with the single aim of obtaining the maximum profit for operations, naturally similar results have been reached in widely distant districts. The most impressive feature of American practice seems to have been the magnitude and organization of the operations, while in the Kalgoorlie and Broken Hill districts of Australia the excellence of 'work-effort' is notable. Cornwall, which has produced so many mines for other districts, seems to have lagged behind and to be addicted to obsolete and inefficient methods of mining.

GRADUATE work in engineering is to be a specialty of the University of Illinois, according to a recently issued bulletin. Practicing engineers will not be apt to take exception to the view that engineering, in developing, becomes more scientific, and that specially trained and prepared men will be required to successfully meet new problems which arise in old professions. There is no question as to the need, but the University will have to prove by the result of research work done, or by the high quality of the men trained in the laboratories, that it is prepared to fully meet this need. A graduate school of engineers is probably the dream of every engineering instructor, but even the boldest must have some question as to methods to be tried and results to be sought. The best field for the professional schools has been in supplying students with the essential fundamental knowledge, underlying the various professions, and a training which has given them confidence in meeting new difficulties. The University can supply the working tools and sometimes the inspiration, but the graduates must do their own building outside the supporting arms of their alma mater. For this reason there must be some question as to the probable success of any university which attempts to give its recent graduates a comprehensive enough view of the future of engineering to enable them to work to advantage in research. A man must usually find his own problems before he can attempt to solve them, and these problems are easiest to find in actual practice. The university which best equips its student to solve problems outside the walls of its own buildings is best maintaining 'graduate work in engineering.'

TEN YEARS ago no reputable engineer would have thought of estimating ore reserves in terms of 'millions of tons.' Outside of the elaborately worded prospectus designed to sell stock in Western bonanzas to New England school teachers, the phrase was unknown. So fast has our education progressed, however, under the influence of the bulletins of the low-grade 'porphyry copper' companies, that little comment is excited when an official announcement is made of an orebody with a tonnage estimated in seven or eight figures. The Braden Copper Company, which in April 1911 reported a modest 12,000,000 tons as the amount of its ore reserves, now finds that this was a conservative estimate, and that 23,000,000 tons is developed, with a chance for still further increase. To the shareholders this is undoubtedly gratifying information, but before engineers at large the question will arise, "What is to be the policy of the company in handling this ore? Will the management be content to effect a recovery of 60% of the metallic contents, on the ground that copper is the cheapest thing it has, crowding the production to take advantage of a favorable market, or will it work slowly toward an increased saving by careful tests and trials of new methods?" According to press dispatches, the flotation process of the Minerals Separation Limited of London, and the leaching

of concentrate will both be tried. The outcome of these experiments will certainly be watched with interest by engineers and with hopes for success. It may not be an acceptable commercial attitude, but there are engineers who believe that a company possessed of enormous resources, owes something to the public beyond the mere production of rapid dividends. The exhaustion of a part of a country's resources should be attended with the least possible waste, and with some contribution toward the advancement of the industry which handles the material produced.

OUR esteemed, so to speak, contemporary, the *San Francisco Chronicle,* has been indulging in an orgy of figures in discussing the Alaska Juneau mine. The latter contains, undoubtedly, a large orebody, and by careful work it may be made a valuable one, but the most sanguine of its owners hardly expects "$4,000,000 per year for 200 years," and we are forced to believe someone slipped in a few extra ciphers. As a matter of fact, Mr. F. W. Bradley and his associates are planning now to treat 25,000 tons of ore per month, and hope by careful sorting to keep the grade of the ore up to $2 per ton. Up to now the mine has been worked on a small scale only, by open pit and with 40 stamps. The average grade of the ore has been about $1.60 per ton and the cost $1.10. This performance, we think, is more remarkable even than the admittedly large size of the deposit. It is relatively easy, in the case of large orebodies, to obtain low costs when working steadily with large and expensive equipment, but to obtain minimum costs with a 40-stamp mill operating only in the summer, is the acme of good work. Under the peculiar conditions at Juneau these costs would undoubtedly have been increased if mining had been attempted upon a large scale, and to make a success of the enterprise under way it was necessary to so mine and sort as to raise the grade. The careful studies of this phase of the problem were quite as necessary to success as the planning for the new mill and workings. Incidentally, the new workings involve some interesting features. The old open pit is to be tapped by a 900-foot raise from a 7000-foot adit now being driven, and from the mouth of the latter a flume and tramway will be carried around the edge of the mountains to about 500 feet above the mill, which has been built on the shore below Juneau to avoid the snow at the mine. Water from the Silver Bow basin will be piped down through the raise and used to generate power in the mine. At the mouth of the adit the flow will be joined by the additional stream won last summer, and at the mill there will be another drop and power station. The whole plan has been carefully devised and the enterprise is an excellent example of how constructive imagination reinforces experience in development of modern industry.

Management of the Institute

Mistakes are less interesting than plans, and for our part, in considering the affairs of the American Institute of Mining Engineers, we are more concerned with the future than the past. Such errors of judgment as have occurred have been few and relatively unimportant, and blame may well be shared equally by officers and members. A more general assumption by the members of responsibility for the conduct of the Institute would have precluded the overconcentration of power which seems at the bottom of the present trouble. If responsibility is left to an officer the power must go with it, and those who shirk have little right to complain.

Among the recommendations of the Committee of Five, the one which appeals to us as of first importance is for a reorganization of the business of the Institute so as to prevent for the future a 'one man' management. The Council and the Directors, acting together, should be the real centre of authority. Men are elected to these boards as trustees for their fellow members, and should not accept the position unless prepared to give time and thought to the work of the Institute. Service rather than money is needed. It has too often happened in the past that officers, finding themselves unable to devote time to the Institute, have contributed instead money to the land fund. There is nothing so dangerous as an 'ornamental' trustee, and that he is at the same time generous makes the matter no better. The members, having voted to accept the Carnegie building, should not be relieved from responsibility for paying for the land, and, on the other hand, the Directors and Councillors are trustees for funds belonging, not to the officers, but to the members. In many cases payment of the annual dues involves real sacrifice on the part of beginners in the profession and even of older men when out of work. This position of trusteeship should be kept in mind, but, with the large membership in the Institute, there should be no difficulty in selecting always an active and able body of trustees.

In considering the routine management it should be remembered that there are two things to be taken into account. The Institute is a social-technical society, and it is also a publishing house. Examination of the figures compiled by the Committee of Five shows that the actual income from members is now less than in 1906, while the expenses have steadily increased. That the business affairs have not become hopelessly involved has been due to increased profits from the publishing end of the business. In other words, the advertisers in the *Bulletin* are footing the bills. Whatever questions there may have been originally as to the wisdom of the Institute embarking upon publication in a competitive field, it has already been done. Speaking for one publishing house in this same field, we can only say that we extend it a hearty welcome. Publishing, however, is a business, and its proper conduct requires a trained business manager. The secretary of the Institute is, and should be, mainly concerned with other matters. His training and outlook should be that of an editor rather than of a publisher, and an excellent secretary may well be a poor business man. Indeed, the better he fills the one place, the less desirable it is that he should be charged with duties belonging to the other. There should, therefore, be two chief officers in the permanent force, a secretary and a business manager. Toward the salary of the latter may be applied the commissions now paid on advertising, since the size of the business is not, as yet, too large to prevent one man doing the soliciting and also handling the office. If he takes entire charge, under an executive committee, of the business of the Institute, the secretary will then have the time to do his proper work in building up the membership and sustaining the Transactions on the high plane set by Dr. Raymond.

Mention of the latter brings up another point upon which a word is due. The Directors, it now seems, find that there was no legal authority for creation of the position of secretary emeritus when Dr. Raymond retired from the secretaryship, and that formal action of the members will be necessary to carry out their intention. In the meantime Dr. Raymond has been appointed special editor. We are sure that the members will vote unanimously for any amendment necessary to show their appreciation of the long and faithful service of the ex-secretary and to provide for such continued connection with the work of the Institute as his strength will allow and the funds available will permit. The members have a lively appreciation of what Dr. Raymond has done for the Institute and will wish to do everything possible to express that feeling.

Modern Methods of Gravel Excavation

By Francis J. Dennis

Having had occasion recently to attempt to find some method for removing the overburden of barren gravel from a strip of 'pay' gravel, which it was planned to subsequently mine by small steam-shovels and by hand, I was impressed anew with the difficulties in such a situation. In the particular instance in view, placer work, the gold was so distributed and the character of the bedrock was such that it was not feasible to dredge the ground. The width of the 'pay' channel was from 100 to 200 ft., and the thickness of the overburden from 12 to 20 ft. The surface for a considerable distance on either side of the 'pay' channel was practically level with the surface of the overburden of the channel. It was desirable to avoid the use of cars or wagons in disposing of the spoil from the stripping process. The character of the gravel ranged from fine gravel, sand, clay, and mud up to boulders of from 18 to 20 inches in diameter; in fact, the characteristic gravel usually found in the ordinary river bed. The problem was first to find an efficient method of disposing of the spoil on the banks on either side and still permit access to the pit, so as to mine the 'pay' gravel below. The steam-shovel naturally suggested itself as the most efficient digger, but the average steam-shovel has a very short digging radius and an even more limited stacking radius. Either some other form of digger capable of excavating gravel of the character described and also capable of stacking the large amount of spoil to be handled, had to be found, or some means provided for taking and stacking the spoil from the steam-shovel. Any machine or machines chosen had to be such as could be readily moved forward as the work advanced along the channel. To find the most efficient machine, a trip was made to various points in the country where aqueducts and canals are being constructed and coal and iron-ore stripping is going on.

Various methods of digging and stacking the spoil were found to be in use, and about as many different opinions as to the best machine for the purpose as there were machines in use. The shallow canal usually constructed for carrying water for irrigation or for drainage purposes is a comparatively simple problem. The canal dredge, the steam-shovel, the drag-line bucket, and the clam-shell are all being used in digging it. The disposition of the spoil on either side of the cut is a simple problem; it is a question of getting the most efficient digging machine to meet the local conditions. But where the cut is comparatively wide and deep and the amount of spoil large, and especially where it is desirable to leave a fairly wide berm between the edge of the cut and the spoil-bank, the question of handling the spoil becomes serious. To get a machine or machines that will dig and stack efficiently, and yet be capable of being easily moved ahead as the work advances is a problem that has led to various types of installations. In some cases where coal and iron-ore stripping and mining is in progress, the large revolving steam-shovel with a very long boom has been found quite efficient machines. These shovels are capable of making a comparatively wide cut, 40 ft. or more at the bottom, and of stacking this overburden on the bank of the cut so that the coal or iron under the overburden can be readily mined; one handling only being necessary in order to give access to the coal or iron. I witnessed instances where this was successfully carried out, where the overburden was 22 ft. thick. Where the overburden is very thick, the width of the cut is necessarily narrow. Of course, the character of the overburden, especially whether or not it can be taken out and leave the walls of the cut fairly steep, has much to do with the success of this method of mining. The width of the bottom of the cut is the important point. It is not only a question of yardage excavated, but of coal or iron exposed by the operations, and where the overburden is of such a character that the sides of the cut would naturally take on a decided slope, this method of mining would be impracticable, the shovel being unable to stack the spoil. The material overlying the coal and iron at the points visited stood up well, leaving the sides of the cuts very steep. Where the cut was deepest it was sometimes found necessary to use the dipper and dipper-handle and crowding engines to push back the top of the spoil-bank in order to enable the shovel to stack all the overburden. This retarded the speed at which the shovels dug, but the small percentage of delay caused was of little importance when it is considered that only one handling was necessary to uncover the coal or iron. The swing of a long boom also necessarily consumes more time than would that of a short one, but these large shovels dig and make the swing surprisingly fast. A good operator will dig and stack from 40 to 60 loads per hour, and as a dipper carries 3½ cu. yd., the capacity of one of these large shovels is considerable. One of these shovels will dig and stack from 120 to 200 cu. yd. per hour. They are capable of digging very hard material, but this necessarily consumes more time, and where this condition exists it pays to keep a couple of men in advance of the shovel with steam or air drills, putting down holes and loosening up the ground by blasting.

It is not proposed to describe in detail these big shovels, but merely to state what I found them capable of doing. However, a few general statements in regard to the construction of these big shovels might not be amiss. The lower frame is of steel, mounted on four swiveling trucks with four double-flange wheels on each truck. To the top of this frame is fastened a rail circle and cast-steel circular rack for rotating the machine. A hydraulic equalizing device is provided, so that the machine can be moved ahead and operated on uneven tracks without twisting the frame through the unequal distribution of weight, and to keep the turntable on a level so that it is capable of revolving without unnecessary strain and with a minimum application of power. The machines are self-propelling. Three men are required on one of these large machines, and four more to lay tracks and prepare for moving ahead. These machines have 65-ft. booms and 3½-yd. dippers, and are capable of doing the work above indicated. Larger shovels with 90-ft. booms, 6-yd. dippers, and weighing about 200 tons are now being built. These new shovels should stack to a height of about 62 ft. above rail (boom at 45°) with a radius of cut at the bottom of the pit of 61 ft., and should have a capacity of from 150 to 300 yd. per hour. These larger shovels will handle a depth of overburden with which the present shovels are unable to cope, to say nothing of taking a much wider cut, and should open new fields to stripping operations. The shovels make one cut to the limits to be worked, the stripped material is removed, and the shovel returns on another cut, depositing the overburden in the open space. This permits of a wider cut on the second trip, the shovel not having to stack so high, and as the swing is less, the capacity is greater. It must always be borne in mind, however, that the use of the long-boom steam-shovel for stripping operations and the disposal of the spoil in one handling, providing that any considerable depth of overburden is to be handled, is limited in its application to ground where the sides of the cut will stand fairly steep. Where the ground is soft and the banks take a decided slope, it is difficult to strip any considerable width so that the underlying material can be mined, even with a long-boom shovel. The short-boom shovels handle a greater number of dippers per hour, cost less, and consume less power. At the Chino Copper Co.'s property, in January 1912, a No. 1 Marion, model 91, steam-shovel, with 3½-yd. dipper, averaged 1721

yd. per shift and at the rate of 200.8 yd. per actual working hour. It is often desirable to use the smaller short-boom standard steam-shovels, the spoil being disposed of by a second handling. Cars and locomotives are generally used for this purpose, a dump being established at some distant point. But where it is desirable to stack the spoil on the immediate banks, and especially if a berm is to be left between the edge of the cut and the spoil bank, some form of crane, incline tipple, elevator, or conveyor must be provided.

The locomotive crane, traveling on rails along the berm as the shovel advances along the bottom of the cut, has been quite successfully used, the crane lifting and stacking the contents of a shallow box holding from 3 to 5 dipperfuls of material, another box being filled by the shovel while the crane is dumping one load and returning the 'empty.' The shovel may fill the box while placed either at the bottom of the cut or on the berm at the edge of the cut, but in no instance did I find an application of this system where a standard 1½-yd. steam-shovel was kept busy. The breaking of the bales on the boxes, and the difficulty of effecting a rapid detachment from the empty and attachment to the loaded box, cause a considerable loss of time. In some instances a double-boom crane is used, the booms being opposite each other, the crane making a half circle to each load, dumping, then continuing the circle to drop the empty box and pick up its full load. The double crane is very much more expensive, is a heavier machine to move forward, and it is doubtful if it does any more work.

Another device is a portable incline-tipple, moving along the bottom of the cut just back of the shovel, the upper end of the incline extending well over onto the bank of the cut, so that the spoil can be dumped from cars and stacked without flowing back into the cut. This incline has a double track and is provided with two cars, each capable of carrying from four to six dipperfuls of material. These cars are hoisted by a double-winding engine, each drum working independently, so that one car is at the bottom being filled by the shovel while the other is ascending, dumping, and returning ready to take its load at the bottom. This apparatus is very expensive to construct, entails the laying of a double set of rails to advance it along the cut, and its use means that the shovel must revolve clear around to deliver its load into the cars, thus somewhat curtailing the capacity. However, this apparatus does seem to be able to keep a standard 1½-yd. shovel busy, and to be able to dispose of the spoil so that it will not come back into the cut. It seems out of the question to devise any method of disposing of the spoil on the immediate banks by a machine moving along the bottom of the cut, which would not entail the necessity of the shovel swinging clear around to deliver its load, as this second machine must necessarily be placed behind the shovel. Its cost of construction and the cost of laying tracks are its greatest drawbacks.

THEW SHORT-BOOM, TYPE A-1, STANDARD SHOVEL WITH CROWDING ACTION.

In discussing the problem of disposal, I am assuming that a variable material irregular in size, varying from fine to coarse, is to be handled. The same conditions would obtain in dealing with the average river-bed gravel, and the question arose whether such a product could be delivered from the shovel to a belt-conveyor so mounted as to be readily advanced in conjunction with the shovel. Such a belt-conveyor suitably mounted would be much lighter than the incline tipple above described, would not entail the expensive track-laying, and would be much less expensive to construct and operate. To spill direct from the shovel on to the belt would be out of the question, and the only solution seemed to be to put in a hopper with some feeder to the belt which would give the latter a fairly regular and even load. I was able to find instances where this was being done with run-of-mine coal, but that is a very different material and easier to feed on to a belt than is river-bed gravel of the kind described. The device in use to keep the coal near the middle of the belt was a skirt-board just below a feeder, the skirt-board being given a slight movement which forced the coal toward the middle until it came to rest on the belt. No instance was

found where heavy material such as mixed gravel of the character described was being successfully fed to a belt-conveyor.

The drag-line bucket revolving machine is also largely used for excavating gravel and soil, and has won recognition as an efficient and economical digging and stacking machine. As a digger it is hardly as efficient as the steam-shovel, but as a stacker it has advantages over the latter. The first cost of a drag-line machine is much less than that of the long-boom revolving shovel, it is cheaper and easier to transport, it can be operated and moved ahead on wide wheels moving on planks, and it will handle a substantial yardage per hour. Buckets hung from chains and those having a fixed bale are both in use. The latter seems the much more efficient digger, but where the ground is soft or has been previously loosened, the former does good work. The bucket with the fixed bale will dig harder material and is easier to control and guide in a definite direction. The drag-line bucket with the fixed bale is doing excellent work in widening and deepening the New York barge canal. In this work it is necessary to leave a wide berm and to stack the spoil at a considerable distance from the edge of the cut. The digging is not difficult, clay and ordinary soil being handled by this method. The machines have long booms, are of the revolving type, have 1½-cu. yd. buckets, and cut the soil and clay more readily than any other machine in use with the exception of the steam-shovel, and where the latter method is used, a second handling is necessary in order to dispose of the spoil. Even the very long boom steam-shovels previously mentioned in this article would be unable to dig and stack with one handling. These 1½-cu. yd. drag-line machines dig and stack from 600 to 800 cu. yd., and sometimes even more, of this material in eight hours. The material is dug from the bottom and side of the canal and stacked to leave a berm about 20 ft. wide between the edge of the cut and the spoil heap. The cost of operation is not great; five men operate the machines, level ahead of the machine, and assist in moving along the berm after a portion of the spoil has been deposited thereon; it being necessary to raise the berm of the canal some three feet in order to conform with the conditions of the contract. The bucket is first used to roughly level the spoil deposited on the berm. The machine is moved ahead by gripping the bucket in the soil ahead of the machine and moving up under power of its engine. The laborers take the planks from behind the wheels and place them in front as the machine advances.

The clam-shell revolving derrick is also in use on this canal, but is a very inefficient digger and does not give satisfaction. The clam-shell bucket is useful in unloading coal and ore from barges, and in dredging mud from river bottoms and similar work, also for digging soft loamy material, but can hardly be classed as an efficient digger for the handling of the harder ground in place or for coarser gravels.

Cantilevers moved along the berm on wide tracks are also used in the canal work. One end of these cantilevers extends well out into the centre of the canal, and the other back from the edge to a point designed to be the apex of the spoil heap. Drag-line buckets are usually operated from these cantilevers, the machine being moved ahead as the work progresses. The time consumed to load the bucket, raise it, and pull it up along the cantilever to the dumping point, is considerable, and the capacity of the machine correspondingly small. It is no better digger than the ordinary long-boom, drag-line bucket, revolving machine. It is very much more expensive to construct, harder to move ahead, and does not allow the same flexibility in digging, the operation of the bucket being confined to a space directly in line with the cantilever. Furthermore, the machine cannot be used as a crane or for the various other purposes to which a drag-line boom machine can be put. It is a formidable and costly machine for the work which it accomplishes. At points along the canal where the cut is necessarily very deep, due to the topography of the country, two handlings are necessary in order to dig the material and dispose of the spoil. A drag-line bucket would be too far away from the boom to do good work, and the time consumed in hoisting, swinging, dumping, and returning would curtail its capacity too much, while any steam-shovel built could not possibly stack on the sides, away from the edge of the cut. In such instances it has been found most economical to use the standard steam-shovel to dig the material, the spoil being deposited in large shallow boxes, carrying from four to six dipperfuls, which are raised and dumped by a locomotive traveling crane moving along the berm as the steam-shovel advances. Where rock work is encountered, holes are drilled and blasted to loosen the material before being attacked by the shovel. This method of second handling is not sufficiently efficient to keep a fair-sized steam-shovel busy, and the work is necessarily costly. Movable towers on either side of the cut, from which a 'flying-fox' is operated, have also been used with some success, but are also too slow in operating to work a standard shovel to its capacity.

A machine designed and manufactured in Germany has been used in that country and in Siberia with considerable success. It has a ladder and bucket-line similar to an ordinary gold-dredge; the machine is on a track on the surface in front of and at right angles to the direction of the cut, the ladder and bucket-line extending down into the cut and the buckets being dragged against the bank and digging it away as in the case of an ordinary dredge. The material is brought up over a tipple and dumped upon a belt-conveyor, and thence passed to the spoil bank. The material is dug dry, and the machine digs the ordinary river gravel fairly well. The buckets are not large, and the feed to the belt is sufficiently regular so that this form of conveyor can be successfully used. It is said to be an efficient and economical excavator and has been used as such successfully over a period of years. Putting conveyor-belts on these machines is a new departure, but it is reported to be giving satisfaction. Previously the machine delivered the material into cars for removal.

The types of excavators described in this article are the ones principally used in cutting wide deep trenches, and in stripping operations where the overburden is considerable and it is desirable to stack the spoil along the sides of the cut. There are other types of excavators doing good work in digging the smaller irrigating and drainage canals, and for cutting trenches and digging ditches, but their description is hardly within the scope of this article. As an excavator, the California ladder-bucket dredge is undoubtedly far superior to any of the above mentioned, and where the material can be so dug, its gold contents won on tables placed on the dredge, and the gravel disposed of immediately behind the boat, this is undoubtedly the cheapest method of handling the material. But the conditions are not always favorable for dredging. It may be desirable to remove and stack the overburden and subsequently mine and wash the pay-gravel, and in that instance one of the methods of excavating above mentioned may prove of value. Moreover, these methods, or some one of them, may be profitably applied to forms of excavating other than the handling of gravel, such as the stripping of coal and iron ores, digging canals, or other similar work.

The best type of excavator for any particular work depends largely on the amount of material to be handled, assuming that two or more types will efficiently dig and stack the spoil. The revolving long-boom, drag-line bucket machine is much cheaper to install than would be a steam-shovel of large size and very long boom, and although the actual operating cost of handling per cubic yard might be somewhat in excess of that with the steam-shovel, the lower amortization charges on the drag-line installation might more than compensate for this. Consideration of the value of each machine after completion of the contemplated work must be taken into account, and here locality, transporta-

MODEL 250 MARION LONG-BOOM SHOVEL STRIPPING COAL AT DANVILLE, ILLINOIS.

CLASS 14, BUCYRUS, DRAG-LINE SCRAPER, WITH 60-FT. BOOM, AND 1½-YD. BUCKET, MAKING A RAILROAD FILL.

tion facilities, and prospects of future work are important factors. The heaviest part of the drag-line machine and its total weight being very much less than that of a large-boom, heavy, revolving steam-shovel, it may be successfully taken to localities where it would be impracticable to transport the shovel. Where it is necessary to erect a second machine for stacking to be used in conjunction with a standard steam-shovel, the same consideration as to first cost and future value must be taken into account. Moreover, inasmuch as the standard shovel requires the laying of tracks, always an expensive item in steam-shovel operations, and other tracks have to be laid for any form of successful stacker yet devised, and as no machine other than the expensive incline tipple, previously mentioned in this article, seems able to keep a standard steam-shovel constantly working, it is a question as to whether the operating cost per yard with the drag-line machine would not prove less than the double-handling method where the drag-line machine is capable of digging the material. The shovel requires its full complement of operators and track-layers without being operated to anything like its full capacity. Where the drag-line machine can dig efficiently, by the use of a large bucket, one set of men can handle a substantial yardage at a comparatively low operating cost.

Pioneer Company of Siberia, Ltd.

By C. W. Purington

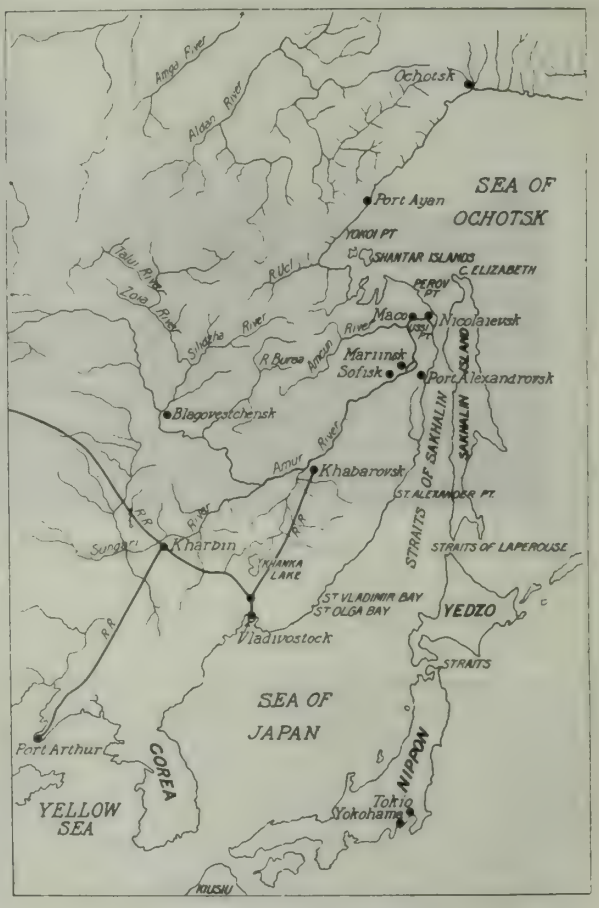
The gold-dredging possibilities of of the lower Amur region in East Siberia are being thoroughly investigated this season by a corps of engineers under the direction of Ross B. Hoffmann, of Oakland. The Pioneer company has acquired by location nearly 100,000 acres of dredging land within a radius of two hundred miles of the city of Nikolaievsk. The areas are situated on and adjacent to some twenty different creeks and rivers tributary to the Amur river, and to the Amgun river. The country rock of this district is slate and schist, extending with great uniformity of occurrence over enormous areas. Small quartz veins interlaminated with the schist have supplied the alluvial gold. The gold occurs finely divided and averages $18 per ounce in value.

The region has been for many years the scene of a desultory mining activity, the rich gravels at the headwaters of the streams having been worked by hand methods. Since 1869, it may be estimated that a product of $30,000,000 in placer gold has been obtained, by laborious and wasteful methods. The old properties are now for the most part exhausted and for sale, but even though they contain valuable gravel they are of little importance, as they occupy small and isolated creeks near the head of the river systems and are almost impossible of access for the transport of machinery. Besides this, the tailing has been stacked in such a way that to re-work it by dredging is difficult and expensive.

The Pioneer company has adopted the policy for the most part of locating, through specially granted permits, the gravel flats below these old properties where suitable dredging conditions are known to exist, and which are accessible directly by water transportation. Government patents to these claims are being obtained as fast as desirable, and it is expected that before the end of the year several thousand acres will have been patented. In the meantime prospecting rights have been granted and the drilling of the ground is proceeding. Several of the properties held by the company, as, for example, the Somnine, the Semi-Amgun, the Nummul, the Geri, and the Pilda, appear to contain an amount of gravel in continuous areas on the scale of the larger California properties, and there are several smaller areas where rich deposits have been indicated by the operations of the so-called *hishniki* or illegal wandering gold miners of the country.

The region is one of comparatively low latitude, being about 53° north, and permanent frost is not found at all, or only in very small quantity. The operations of the dredges of the Orsk Goldfields, and the dredge belonging to the Amgun company have shown that favorable conditions for dredging exist, and it is estimated that gravels carrying 20c. per cubic yard recoverable gold, if found in large quantity, can be made to pay. It is hoped that during the season at least one of the large properties will be found sufficiently promising to warrant sampling in detail. Permanent frost is not found in any quantity in any of the areas under location. A little frost is found in the upper Amgun properties, but not elsewhere, so far as known.

The region has the advantage that it is incapable of wheat growing or supporting an agricultural population,



EASTERN SIBERIA AND JAPAN.

consequently it is practically empty except for the mining and fishing population. No agricultural rights are likely to hinder the dredging industry. The labor is mostly Chinese, and entirely satisfactory for all drilling and pit-sinking work, and also for dredge-construction purposes. It has also been found that dredge operators can be trained from among the Russian mechanics, especially those from the Baltic provinces. There is an abundant supply of timber in the region for fuel purposes, prices ranging from $1 to $1.50 per cord for spruce wood or birch, as the case may be, cut and delivered at the boilers. There is little timber suitable for construction work, and dredge hulls must for the most part be of steel. Housing lumber can easily be obtained locally. For a large dredging enterprise implying a central power plant to operate several dredges, it would probably be advisable to import crude oil in tank steamers from the Black Sea.

It has been found by experience that the season for gold-dredging lasts from seven to eight months. The region enjoys a superb climate and abounds in fish and game. A bi-monthly service of steamers is maintained during the summer between Hamburg and Nikolaievsk, by way of Suez. For passengers Nikolaievsk can be reached by way of Trans-Siberia from London in seventeen days.

Australian Mining Laws

By A. Montgomery

*For a good many years past most of the governments of the Australian states have adopted as a principle that when Crown lands are sold, granted, or leased, the demise does not include mineral rights of any sort as regards the precious metals and the more important metallic minerals. A person buying land for purposes of residence, cultivation, or any other ordinary occupation not depending on minerals in the land, is presumed to have obtained it for the ostensible purpose for which it was taken up, and not for unknown mineral values which it may ultimately prove to contain. The state and the purchaser then both know what part of the public estate is being treated for, and neither party has any call to be aggrieved if subsequent discoveries show that the land had mineral values in it which were not contemplated in the original transaction. The principle is not, however, carried out by any means completely, or to its logical conclusion of reserving to the state all values which may accrue to the land in the course of time from considerations not contemplated at the time of the original transaction, namely, 'unearned increments' due to position. All minerals are not strictly reserved, the land-owner being, as a rule, entitled to all benefit of such products as clays, slate, building stone, limestone, and similar minerals.

The older Australian titles included all minerals in the fee simple of the land except the precious metals, and in a few cases even these were specially included also. These rights have rarely, if ever, been interfered with. In the case of lands over which the mineral rights have been reserved at time of sale, it is in practice so difficult to effect entry upon private lands to search for and work minerals, except with the consent of the owner secured by definite agreement with him, that it is rather uncommon for any attempt to be made to force them open for mineral selection, and the greatest practical difference between this case and that in which the land-owner owns the minerals, is that the latter is not in any fear of compulsory resumption of his land by the government, at a valuation which takes no account of the mineral values, for the purpose of having it thrown open for mining operations, and consequently is free from the pressure which may be exercised upon the former class of owners to induce them more readily to admit mining on their lands on what they may consider unduly easy terms. The land-owner remains in a pretty strong position, however, even if the minerals do not belong to him, as it is usually easier to make terms with him for entry upon his land than to get the machinery of government to work to have the ground resumed for mining purposes with consequential compensation of the land-owner.

The general trend of Australasian legislation on this matter appears to be toward more rather than less restriction of the land-owner's rights, confining them to use of the surface for the purposes for which it was declared to be occupied, and toward greater facilities for mining adventurers to enter upon such lands in search of minerals and to work them without hindrance from the land-owner. This seems quite a logical outcome of the root idea that the lands of the country belong to the state, and that the surface is open to be sold to one owner for agriculture or any other declared purpose, while the mineral rights, with necessary way-leaves to work them, may be sold or leased to another person without more reference to the first than to fairly compensate him for the interference with his possession of the surface entailed by allowing mining on his land.

*Extract from reply to the circular letter of the committee of the M. & M. Soc. Amer. on revision of the American Land Law.

Much the same idea underlies the strong preference shown in this part of the world for leasehold tenure of mining lands as against freehold. The mineral rights are granted by the state on easy terms on the condition that they are worked, and that if not worked they revert to the state, a condition much more readily enforceable with leases than with freeholds. The mining investor's point of view is naturally a different one, and among such there is a strong desire for the fee simple, in order to be able to retain the mineral rights without working the mines, if their interests seem to them to make inaction the best course. Where a mine has been worked and has come to the end of its resources for the time being, there is a good deal to be said for the freehold tenure, as it gives better opportunities to the owners to await the chances of sale of their property, or of recuperating their finances. From the state point of view, however—which is very similar to that taken by a private owner of mineral lands when he lets portions of his ground for mining purposes—the most essential consideration is to have the ground worked, and if not worked by the first holder, to be thrown open as soon as possible for anyone else desirous of coming in to work it. The terms given by the Australasian states to their mining lessees compares very favorably indeed with those commonly granted in the United Kingdom by land-owners to the mining companies and others who take mines on lease, as regards continuity and scale of working. The administration of the law is also usually much less harsh than is permitted by the letter of the statutes, the governments taking powers to act in these which they need not necessarily enforce to the utmost unless the circumstances seem to require their full exercise. In this, also, they follow the example of most private land-owners, who require discretion to be left with them as to how much more or less strictly they may enforce the conditions of their mining leases, and the less personal and more public-spirited views taken by members of a government as compared with private land-holders may be relied upon to effect greater consideration for the mineral lessees.

Preference for a freehold or leasehold tenure of mining lands depends greatly on the nature of the interests of the parties concerned, and in considering the principle most expedient for a state to adopt, regard must be had to the predominance of interests. If the matter of greatest moment is to attract the capital of investors to the development of the state's mineral resources, it may be politic to meet their views upon security of tenure and allow them to acquire the freeholds which they so much desire, with complete control of their future development entirely at their own will. This is the bargain which appears to appeal most strongly to capitalists, and to secure their support a state may think it best to offer them a proposition to their liking. If, however, the state prefers to keep the control of its mineral lands in its own hands, to prevent their being locked up for years for speculative purposes, and to offer facilities for the location and working of mines by parties of its citizens who may have little or no capital but their labor, the leasehold system seems entirely preferable. It is to be remembered that in framing legislation the state has decision of its policy altogether in its own control, and has a right to settle it in what it considers to be its own best interests, and at one stage of its development it may well find it most expedient to offer its mines on freehold terms, and at another to change more or less entirely to a leasehold system. Where the immediate support of capital is not of prime importance, the leasehold system appears to me to be usually more in the best interests of the state than the freehold one, and in making its laws it is surely for the

state to consider its own interests first, to the subordination of all others. The mining laws express the terms on which the state offers its mineral lands for exploitation, and should be drawn up to conserve the interests of the state first and foremost, studying those of outsiders only from the point of view of benefits to accrue to the state. The mining investor who clamors for all sorts of concessions from the state in return for putting his money into its mines rarely appears to consider that the state has any rights, and looks at the proposition entirely from his own point of view, and is apt to agitate for legislation on lines designed entirely to further the investor's interests without any regard to those of the state. This is natural enough, but what would one think of a statesman who in advocating outside interests should forget their duty to their own state?

In discussing the lines on which mining legislation should proceed, therefore, the members of the Mining and Metallurgical Society should remember to hold the balance clearly between the somewhat opposing interests of the buyer (the mining investor) and the seller (the state) of the mineral lands, and take a wide view of the question, looking at what is best for the development of the mineral industry as a whole, with due consideration of the points of view of both parties. There must be more or less of a compromise, to encourage the investor to the utmost to open up mines by giving him good security of tenure and all reasonable latitude in development and working, while at the same time conserving the state's interests by preventing mineral lands from being locked up and monopolized without being worked. It may be prejudice owing to being accustomed to the leasehold system, but it appears to me that leasehold tenure offers a better basis of negotiation in this respect than can be obtained from any freehold system. Australian experience of mining freeholds has been anything but encouraging.

The above remarks cover a good deal of your questions No. 1, 2, and 3. As regards initiation of mining rights, the Australian practice is based on priority of right to be allotted, mineral lands being given to the discoverer of valuable minerals, and the 'miner's right' system gives him a large measure of security in at once taking possession of the ground. Priority of pegging out ground and applying for lease thereof is also fully recognized in issuing leasehold titles, and a discoverer usually protects himself by applying for a lease as soon as possible after making a valuable discovery. The system of prospecting licenses in vogue in Western Australia allows time to a prospector to test a piece of ground before taking it up on lease, and has proved very useful. It is not customary here to insist that minerals shall have been actually found on ground applied for before a lease is issued, and it very commonly happens that 'position blocks' are taken up all around a new discovery in the hope that subsequent prospecting may find something on them. The obligation to work these blocks under pain of forfeiture leads to their being pretty closely searched for minerals, and if an owner is lax in this respect, he knows that others may apply for the ground over his head, on the ground of his insufficient working, and get it away from him. There has often been a question raised if it would not be better to require some actual discovery to be made before a lease is issued, but the present system works very well, and enables people to secure a piece of land for their own uninterrupted prospecting, which is more generally satisfactory than if no one had a title to the land until an actual discovery was made.

The question of terms of renewal of mining leases is one on which there is much difference of opinion in Australasia, but as a matter of practice there have been few instances of the terms for renewal of leases for a second or third term being made very seriously different from those of the first term. The good sense of governments comes in here, and their impersonal interest in the matter, to ensure that renewals are dealt with on broad and general principles and not on any rack-renting policy which might commend itself to a private owner of land in a like position. Most of the state governments reserve the right to impose increased rental and sometimes royalty in the event of granting a renewed term of lease, but I am not aware of any instance of its being exercised to any extortionate extent.

Most of the Australasian states grant much larger leases of land for coal and other minerals which are of low value per ton, and are worked out rapidly over large areas, than for metallic minerals, and generally mineral leases for tin, lead, bismuth, and other base metals are of larger areas than are allowed for gold. It is difficult to see any very sound reason for differentiating in the areas allowed on, say, gold and tin lodes, as the nature of the workings is quite similar and also the rate of exploitation. Ton for ton, both sorts of ore are of much the same net value, and it is immaterial to the owner who gets a profit of a dollar a ton whether it comes from gold or tin. The difference in areas leased appears to be merely a concession to popular ideas that gold mines are naturally more profitable than those of base metals, which of course is entirely a misconception. The principle which should govern the extent of ground to be granted seems rather to be rate of exploitation than value of mineral, the area to be granted being such as—taking into account the mode of occurrence of the ore—will allow the leaseholder ample time to work his mine long enough to make it well worth his while to undertake the proposition and ensure redemption of his capital expenditure before the mine is worked out.

The extralateral right principle obtaining in portions of the United States is a standing marvel to the rest of the world, and that it could be seriously proposed to perpetuate it outside of cases in which it has unfortunately already been granted, seems incredible to most outside engineers with whom I have come in contact. If all ore deposits could be relied upon to behave themselves in accordance with elementary diagrams in the text-books representing a few of the simpler occurrences of fissure veins, there might be some hope of maintaining the extralateral right system on consistent and logical grounds, but since their forms are in fact protean and never predictable with any real certainty, and since even the best authorities differ, often radically, in their views as to the nature and origin of the ore occurrences, there seems no hope of attaining such precise legal definitions as will serve to justly decide all cases of extralateral right. The claim of the discoverer to follow out his discovery in all its ramifications has a certain amount of apparent justice, but is practically impossible to be granted in very many cases without infringing upon the equal rights of others. If the first man to obtain petroleum by boring, for example, were to have the right to all petroleum that would come to his wells, thus exercising the right of the discoverer to its utmost, he should be protected from the boring operations of neighbors, whose bores may and probably will tap oil that otherwise would flow to the discoverer's well. What a lovely problem for courts to decide, on the evidence of 'expert' witnesses, whether bore A would have got the oil obtained from a neighbor's bore B if the latter had not been made! Again, in coal-seams or any bedded deposits, should a discoverer have an extralateral right to follow his discovery beyond the limits of his location? If so, he should monopolize the whole seam, but if he is not given this right, why should it be given in the case of a lode? Some limit has to be placed on the rights of the discoverer, and it is surely best to follow the same principles as obtain in all other occupancy of land and confine his operations within the boundaries of the land he has located.

BISMUTH-BEARING ORE, so far as known to the U. S. Geological Survey, was produced in this country during 1911 in La Plata county, Colorado. Ore mined here contains 6 to 8% bismuth. This ore, however, was sold for its gold and silver content. Another lot of still richer ore was mined from a claim about 35 miles southwest of Tularosa, New Mexico.

Genesis of the Lead-Silver Ores of Wardner District, Idaho

By F. L. Ransome

Under the above title, Oscar H. Hershey has recently contributed to the *Mining and Scientific Press*[1] a valuable and interesting paper in which he presents briefly some results of a detailed study that extended over a period of nearly two years and occupied his time fully for over 18 months. Thorough discussion of the points wherein Mr. Hershey differs from the conclusions previously reached by Ransome and Calkins[2] would be possible only after some re-examination of the field by these geologists with particular reference to the issues raised. This is not immediately practicable, but those interested in the district and in the articles mentioned may reasonably expect some present comment from one of the geologists who wrote what Mr. Hershey kindly refers to as "the standard work of reference in the district." In attempting to meet this expectation, I have no intention of adverting to every point brought up by Mr. Hershey, nor of continuing the discussion beyond this brief communication.

The Wardner district, it should be noted, in introduction, comprises but a small portion, perhaps not more than one-tenth, of the area to which F. C. Calkins was able to devote about six months, and I about three months, in field study a few years ago as a basis for our report on the Coeur d'Alene district.

This report supplied Mr. Hershey with a broad foundation of ascertained geologic facts upon which to build, so that with the advantages of extensive mining development since the Federal geologists left the field, and of the exceptional facilities afforded him by the Bunker Hill & Sullivan Mining & Concentrating Co., it would be strange if so capable a geologist found nothing to contribute to our knowledge of the ore deposits. When, however, Mr. Hershey states that "previous to this [that is, his own work] no detailed geological study of the mines had been made, although the areal geology of most of the district had been mapped in 1903 or 1904 by F. C. Calkins * * * and the mines *visited*[3] by F. L. Ransome", and that "Mr. Calkins found that the structure in the Wardner district is too complex and obscure to enable him to do any but very generalized mapping in the time that he could give to the work", those who first gave a comprehensive account of the geology and ore deposits of the district may perhaps be pardoned for taking exception to the probably unintentional disparagement of their work conveyed by his form of expression. The opportunities enjoyed by Mr. Hershey for prolonged study of a single group of orebodies were exceptional, and his work was so different from anything that is practicable in the general geologic study of a region where perhaps a fortnight is all that can be spared for examining a single large mine and grasping its essential characteristics, as scarcely to afford a fair basis from which to impugn more rapid work as necessarily lacking in detail or essential accuracy. If, in addition to unraveling the general stratigraphy and structure of the district, the Government geologists had studied the whole field with the same leisurely attention that Mr. Hershey has focused upon a small part of it, their examinations of the mines might not have been dismissed by him as mere "visits"; but their field work would have lasted from ten to twenty years, and the results, such as they are, would not have been available as a starting point for his own investigation. The atmosphere having been cleared of cloud by this preliminary protest, attention may now be given to more important matters.

In his discussion of the geology of the Wardner district, Mr. Hershey has locally subdivided the Revett quartzite as originally defined by Calkins into three members, and the Burke formation into two members. He has also added to the bottom of the stratigraphic column the Cataldo formation, a quartzite exposed west of the Coeur d'Alene district and interpreted by him (whether correctly or not, I am unable at present to say) as underlying the Prichard, whose base is not exposed at the surface in the area studied by Ransome and Calkins. In addition to a few great faults mapped and described by those authors in the Wardner area, Mr. Hershey has platted and named over 90 faults which he divides into nine systems "each representing a distinct period and stress." The small outline map accompanying his paper is not adequate for a full discussion of Mr. Hershey's treatment of the faulting. It is possible that all of the 97 faults exist as they are platted and that each is definitely referable to the appropriate one of the nine systems. Knowing something of the soil-mantled and brush-covered slopes in that region, however, I can only wonder how Mr. Hershey did it, and hope that some time we may have an opportunity to review the ground together. Of course, many of the faults were discovered and mapped by him in the mines, but this scarcely detracts from the remarkable character of the network of fissures shown on his map.

Mr. Hershey distinguishes no less than 12 distinct and successive periods of "mineralization." The oldest type of mineralization is that represented by disseminated siderite. Mr. Hershey's "impression" is that this dissemination of ferrous carbonate antedated the monzonite intrusions and the mineral may have been deposited with the sediments, possibly in the Prichard formation. Next in order of age are deposits of contact metamorphic character, not well represented in the Wardner district. Then follow ten types of mineralization of which the first eight are each connected with one of the first eight systems of faults, while the last two are connected with the ninth system. Mr. Hershey's conclusions are briefly summarized in his own words as follows:

"I favor the theory that the lead, silver, and zinc minerals of the Wardner district were originally disseminated through certain bands of the Belt sediments; were first concentrated into the visible disseminated zinc and lead deposits through the action of the heat and probably water emanating from a monzonite magma; and were then concentrated into commercial orebodies by hot waters that were forced to ascend by the compressive stresses that produced the thrust faults, these thrusts opening the fissures in connection with which the ores have been deposited. The ores of each successive stage have probably been derived in part from those of earlier ore-forming stages, in part from the visible disseminated deposits, and in part from the original minute disseminations in the sediments."

My own view of the genesis of the Coeur d'Alene ores, as presented in Professional Paper No. 62, is, very briefly, that the fissuring of the district was due to stresses set up during the intrusion and solidification of the great quartz monzonite batholith of central Idaho, of which the exposed monzonitic masses in the Coeur d'Alene district are probably offshoots, and that the ore constituents, inclusive of the siderite but probably exclusive of some of the quartz, were given off as emanations from the deep-seated portions of the slowly crystallizing batholith. Among the facts adduced in support of these conclusions was the mineralogical connection, through deposits of intermediate character, of the orebodies of the Wardner type with others in the same region that are genetically connected with contact metamorphic action.

It will be seen that Mr. Hershey agrees that the ore-

[1]June 1, 1912, pp. 750-753; June 8, 1912, pp. 786-790; and July 15, 1912, pp. 825-827.

[2]'Geology and Ore Deposits of the Coeur d'Alene District, Idaho.' U. S. Geol. Surv., Prof. Paper No. 62, 1908.

[3]Italics by F. L. Ransome.

bearing solutions were hot, were under heavy pressure, and came from below. He agrees further that some of the older mineralizations—namely, the lead-zinc disseminations—were formed by water expelled from the monzonite, although he thinks the lead and zinc may have been leached from the sediments. But having, as he believes, established twelve periods of mineralization, ten of them connected with nine systems of faults of different ages, he maintains that the process of ore deposition must have extended over too long a time to be all referable to a cooling batholith.

His conception is that at each period of reverse faulting the stresses that produced the faulting heated the water that he supposes to be present in the rocks at great depth and forced it upward, and that this water, after dissolving the disseminated ore constituents from the rocks traversed, or after attacking ore deposits that had been previously formed, deposited its burden in a higher part of the fissure as a body of commercial ore. In connection with this view he explains a supposed association of ore deposits with reverse faults by the suggestion that "normal faulting makes stronger gouges than reverse faulting, and gouges were distinctly inimical to the deposition of mineral." The first part of the suggestion is questionable; the second part paraphrases a conclusion expressed in Professional Paper No. 62.

Mr. Hershey's hypothesis is both novel and ingenious, but while it would be unfair to expect him to marshal all of his significant facts in a short paper, nevertheless his presentation, in view of the work previously done in the district, appears deficient in evidence. For example, his "impression" is that the disseminated siderite antedated the monzonite intrusion, but he gives no real evidence for this view, and on the same page states that the siderite "in its present form" is younger than the metamorphism. An impression unsupported by definite evidence is certainly not a very formidable missile to hurl at a conclusion previously intrenched in the field. He believes that the materials for the orebodies as they were successively formed were leached from older deposits, but I have been unable to find in his paper any facts, mineralogical or otherwise, in support of this belief, or any clear evidence that the disseminated ores are not all younger than the monzonite. Above all, a geologist who has studied the region without seeing these things, may be pardoned some curiosity to know how Mr. Hershey establishes so definitely that the nine systems of faults are of different ages and that each system has associated with it a distinct type of mineralization. One such geologist, at least, awaits more evidence before accepting as a fact so remarkable a sequence of faulting and ore deposition—a sequence so elaborate that, if true, any worker of experience must know that it could be recognized and established only under ideal conditions of observation. Mr. Hershey, I think, fails to appreciate in their full significance the gradations in character worked out in Professional Paper 62 between the garnetiferous deposits near the monzonite and deposits of the Wardner type, or the widespread development of tourmaline in the Coeur d'Alene sedimentary rocks. Moreover, even if it be granted that there has been successive faulting followed in each case by ore deposition, the advancement of this alleged fact as an argument against a genetic relationship between the solidifying of a batholith and the formation of the orebodies carries with it the implication of a quicker cooling and solidification on the part of a deeply buried batholith, particularly the deeper portions of such batholith, than most geologists perhaps will admit. At all events, too little is known of the depth and rate of cooling of such a mass to lend much force to the contention that manifold faulting and ore deposition could not have taken place concurrently with cooling, which possibly is still in progress. This view appears to encounter fewer difficulties than does Mr. Hershey's suggestion of deep-seated supplies of water, squeezed out by fault-movements and acting as an energetic solvent and carrier of ore constituents.

In conclusion, while admitting that the questions relating to ore genesis are too obscure for geologists to reach unanimity upon them within our generation, and while welcoming Mr. Hershey's suggestions as worthy of consideration and investigation, I do not feel that he has brought out such evidence in their favor as to justify their general acceptance, or to necessitate any essential change in the hypothesis of ore genesis given in Professional Paper No. 62.

Gold and Diamonds in British Guiana*

Historical.—It is not definitely known when gold was first discovered in British Guiana, but the first expedition in search of it was made in 1720 up the Berbice river. In 1863 the first well organized attempt was carried out by a company up the Cuyuni river, and gold-bearing quartz was then discovered at Wariri, on the right bank of that river, about 25 miles from the mouth. The project, was, however, abandoned, owing to the district being in dispute between British Guiana and Venezuela. Eventually, in the eighties, attention was again directed to the auriferous possibilities of the colony, and after several expeditions up the Essequibo, Mazaruni, and Cuyuni, the gold industry became established in 1886, and the first set of mining regulations was passed in that year. From that date the industry developed rapidly, and the gold production rose steadily in each year, until it reached the highest record in 1893-94 with 138,528 oz. In recent years the production of gold has averaged about 82,000 oz., but the production is still falling.

Distribution of Gold.—The gold-bearing areas are widely distributed throughout the colony. Gold has been found in all the rivers, with the exception of the Corentyne and the Berbice, but traces have been found in the latter. The districts of the colony where mining has been carried on are those adjoining the Essequibo river and its tributaries, the Potaro and the Konawaruk; the Mazuruni and its tributary the Puruni; the Cuyuni, the Barima, Barama, and Waini rivers in the northwest; and the upper Demerara; and a new field has been discovered on the Wenamu, a branch of the Cuyuni, and part of the boundary line between the Colony and Venezuela. The gold from the Wenamu is very coarse, the overburden lying on the gravel being very shallow, and the 'pay-dirt' deep and rich. The government geologist, who has made a reconnaissance of the gold-bearing areas of the colony, states that "the gold is found widely diffused in the districts occupied by the Archean rocks, but usually only in profitable quantities near intrusions of basic rocks. The basic rocks belong to at least two periods: (1) those of the gneiss formation, probably originally gabbro and diabase, but now quartz-diorite, apodiorite, amphibolite, or hornblende schist; and (2) the unaltered diabase which is of later origin than the sandstone formation." All the fields have proved of good value, and rich finds have been made in each; perhaps the most valuable field for its size being at Omai on the left bank of the Essequibo river, from which place over 95,000 oz. has been obtained, from an area of about 60 acres.

Production of Gold.—The following is the amount of gold recorded at the Department of Lands and Mines since 1884:

	Oz.
From 1884 to 1905	1,756,630
1905-06	94,363
1906-07	85,505
1907-08	67,209
1908-09	73,655
1909-10	64,830
Total	2,142,192

*Prepared by the Committee on Permanent Exhibitions.

The total value of the above amount is £7,810,075. Fine gold occurs in places, but as a rule the gold saved in this colony is coarse. The largest nuggets are one of 333 oz., from the Five Stars district, on the upper Barima river, and one of 11½ oz., from the Tiger creek, Potaro.

Methods of Working.—The major portion of the gold obtained has been from alluvial washing. Auriferous quartz has been discovered and worked successfully at the Peter's mine, in the Puruni river, at the Aremu mine, in the Cuyuni and at the Barima mine, near Arakaka in the Barima. The Peter's mine started crushing operations in September 1905, and up to March 31, 1910, obtained 39,017 oz. of gold. Dredging is also being successfully carried on in the Konawaruk river. Four dredges are now at work in this river, and from the commencement of operations in December 1906 the company has obtained 11,496 oz. of gold. Another company is also successfully working a dredge on Minnehaha creek, a tributary of the upper Konawaruk. Hydraulicking was carried on for three years at Omai, during which time 27,123 oz. of gold was obtained. Similar work is now being carried on at the Tassawini mine, in Barima river.

Diamonds.—Diamond mining was first started on the upper Mazaruni at Patareng creek, and is still being carried on in that district. Diamonds have also been discovered in the country around the Kuribrong and Cuyuni rivers. The stones are found over a fairly large area in the Mazaruni, and are obtained by washing the gravel in which they lie in a similar manner as is carried on for gold, which is often found with diamonds. The following is the production of diamonds for the last 5 years in carats: 1905-06, 4097 5/16; 1906-07, 4661⅜; 1907-08, 2121 11/16; 1908-1909, 5617⅝; 1909-10, 7180 13/16. The stones are of good quality, and run on an average from 10 to 15 to the carat, though some large stones have been found, two quite recently, weighing 12½ and 12¼ carats, respectively.

Mining Regulations.—The mining regulations of British Guiana are simple and generous. A prospecting license available for one year from issue can be obtained for $5 (20s. 10d.), and this permits the holder to roam the colony, and to locate any number of claims, of a size not exceeding 1500 by 800 ft. (27½ acres), for gold, and of an area not exceeding 500 acres for diamonds. On each gold claim a rental of $5 per annum must be paid, and on each diamond claim 20c. (10d.) per acre. These rentals are due on the first of April of each year. All claims, the rentals for which are not paid by the Tuesday following the third Saturday in June, are sold at auction on that day, and if not sold are revoked and the land again becomes open to location. 'Exclusive Permissions', or really 'Exploration Permissions', can be obtained for 3 years in the payment of $10 (£2 1s. 8d.) filing fee, and an annual rental of 7½c. per acre, giving the holder the sole right to prospect over large areas of country. These are of great value to the prospector in a new and untried district. As soon as he discovers that the district in which he is prospecting carries gold in profitable quantities, he can take out one of these permissions and so give himself ample time to carefully prospect and locate all the claims he requires, before being crowded out by the rush that always follows a successful find. After locating the claims he desires, the holder of the permission can surrender it, retaining of course such portions as he has located, and for which he then obtains a claim license. Mining concessions or leases for 99 years or under, can be obtained for any area on payment of $10 with application, and an annual rental of 20c. (10d.) per acre. These concessions are suitable in cases where the work to be carried on is of a permanent nature and necessitates the expenditure of large capital, as they are not open to automatic revocation for non-payment of rental in the way an ordinary claim license is, every June. Dredging concessions for the rivers and creeks can also be obtained on similar terms; in this case, however, the rental is only 10c. (5d.) per acre per annum.

Royalties.—The royalty on gold is 70c. (2s. 11d.) per ounce and 4c. (2d.) per ounce on silver, but all gold and silver obtained by milling pays a tax on profits of 5% in lieu of royalty. Diamonds found in prospecting pay a royalty of 10% of their value, but when obtained from a claim a fee of $25 (£5 4s. 2d.) per quarter acre is charged for all land worked, and no royalty is payable in that case. All gold, silver, and diamonds must be reported on arrival in Georgetown at the Department of Lands and Mines.

Administration.—The colony is divided into mining districts, each under the control of an officer of the Department of Lands and Mines styled Warden or Sub-Warden, who has power to settle all disputes as to claims, and who is continually traversing the district, and whose help and assistance in carrying out the regulations is therefore easily obtained.

Transport.—The colony being so intersected by rivers, the general means of transport is by water, and the facilities are good. There is steamer communication from Georgetown to all the centres of the districts, from where boats and crews can easily be obtained to cover the remainder of the journey at a reasonable cost.

Labor.—The men generally employed in the gold and diamond industries are negroes, natives of the colony, and from the West India Islands, and a few from Dutch and French Guiana. They are strong and capable of great endurance, and are well fitted for the work. All laborers, with the exception of aboriginal Indians, must be registered by the Institute of Mines and Forests, whose head office is in Georgetown, with branches in all districts. They are generally engaged to serve for a period of three or four months, and the daily wage paid ranges from 36c. (1s. 6d.) to 72c. (3s.) for ordinary unskilled men. The mining regulations require that all laborers must be supplied with rations according to a scale fixed by the Government. The shops which exist in all districts will arrange to supply the men these rations at from 20c. (10d.) to 30c. (1s. 3d.) per man per day, according to the district. Qualified dispensers are required to be kept on all claims where 50 men or over are employed, and certain medicines for their use must also be kept on the claim. Failure to pay laborers their wages within 14 days after they are due renders an employer liable to a fine of $50 (£10 8s. 4d.) or imprisonment, and any laborer who fails to complete his contract is liable to a fine of $48 (£10) or imprisonment.

BARYTES, in the form of crude ore, was produced in the United States in 1911 to the amount of 38,445 short tons, valued at $122,792, according to the U. S. Geological Survey. Compared with the production of the preceding year, this was a decrease of 4530 tons in quantity, but an increase of $1046 in value. The total quantity of refined barytes reported as sold by mills in 1911 was 39,611 short tons, valued at $503,867. The greater part of the barytes produced in the United States is used as a pigment in the manufacture of mixed paints. It is also in the manufacture of lithopone, a white pigment. Other uses for the mineral are in the manufacture of rubber, wall paper, asbestos cement, and poker chips, and in tanning leather. A use of barytes reported from Italy is in the manufacture of gorgonzola cheese. The cheese receives a covering in the form of a thick heavy crust of the finely-ground material which has the property of affording just sufficient protection from aeration.

SULPHUR deposits in Wyoming are found in the upper portion of Sunlight basin, about 32 miles in a direct line northwest of Cody and 14 miles east of the eastern boundary of the Yellowstone National Park, according to a report (Bull. 530-O) issued by the U. S. Geological Survey. The deposits occur in seven isolated groups, six of which lie in a belt about three and one-half miles long. No sulphur has been produced from these deposits, and it is extremely improbable that they will be sources of production until the transportation facilities of the region are greatly improved.

Geology of the Miami Copper Mine

By M. H. Loveman

The mine of the Miami Copper Co., situated about six miles west of Globe, Arizona, lies within the area treated by F. L. Ransome in the Globe Folio of the U. S. Geological Survey. At the time that report was written, however, the extent and commercial value of the low-grade copper deposits around Miami were unknown, and the geology of that special section was touched upon only as it applied to several mines working higher-grade oxidized ores.

The ground owned by the Miami Copper Co. includes quite a variety of rock types, first in importance being the Pinal schist of the pre-Cambrian age, the principal, and in fact with one exception, the only rock carrying sulphide ores of a commercial grade. The schist is largely sedimentary in origin changed to its present form by extensive regional metamorphism accompanied by the introduction of a large amount of silica. In many places the severe crushing and recementing by silica gives it the appearance of a quartz breccia. In its normal form it is a muscovite schist, the muscovite being largely sericite. Intricately intermingled with the more common muscovite schist are considerable amounts of a biotite schist, probably, in part at least, formed from basic intrusions. The ore-bearing schist has been generally silicified to an extreme degree. On the surface it is of a pronounced red color, due to the oxidizing of the iron formerly present as pyrite. This gossan covering the Miami ore zone can be picked out from mountain summits many miles distant.

Next in importance is the Pinal schist in the Schultz granite, and its closely related offspring, a granite porphyry. The Schultz granite is intruded into the Pinal schist, and fragments of the latter included within the granite are common. That the granite is younger than the schist and older than the dacite of the region is the most that can be definitely said concerning its age. It is white in color, and its essential mineral is orthoclase, with some plagioclase, quartz, and biotite. Bordering the granite and radiating off from it are numerous dikes of granite porphyry. One such dike cuts east and west through the orebody and carries ore of the same grade and character as the enclosing schist. This is the single exception mentioned above to the exclusive occurrence of the ore in schist. This ore-bearing dike is from 25 to 60 ft. wide, dips south at about 60°, and runs entirely through the orebody. It is present at the greatest depth in the mine that has been so far developed. In the underground workings the true granite and schist are in no place in actual contact, but are always separated by from 30 to 75 ft. of what is either a granite porphyry or an altered granite. The fact that this zone is separated from the granite proper by a distinct fault plane, and that the change from one type to the other is generally sharp, would seem to indicate that it is a porphyry and not simply an altered phase of the granite. It is, however, undoubtedly derived from the same magma. This marginal zone sometimes carries copper to the amount of over 2%, but almost invariably in a highly oxidized form, and therefore not to be classed as ore. The granite proper in the vicinity of the orebody carries copper to the extent of about 0.7%, largely as cupriferous pyrite and chalcopyrite.

Dacite is present along the western and northwestern edges of the property, but is not found in the underground workings and appears to have no relation to the ore. Occurrences in other places have proved it to be younger than the ore. It is a biotite dacite occurring as flows, intruded sheets, and tuffs. The eastern portion of the property is overlain by the Gila conglomerate, a formation formed by the erosion of all the other rocks present in the district, but near the mine consisting largely of boulders and sand derived from the schist and the granite. The conglomerate and the schist are separated by a fault, and, if amount of gouge, strong slickensiding, and excessive rounding of rock fragments are any criteria, the fault is one of considerable magnitude. As the dacite is younger than the ore, and the conglomerate in turn younger than the dacite, the faulting between the conglomerate and the schist evidently took place after the formation of the ore. The rather angular character of the fragments of schist in the conglomerate and the absence of sorting indicate very little movement by water. Numerous small dikes of diabase are encountered, generally copper stained.

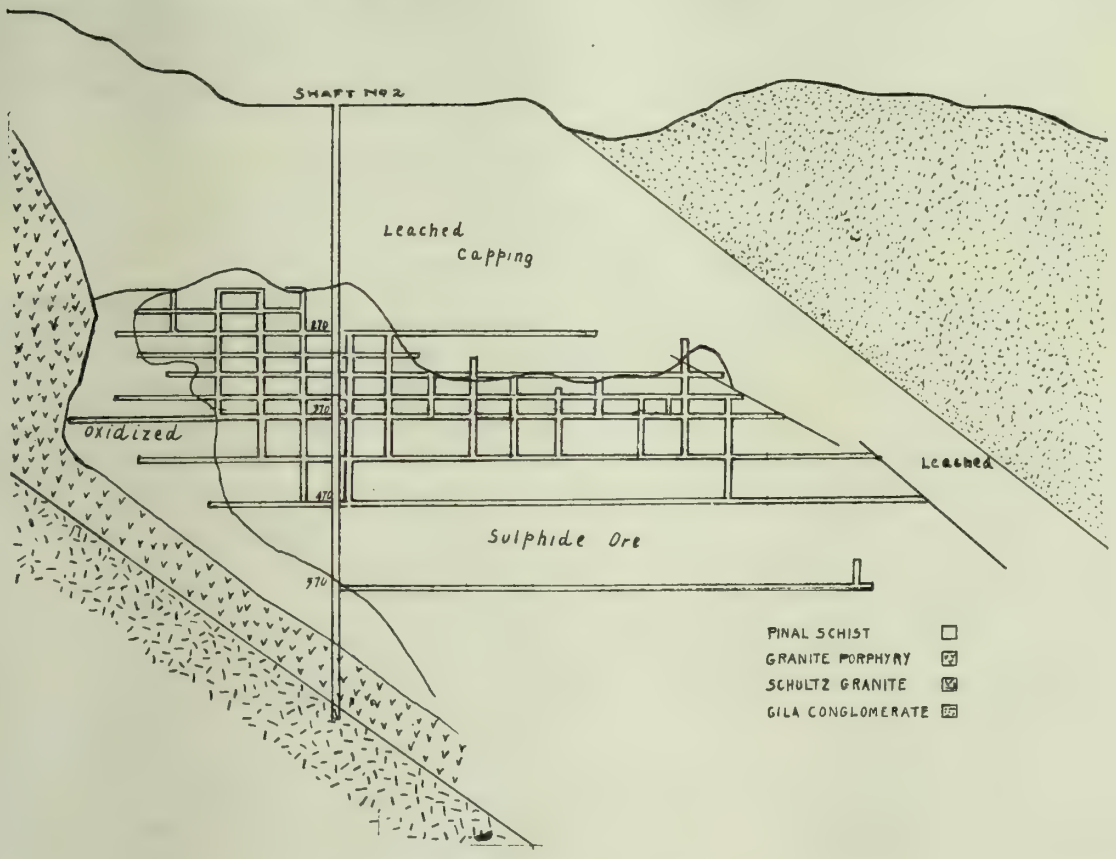
In its general character the Miami resembles the other low-grade disseminated copper deposits of the West. In going downward from the surface the normal succession zones are passed through. First the leached zone or capping, varying in thickness from nothing to about 400 ft. From this zone the copper has all been leached, leaving a highly altered silicious iron-stained schist. Next is the oxidized zone, containing carbonates and silicates of copper, some oxides and native copper, and considerable oxidized iron. This zone is variable in thickness, in some cases coming to the surface, in others being simply a thin layer above the sulphide zone, or, as is the case over a large portion of the orebody, being entirely absent. Bodies of oxidized ore have been found in the sulphide zone. This condition is probably in the majority of cases accounted for by faulting. The secondarily enriched sulphide zone lies below the oxidized zone and contains all the commercial ore of the mine. It varies from 200 to 400 ft. in thickness in the west and central portions, and the lower limits are as yet undetermined in the eastern part, where it seems likely that the thickness is somewhat greater. With greater depth it is probable that the amount of pyrite will increase and chalcocite decrease, marking the approach to the zone of original sulphides. This zone has never been reached in the Miami mine, as the one shaft which passes out of ore does so by reason of its entering granite rather than through its passing into original sulphides.

The shape of the orebody is extremely irregular. Its greatest east and west extent is roughly equal to its greatest north and south extent, but no two lines can be drawn at right angles representing these conditions, as the greatest western prolongation is in the northwest, the greatest eastern in about a central position, the greatest northern in the northwest, and the greatest southern slightly to the east of a central line. The upper limits of the orebody are also extremely irregular, rising and falling with apparently no definite system, although sometimes explainable by faulting. There is no discernible relation between the upper limits of the sulphide zone and the present contour of the surface. The lower limits, as before stated, have not been definitely determined. The irregular shape of the orebody is inevitable in a mine where in a number of directions the boundary is purely a commercial one, although in some places the ore either becomes low grade or is badly oxidized before reaching the actual limits. The Schultz granite marks the western edge; it strikes about 12° west of north (all directions are in mine coordinates) and dips about 38° east. This eastern dip causes the shaft in the orebody to pass through the schist into granite and gives the whole orebody a corresponding dip to the east. The southern boundary is V-shaped, formed by the granite contact just mentioned and by the contact between the schist and the conglomerate. This latter contact, which is marked by a large fault, strikes N. 43° E. and dips about 45° to the southeast. The fault plane is remarkably straight along both its strike and dip. In some places the ore persists to the actual contact, in others it is separated by a leached and crushed zone of as much as 80 ft. The eastern limits are also V-shaped, formed by the conglomerate contact and by a large fault striking N. 30° W. and dipping about 58° to the northeast. This fault above the 420-ft. level cuts the ore off clean; on the 420-ft. level and below, it appears to have had no

effect, and the ore limits are undetermined.

The mine is literally cut to pieces by faulting. The faults vary from those of apparently considerable magnitude to those of microscopic dimensions. Owing to an absence of recognizable horizons, the amount and even direction of the throw is generally undeterminable. In the minority of cases, however, the faults are undoubtedly of the normal or gravity type. A few instances of reverse faulting have been noticed, but these are of only a foot or two thrust. Faults can be observed with practically every possible strike and dip, but the majority can be grouped into two divisions, those striking northwest and dipping northeast, and those striking northeast and dipping southeast. The northeast-striking faults appear to be in most cases the older. Although the faults and dips are countless, only a comparatively few have any important effect upon the ore. With the exception of those described as limiting the orebody, only one other fault cuts off the ore for any considerable extent. This is a large one, cutting roughly through the centre of the mine, striking northwest and dipping northeast. The action of the fault through the ore is extremely irregular, in some places along its strike and dip it cuts the ore off sharply, while in others it has no effect whatever; the transition from one state to the other being often abrupt. These sudden changes are undoubtedly due to cross-faulting. In depth this fault, while still present, no longer affects the ore. A gradual dying out in depth is common to almost all the faults. The gouge and crushed matter becomes less pronounced and harder; this may be due to a decrease in the amount of water circulating along the fault-plane rather than to an actual diminishment in intensity of the fault itself. A good many of the faults do, however, affect the ore in a less marked degree. Along the larger ones there is generally a zone of a few feet on both sides of the fault-plane of oxidized ore, due to the freer passage of water along the crushed zone.

Copper, iron, and small amounts of gold, silver, molybdenum, and titanium are present in the orebody. Copper occurs in combination with sulphur as chalcopyrite, chalcocite, and as a cupriferous pyrite, the copper content being too low in the last case for chalcopyrite. In its oxidized forms the copper is present as the carbonates, malachite and azurite, the latter in very small amounts; as the silicate, chysocolla; as the oxides, cuprite, the latter often intimately mixed with iron oxides, and tenorite; although it has never been definitely recognized in this last form. The sulphate, chalcanthite, has been found as fibrous incrustations on exposed surfaces where it has formed since the opening of the mine. Native copper is present along the margins of the sulphide body, occurring as films and in dendritic form. The iron minerals present are pyrite, hematite, and limonite. Chalcocite is the form in which the commercial ore is found, although small amounts of the oxidized forms are of necessity mined and are partly recovered in the mill. The chalcocite occurs as fine grains disseminated through the schist, as thin plates along minute fractures, as a film on the surface of grains of pyrite and in more advanced stages in the replacement of the pyrite, and occasionally as small vein fillings.



CROSS-SECTION OF THE MIAMI OREBODY.

The origin of the ore in its present form in the schist is undoubtedly due to the oxidation by surface waters of copper-bearing pyrite and chalcopyrite present in the schist, and a concentration by the same agency at a later time in the present enriched zone, partly by replacement of pyrite by chalcocite, and partly by deposition in crevices and along seams. The original source of the ore cannot be stated with any claim to certainty. Contemporaneous deposition of the copper-bearing minerals and the schist cannot be possible, as the bordering granite, a younger rock, carries the copper minerals in what is probably their original form. The same objection can be brought against the granite porphyry as a source of the copper, as, if that rock is distinct from the granite, it is certainly younger. The diabase present shows no evidence of having been the source of the ore. There are only two reasonable sources: the granite or mineralized solutions arising from an unknown source in depth. The granite carrying copper in proximity to the orebody is itself shattered, and it is along the seams caused by this shattering that the bulk of the pyrite and chalcopyrite occurs. Massive uncrushed blocks of granite are practically free from sulphides. This

would appear to indicate that the sulphides in the granite have been introduced since the cooling of the rock itself, and after several regional movements had shattered the already consolidated granite. Copper-bearing and iron-bearing waters arising from depth along the contact between the schist and granite and impregnating both rocks would appear, therefore, to be the most reasonable hypothetical source for the original sulphides. The schist, because of greater brittleness with consequent greater shattering, afforded more favorable ground for the circulation of surface waters, and the oxidizing and concentrating processes resulted from this water circulation.

Two New Treatment Plants in Western Australia

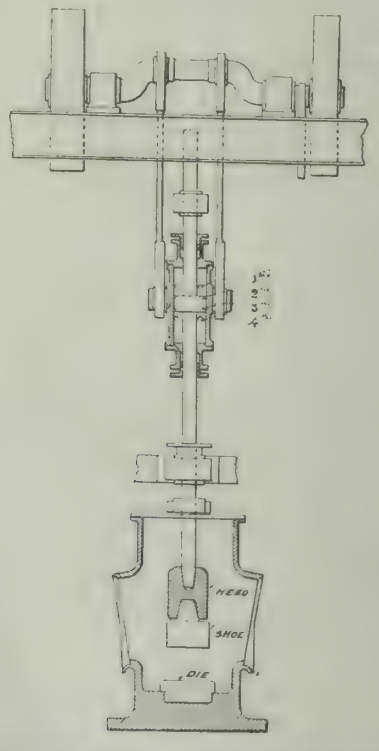
By M. W. von Bernewitz

The Mountain Queen mine near Southern Cross, and the Yuanmi mine in the East Murchison, recently started the treatment of ores in rather interesting plants, and through the courtesy of J. A. Agnew, of Bewick, Moreing & Co., I am able to give a sketch of the methods of treatment.

The published yields from these two mines for April were as follows:

	Mountain Queen.	Yuanmi.
Tonnage	3,735	4,280
Yield	$17,200.00	$43,700.00
Profit	$5,600.00	$20,400.00
Mining cost	$1.20	
Milling cost	$1.06	$4.32
General cost	$0.40	

The Mountain Queen has a set of double No. 1 Holman pneumatic stamps crushing the ore through 10 by 10-in.



PATENT PNEUMATIC OR AIR-CUSHION ORE-STAMP.

wire screens. These are the first pneumatic stamps at work in Western Australia, and I believe in Australia, though they are common in Cornwall, where they show a marked improvement in costs over the ordinary stamp. The pair under review crush from 135 to 160 tons of fairly hard ore per day, or 67 to 80 tons each. The speed is from 123 to 135 drops per minute, and, other things being equal, the pair is equal to a battery of fifteen 1250-lb. stamps. There has been no trouble with the patent gear, only the usual battery repairs are necessary, and the wear and tear is about the same as with ordinary stamps. Mr. Degenhardt, the firm's engineer, informed me that for cost of erection and general upkeep, the Holman stamp is very satisfactory.

The air-cushion is produced in the following manner: In the walls of the cylinder are four rows of holes (see figure), two above and two below the centre position of the cylinder. Rows two and four are plugged. As the cylinder travels up and down, it traps the air between the piston and the cylinder covers, and the air thus compressed acts as a cushion, and on the return stroke assists in the propulsion of the stem. As the shoes and dies wear, the holes in rows two and four come into use, and rows one and three are plugged. By this patented device an equal distance is maintained between the shoe and die, for owing to the thinned 'air-cushion' being at the bottom of the cylinder, the piston, and consequently the shoe, is not raised as high as previously; a very considerable improvement on the old method. The following details are supplied by the manufacturers, and the weights given include steel framing:

Size.	No. 1.	No. 3.
Diameter of cylinder (in.)	9½	6
Stroke (in.)	12	10
Power for stamp (hp.)	25	15
Single stamp, weight of battery (tons)	12¾	5¼
Double stamp, weight of battery (tons)	21	8¾

The pulp from the stamps in the Mountain Queen plant passes to two 5-ft. grinding pans fitted with Freeman classifiers, in which classification is by segregation due to centrifugal force. The flow from the pans then passes over two copper plates, 12 by 6 ft., and in all, about 70% of the gold is recovered by amalgamation. The sand and slime flow to ponds, and will be treated later with the current mill product, by a new process, which is claimed to be of considerable interest. The plant described is driven by a 165-hp. Kynoch suction gas engine, which is powerful enough to drive the other plant being erected.

At the Yuanmi, the ore, after passing a jaw-breaker, is crushed by 20 Fraser & Chalmers 1250-lb. stamps, dropping 7½ in. 103 times per minute, at the rate of 8 tons per stamp daily through 10 by 10-in. screens. A larger screen, 10 by 12, is occasionally used, depending on the character of the ore, which, from some portions of the mine, is very hard. Crushing is done in weak cyanide solution, this coming from the treatment plant. The mine-water is fairly fresh, containing the usual magnesia salts found in our northern waters. The mortars have a band shrunk around the screen opening to prevent cracking at this weak point. In this mill there is no amalgamation.

The battery pulp flows to one leg of a Forwood-Down 10 by 48-in. sand pump, and is elevated about 12 ft. to a cone classifier, 6 ft. diam., the underflow going to a 16½ by 4-ft. Krupp tube-mill, working at 29 r.p.m. The overflow from the classifier, as well as the discharge from the tube-mill, goes to the other leg of the pump. This is raised to another cone, and the underflow, which consists of coarse sand, returns to the first leg of the pumps, and through the tube-mill. The tube-mill is fitted with the corrugated liners so popular in Western Australia now, and a great quantity of the pebbles used consists of hard ore from the mine. The overflow from No. 2 cone-settler gravitates to two continuous mechanical thickeners, the overflow of clear water being returned to the battery-supply tanks. The thick slime flows to three ordinary agitators, agitated with cyanide, and finally treated in a gravity-type vacuum-filter, similar to that described by Degenhardt and Stevens in the *Monthly Journal* of the Chamber of Mines, for March of last year. The residue, containing 27% moisture, is mixed with mine-water, and flows to a pond. The first 15 to 20 minutes wash from the filter is passed through vacuum clarifiers, and then to the precipitating boxes.

The whole plant is driven by 200-hp. Crossley suction gas engine, with low cost. The simplicity of the Yuanmi mill is at once apparent, as there seems a tendency in some mills at present to be as complex as possible.

Midyear Spelter Statistics, 1912

Production.—Figures compiled by C. E. Siebenthal, of the United States Geological Survey, from reports by all zinc smelters operating during the first six months of 1912 and from the records of the Bureau of Statistics show that the production of spelter from domestic ore in that period was 159,952 short tons, and from foreign ore 6544 short tons, a total production of 166,496 tons of primary spelter, compared with 140,196 tons for the first half of 1911, and with 146,330 tons for the last half of 1911. This production for the first half of 1912 is at the rate of over 330,000 tons per year, more than double the production of any year prior to 1904 and approximately 46,000 tons greater than the production in 1911. The apparent consumption for the period was 159,046 short tons, as compared with 145,157 tons for the last half of 1911 and 134,902 tons for the first half of 1911. The stock of spelter held at smelters on June 30, 1912, was 6414 short tons, as against 9081 tons at the beginning of the year. This stock of spelter is in part made up of the ordinary working stocks at smelters, but also includes stocks of special grades of metal held for particular demands. The stocks are now smaller than at the close of any year since 1906.

	Jan. 1 to June 30, 1911.	July 1 to Dec. 31, 1911.	Jan. 1 to June 30, 1912.
Supply:			
Stock at beginning	23,232	17,788	9,081
Production—			
From domestic ore	135,061	136,560	159,952
From foreign ore	5,135	9,970	6,544
Imports	146	463	3,053
Total available	163,574	164,581	178,630
Withdrawn.			
Foreign exports	7,903	6,452	7,331
Domestic exports	2,981	3,891	5,839
Stock at close	17,788	9,081	6,414
Total withdrawn	28,672	19,424	19,584
Apparent consumption	134,902	145,157	159,046
Spelter made in—			
Illinois	41,255	41,875	44,224
Kansas	50,574	47,839	52,485
Oklahoma	19,997	26,318	36,010
All other States	28,370	30,298	33,777
	140,196	146,330	166,496
Zinc ore imported	37,885	38,097	27,049
Zinc content	15,028	17,112	12,228
Zinc ore exported	9,625	8,656	13,709

Imports.—The imports of zinc ore were 27,049 short tons, containing 12,228 tons of zinc, as compared with 38,097 tons of ore, containing 17,112 tons of zinc, in the last half of 1911, and 37,885 tons of ore, containing 15,028 tons of zinc, in the first half of 1911. Of the imports of zinc ore in 1912, about 95% came from Mexico, the remainder being credited to British Columbia and other countries. These figures are exclusive of lead ores from South America containing less than 13% of zinc. The exports of domestic zinc ore were 13,709 short tons.

Smelter Capacity.—At the beginning of the year the total capacity of the smelters reporting production for the first half of 1912 was 81,582 retorts, and the construction of 15,868 additional retorts was contemplated in 1912. At an annual average of 4¼ tons per retort, the spelter capacity of the 81,582 retorts for the first six months would be 173,362 tons, less than 7000 tons in excess of the actual production of primary spelter. Taking into consideration the secondary materials, such as zinc drosses resmelted at the regular smelters, the large quantity of low-grade carbonates recently smelted, and the impossibility of operating continuously at maximum capacity, it is evident that the smelting capacity of the plants in operation has been strained to the utmost during the past six months, and that any added retorts must have been put into operation as fast as completed. The plants of the American Zinc Co. of Illinois and the R. H. Lanyon Zinc & Acid Co., both under construction at Hillsboro, Illinois, will go into operation with 5800 retorts between October 1 and the close of the year.

Prices.—Spelter started the year at 6.25c. per lb. at St. Louis, the minimum price for the first six months. The price rapidly rose to 6.90c. by the middle of March, after which it quickly declined to 6.55c. per lb. in sympathy with a similar decline at London. By a steady climb through the remaining months of the period the lost ground was made up, and June closed with spelter at 7c., the average price for the six months being 6.65c. per lb. The London price opened at £26 15s. per long ton (5.78c. per lb.), remaining stationary for a time, but declined to £25 per long ton (5.41c. per lb.) by the latter part of March. The then market remained stationary at a little over 5.5c. until the close of June. The difference between the London and New York prices at the beginning of the period was 0.67c. per lb., and at the close of the period it was 1.43c. per lb. As the average New York price of spelter for January was but 0.79c. per lb. higher than the average London price for January, and as the duty on spelter is 1.375c. per lb., it is interesting to note that the Monthly Summary of the Bureau of Statistics for January gives the imports of spelter for that month as 4,377,360 pounds.

The Thames Goldfield

From the year 1867 to 1911, the mines on the Thames goldfield, of New Zealand, have yielded over $25,000,000. Among the chief producers were the Caledonian with $10,000,000; Waiotahi, $3,500,000; Kuranui, $2,500,000; Queen of Beauty, $1,850,000; Moanataiari, $1,800,000; Golden Crown, $1,750,000; Shotover, $1,500,000; Cambria, $1,050,000; Prince Imperial, $1,000,000; and Long Drive, $870,000. The future of the field depends on results from the deep-level work now in progress. The drift from the 1000-ft. level of the Queen of Beauty shaft is now out 2100 ft. in Waiotahi property, which yielded rich ore a few years ago. About $87,000 has been subscribed for driving this level, and subsequent prospecting. The shaft mentioned is equipped with a large horizontal-geared pumping engine, which drains the whole field, the present flow being 600 gal. per minute. The New Zealand Government owns this plant and assists the work in progress. Several lodes have already been cut, and are being opened. Local opinion is divided as to the value of this deep-level prospecting. A good deal of diamond-drilling has been done in the past, with much trouble and disappointing results. Apart from the present work, a number of claims are being developed, and about 6000 tons is treated annually. The population of the district totals some 5000 people. The old-established foundry of Price Brothers, which has specialized in mining machinery, is now busily engaged constructing large locomotives for the New Zealand Government. About 190 men are employed and a new engine steams out every 30 days or so. The Thames district will eventually depend on agricultural pursuits, as the surrounding plains are rich for dairying, sheep, fruit, and vegetables. The fishing industry is being extended, the gulf being exceptionally prolific in all edible fish.

Sulphur is found in Utah, and the deposit has been recently described in a report (Bull. 530-O) issued by the U. S. Geological Survey. The deposit lies in the southeastern part of the state, in the canyon of the San Rafael river, 18 or 20 miles west of the town of Greenriver. At the point where the sulphur occurs the canyon widens until its floor is probably a quarter of a mile across. As the spot is approached in coming up the canyon the existence of sulphurous springs is indicated a mile or more away by the odor of hydrogen sulphide, possibly more because the spring water has mingled with that of the river than because the gas has been carried so far by the breeze. A strip of rock débris about 100 or 150 ft. wide by 750 ft. long is impregnated with sulphur which has been formed from the gas in the springs, and while there is no doubt that sulphur can be extracted, the scarcity of fuel, an 18 or 20-mile haul to the railroad, and a restricted market, make it unlikely that the deposits can be worked at present at much profit.

Discussion

Readers of the MINING AND SCIENTIFIC PRESS are invited to use this department for the discussion of technical and other matters pertaining to mining and metallurgy. The Editor welcomes the expression of views contrary to his own, believing that careful criticism is more valuable than casual compliment. Insertion of any contribution is determined by its probable interest to the readers of this journal.

Drilling Contest Records

The Editor:

Sir—In an editorial note in your issue of July 13 you say that Page and Pickens established a new record in a drilling contest at Tonopah by drilling 45 7/16 inches in Rocklin granite. I should like to call your attention to the fact that at a contest held here in Colorado Springs at the time of our Quarto-Centennial Celebration in August 1901, this record was surpassed by Stewart and Carmack, of Leadville, who drilled 46 inches in 14½ minutes. If I remember correctly, the reason they stopped half a minute before the full time was out, was because they had drilled through the block of Gunnison granite provided for the contest. According to contemporary newspaper accounts, the record previous to this was 39½ inches, which was broken by three teams in addition to that mentioned above. Hupps and Lindquist, of Ouray, drilled 43⅜ inches; Chamberlin and Malley, of Leadville, 41¼ inches, and McNichols and Lamb, of Victor, 40⅛ inches.

HORACE F. LUNT.

Colorado Springs, July 20.

Gilpin County Ores and Their Recovery

The Editor:

Sir—I am sorry to see that the *Mining and Scientific Press*, in its issue of July 6, lends the weight of its authority to support the statements that "the tailing losses (in the treatment of Gilpin county ores) have been heavy; much heavier than was generally realized or admitted"—a statement which, applied indiscriminately, has been the cause of much harm to the spread of sound ideas for the improvement of Gilpin county metallurgy.

It is not the fact that the savings have uniformly been low; on the contrary, the saving by amalgamation and subsequent concentration on such ores as those of the Gunnell and California mines has been remarkably high. Such ores have contributed at least two-thirds of the entire production of the district in the past, and will probably continue to do so in the future. I do not say that there is no possibility of improvement by the use of cyanide; but every metallurgist who has investigated the subject has found that there is a rather depressingly small margin to work on. Another large class of ores in the district yields good recoveries by simple concentration, with the drawback that the concentration ratio is often low, and the ultimate cost of smelting the concentrate necessarily high, figured back on the original ore.

There remains a class of ores, at once varied and complex, on which no milling method has yet proved successful, and this forms a virgin field for the exertions of our cyaniding friends. Unfortunately, all experiments hitherto have indicated that such ores are no more docile to cyanide treatment than to other simple processes; and they remain a problem, or problems, to which as yet we have no satisfactory solution, except the expensive one of smelting.

The real difficulties in Gilpin county metallurgy, as a whole, centre in the fact that the orebodies are exceedingly varied from a metallurgical point of view, and usually relatively small, so that one has often no sooner worked out the best possible method of treatment for any particular kind of ore than that ore is exhausted, to be succeeded perhaps by a different type. It follows that Gilpin county metallurgy must always necessarily consist of compromises, a mill being designed to give the best commercial result on a variety of ores, rather than the best possible result on a single ore. For a large class of ores, simple amalgamation and concentration remain today the best standard method of treatment, and simple concentration for another large class. If there is to be a single method of treatment commercially applicable to all ores, it will have to be something which is not in sight today.

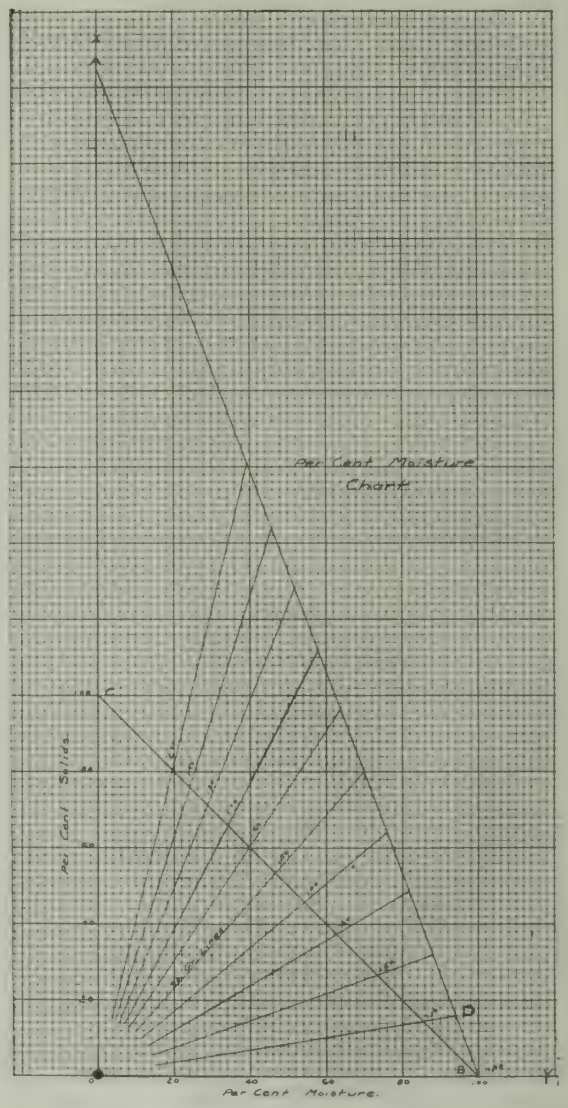
GEORGE E. COLLINS.

Denver, Colorado, July 20.

Specific Gravity Chart

The Editor:

Sir—Frequently in cyanidation, when slime is being handled, the percentage of moisture and the percentage of solids in pulp must be known in order to determine the proper treatment. The common practice is to determine their quantities from the specific gravity determinations,



SPECIFIC GRAVITY CHART.

which are taken at frequent intervals during the day. Most moisture percentage charts involve curves and are to a certain extent puzzling. They are constructed by using an algebraic equation and are not easily made. The chart here illustrated is easily made and is clear and correct. It can be made in a few minutes, and with much more detail than shown in the sketch.

The chart is made by using coördinates. The ore in this case has a specific gravity of 2.65. On OY lay off OB, which represents a specific gravity of 1 and which will be the specific gravity when the agitator, or whatever the receptacle containing the pulp, is full of water. Using

the same scale, lay off OA on OX, representing the specific gravity of the receptacle when full of solids or ore. This quantity is 2.65. Now the line AB represents all specific gravities ranging from 1 to 2.65. Any intermediate specific gravity lines such as those shown on the chart may be found by dividing this line AB into 16.5 equal parts. (The difference between 2.65 and 1 is 1.65, and the lines on the chart represent one-tenth of 1%, therefore divide by 16.5 instead of 1.65 to get the division, such as BD on the chart). An equation containing two variables whose sum equals a constant is represented by a straight line 45° to the ordinate. This is the case of the two variables, percentage of moisture and percentage of solid, the sum of which is always 100%. Let this line be any such line as BC, and let the specific gravity lines cut BC. To read this chart, find the point where the line representing the specific gravity already determined cuts the line BC. Reading directly across from this point to the side scale will give the percentage of solids; directly down will give the percentage of moisture.

This chart can be changed to one for a pulp having an ore of different specific gravity than 2.65. In that case let OA on OX represent this new specific gravity in the same scale with OB.

GEORGE B. MCLAIN.

Tom Reed Mine, Oatman, Arizona, July 1.

Zinc-Dust Precipitation

The Editor:

Sir—Errors of mill construction materialize when the operator is unable to obtain the results expected by the designer. Errors of detail become more serious as the run continues, and their cause generally proves to be the neglect of the constructing engineer, who has followed the so-called 'general mill plans' too closely, instead of consulting the installation prints of apparatus supplied by inventors and patentees.

One of my most recent experiences was in Arizona. The Merrill zinc-dust precipitation process was installed at the time of constructing the mill. Some curious non-results were obtained during the first attempts at precipitation. An inexperienced operator performed the operations as outlined and as universally adopted. Samples of the ingoing pregnant and barren effluent solution assayed the same, indicating absolutely no precipitation of the precious metals. A close regeneration was not expected from the weak NaCN solutions with little protective alkali containing an extremely small gold content, due to the adoption of the decantation methods before the completion of the vacuum-filter. But certainly some press extraction was anticipated even under these conditions. Laboratory tests resulted in the precipitation of the metals from the solutions with a longer contact than the installation would allow before reaching the filtering medium. The Bosqui dust-feeder and tank apparatus seemed a necessity. After these tests I inspected the plant, finding that a pressure of over 25 lb. showed on the gauge with the press filtering at but 50% of its rated efficiency. The filtering medium was light twill, but it was evident that the press was getting an oversupply of air, as the solution coming from the spigots was foaming and bubbling. The air-connection to the press was evidently closed, and at first I thought the pump was taking air at the plungers, until noting the arrangement of piping and position of valves. In connecting up the 5 by 7 triplex electric pump supplying the press, a by-pass was neglected, and the valve on the pump suction was placed on the tank side of the zinc-dust feed-pipe. This valve was used in regulating the press flow and pressure, and naturally the pump took an enormous amount of air from the dust feed-pipe.

To overcome these errors and to lengthen the contact of the zinc with the solution, a return by-pass pipe was extended from a point near the press to the suction of the pump. A valve was placed on this line near the press to regulate the flow and pressure to the press, and a check-valve was put on the suction between the return pipe and dust feed-pipe to check the return of solution to the tank. Thus the circulation of dust and solution before filtration was secured. Results were obtained immediately after these changes, and the press was brought to a high efficiency. It seems obvious to me that by installing a pump of greater capacity than the press, with the use of this return pipe, increasing the velocity and friction within the supply pipe, the danger of precipitate accumulation within the pipes would be lessened and the agitation and longer contact beneficial, in some cases doing away with the Bosqui tank and feeder installation. In this case, zinc-shaving boxes were ordered to replace the dust apparatus by the local mine manager, of South African experience. The order did not pass the main office immediately, so the unnecessary expense was avoided. Think of the enormous bulk of zinc-shaving necessary for the precipitation of 250 tons per day of 50c. solution, and the $4000 or $5000 gold absorption, compared with the simplicity of the zinc-dust appliances.

E. S. PETTIS.

Mill Valley, California, July 11.

The American Institute of Mining Engineers

The Editor:

Sir—As the report of the Committee of Five has now been published, a discussion by the members of the American Institute of Mining Engineers between now and the next meeting might be of value in enabling a proper decision to be made at that time regarding a future policy.

I would call your attention to one peculiar misprint on the sixth line from the bottom of page 11, where the word 'perpetuated' must be wrong. Probably the Committee wished to say perpetrated. I would be very sorry to see the Institute increase the annual subscription for two reasons: one is that $10 is enough; by way of contrast I may mention that I pay $12.50 to the Institution of Civil Engineers and get four volumes of transactions annually. The other reason is that, from my acquaintance with the younger members of the Institute, I am satisfied that many cannot afford to pay $15 annually, and many of them will drop out.

Our organization is face to face with a serious problem, and its solution must be along the lines of elevating the character of the Institute in every direction. The Institute has never been ultra-professional, and it is probably better so. At the same time, subjects such as the formation of local branches throughout the country; the discussion of improved mineral and mining laws; keeping members posted regarding recent advances in mining and metallurgical methods; the preservation of the health and lives of those engaged in the mining industries; the financial aspects of mining operations; and the standardization of mining technology have never received sufficient attention. Only by elevating the general standards of the Institute will its true growth be made. The ownership of a half million dollar equity in the United Engineering building no doubt dignifies our New York headquarters, but this equity will never take the place of the standards which the Institute is organized to maintain and on the maintenance of which its whole future existence depends.

The Institute, like the Republic of Mexico, is suffering today from reactionary management; and the present difficulties must be solved, in a new and progressive spirit. The acquirement of more money is not in reality the vital need of the Institute today in spite of the pressing nature of its financial problems.

JAMES W. MALCOLMSON.

Kansas City, Missouri, July 24.

[We heartily endorse Mr. Malcolmson's statement that "money is not in reality the vital need of the Institute today." Service is more necessary than money, and this should be the intelligent service of the whole membership rather than that of the few.—EDITOR.]

Special Correspondence

BUTTE, MONTANA

JULY PAYROLL OF BUTTE MINES.—REPORT OF STEWART MINING CO.—NEW COMPANIES TO OPERATE IN DISTRICT.

The payroll of the mines of Butte for the month of July shows that the Anaconda company alone will pay out about $1,163,000 and that the total for all the mines of the district will amount to fully $1,500,000. Through the increase in wages granted the miners by the Anaconda company alone, the payroll will be increased in a year by at least $1,500,000, and the total increase in the district will be close to $2,250,000. As long as copper remains above 17c. per pound the payroll of this district will be about $18,000,000 per year. With this amount for labor is not considered the sum the Anaconda company is spending in placing the compressed air system and the underground electric haulage system at the different mines. The controversy between the East Butte Mining Co. and the miners' union over the wage-scale agreement was settled without friction after Oscar Rohn, manager for the company, realized the fact that the smeltermen working in this city were under the direct supervision of the miners' union since the mill and smeltermen's union was disbanded. Mr. Rohn sent the miners' union a letter notifying the organization that he would see to it that the smeltermen employed by the company would receive for June and July in their August checks the amount of the shortage for these months. The report of the Stewart Mining Co. shows that the net earnings for the first six months of the year ran over $200,000. The month of May was the record when the net earnings were $49,800, after charging $12,800 to development and construction. According to a statement given out, the company could well afford to pay a dividend, but in consequence of the application for a receiver and an accounting, nothing will be done in this direction. The Stewart is treating 500 tons of ore per day. The delays which have occurred in the hearing of the application for a receiver are having a discouraging effect on the stock.

The quarterly report of the North Butte Mining Co. shows that a large amount of new ore has been opened in the property farthest north. The 2200-ft. level of the Snowball vein has been advanced over 200 ft. west and shows continuous ore which averages 5 ft. wide, assaying 8% copper and 19 oz. silver per ton. The east drift shows 40 ft. of ore averaging 5 ft. wide, assaying 5% copper and 10 oz. silver per ton.

The Davis-Daly company is shipping 10 cars or about 500 tons of ore to the smelter per week. This ore contains about 6% copper and the returns for the past two months have more than paid the operating cost. The orebodies opened on the 1900-ft. level west cross-cut are encouraging. The cross-cut is now about 280 ft. from the shaft and it is estimated that the main vein, which was opened up on the 1700-ft. level, will be reached in the course of another week. The management will develop this level before sinking deeper.

The Tramway mine, which has been closed for two months while the hoisting engine was equipped with new cylinders for operating by compressed air, is now in commission. The Pennsylvania plant will be the next one to be changed over for air. The Nordberg Manufacturing Co. of Milwaukee, which has the contract for making the changes required, estimates that the entire work of equipping all the engines of the Anaconda company will be completed in another year. At the Mountain View mine, underground electric haulage will be in use in another month. All the claims in the northern part of the district have either been purchased or are held under options as a result of the recent boom in Butte & Superior. At least three new companies are expected to commence operations soon. A boom in the stock of Butte & London, which carried the price from 10c. to 95c. per share, followed the rumor that the Butte & Superior company was prepared to back the reopening of this property.

The Hidden Lake, one of the richest gold-producing properties in the district south of Anaconda, is likely to pass into the hands of New York and English capitalists. An option for sixty days was secured on the property some time ago and this option expired, and a day or two before the expiration an extension of thirty days was conceded. It is stated that the only reason for the extension of time was the death of an interested party which made it necessary to change some of the plans in regard to financial arrangements. The ore being hoisted from the mine runs from $16 to $35 per ton in gold with a fair percentage of copper. A vein 8 ft. wide was opened which is very rich. The property consists of 16 claims, and it is understood that the option calls for the payment of $1 per share on the 300,000 shares outstanding. All the stock is held by Butte and Anaconda people. The property is situated within two miles of the extension of the Butte, Anaconda & Pacific railway.

TORONTO, CANADA

PORCUPINE STOCKS DECLINE ON LACK OF OFFICIAL REPORTS. — PROGRESS AT THE MINES. — RECORD SHIPMENT OF BULLION FROM COBALT.

In spite of highly favorable reports of the operations of the Porcupine mills which appear from time to time with correspondingly optimistic estimates of the output, the share market continues to show a downward tendency to an extent not altogether accounted for the usual midsummer slackness. The cause is probably the entire absence of any official statements as to the actual output, and the reluctance of the public to accept general figures, which may be based on guesswork. It is stated that the results so far obtained prove that the ore is free milling and the extraction high, and that average returns will run over $10 per ton, all of which may be taken for what it is worth as the views of those on the spot who are endeavoring to size up the situation. The average daily tonnage of ore treated at the Dome is calculated at 335 tons, and at the Hollinger 300 tons. It is understood that the former company contemplates adding 20 or 30 stamps. At the Dome mine the 100-ft. level will shortly be connected with the incline up which the ore-cars run to the mill. A body of high-grade ore recently found on this level will considerably increase the average quality of the ore treated. The main workings will be connected with the shaft sunk near the Golden Stairway vein, which is to be put down to the 400-ft. level. The McIntyre has made its second payment of $50,000 on the property, and only a comparatively small amount now remains to be paid. The Hollinger Reserve property is being steadily worked. The main shaft is down 100 ft., and three good veins averaging 4 to 5 ft. wide have been tapped in cross-cutting. At the Dome Lake four shafts are being sunk, two of which are down 170 ft. They will be connected at the 100-ft. level, where a large body of ore will be blocked out. The richest vein is from 5 to 6 ft. wide and has been stripped for 800 ft., samples showing an average of $28 per ton. The Preston East Dome, which has been working the East Dome claim since it abandoned the Preston, has decided on discontinuing operations, there being apparently little chance of success. C. A. Foster, of Haileybury, has taken an option on the Tough-Oak claims in the Swastika district, about six miles north of the Swastika camp, where there is good ore occurring in a porphyry dike averaging 15 ft. in width. Amalgamation is to be adopted at the Swastika, and should conditions warrant it later, cyanidation will be added. Foundations are being prepared for the mill, which will have a capacity of about 60 tons per day. At the Lucky Cross, in the Swastika district, a new vein recently found has widened to 5 ft. of rich ore. Good milling ore is being taken out in several places.

A new record for bullion shipments from the Cobalt

district was made for the week ended July 19, when a total of 153,882 oz. of silver was shipped, this being 30,000 oz. in excess of any previous week's shipments. The Nipissing was a long way at the head of the list with 120,158 oz. The Dominion Reduction Co., which is now operating the Nova Scotia mill, made its first consignment of 23,603 oz. from Crown Reserve ore. The total dividends paid by Cobalt companies for the first six months of the year amounted to $3,578,399. The Crown Reserve, with the payment of its last declared dividend, will have returned to its shareholders 245% on its capitalization. The McKinley-Darragh has produced 1,530,000 oz. silver during the first six months of 1912. Work has been started on the building of the aerial tramway, 5000 ft. in length, by which ore will be brought from the Savage property to the McKinley mill. The Rochester is endeavoring to raise funds to continue development by organizing a holding company capitalized at $1,000,000, which will take over existing stock, giving shareholders one new share for every four of old stock, and selling the remainder of the new issue. The Right of Way has abandoned its option on several claims in the Silver Mountain district near Port Arthur. The court at North Bay has sent to jail three 'high-graders', convicted of robbing the Timiskaming mine, who were cleverly caught by George P. Williams, a Pinkerton detective engaged by the Mine Managers' Association. He posed as manager of a moving-picture show, ingratiated himself with the suspected men, and became their partner. The sentences of the men were for terms of 9, 13, and 14 months imprisonment.

LONDON

WAIHI AND ESPERANZA WILL LOOK FOR NEW MINES.—REPORT OF ZINC CORPORATION.—EXAMINATION OF COAL BY X-RAYS.

Two gold mines which have yielded large profits to English shareholders are the Waihi in New Zealand and the Esperanza at El Oro, Mexico. Both are now showing signs of exhaustion in depth and the directors of both companies are proposing to allocate some of the reserve funds in acquiring other properties. The Waihi yielded £9,785,431 from 1890 to 1911, inclusive; adding the output to June 2, 1912, when the strike suspended operations, the total is £9,990,833. The Waihi Gold Mining Co., Ltd., has paid £4,230,585 in dividends free of income tax, so that the money returned to shareholders represents 42% of the gross output in gold and silver. This has come from 4,057,700 tons; hence the average yield has been 48s. per ton, and the dividends 20s. 10d. per ton. Yet this mine that has yielded ten million sterling in precious metals was originally purchased for £3000. The capital of the company is 500,000 shares of £1 each; these reached a maximum price of £5 8s. 9d. in the early part of 1911, and are now quoted at £1 15s. The Esperanza mine is owned by a company organized in 1903 to acquire a mine in Mexico originally located in 1890 and opened up by August Sahlberg. The mine was a disappointment until 1895; and even then it did not do anything wonderful. The big bonanza was discovered by a drill-hole on the fourth level during October 1904, just a year after the transfer of the property to an Anglo-American company controlled by the Guggenheim Exploration Co. In 1906 the output of the mine attained its maximum, 207,182 tons, yielding ₱15,357,690. The biggest dividends were paid in 1906, the total amount distributed in England in that year being £728,000. Altogether from 1895 to May 31, 1912, the mine has produced 2,015,125 short tons of ore, yielding £6,170,200 in gold and silver, and profits estimated at £2,386,000. The price paid by the company was £450,000. The English subsidiary company, now in control, is capitalized for £455,000 in £1 shares, and has paid £2,331,875 in dividends. This mine is 1600 ft. deep and still has some ore in sight on a new vein called the San Carlos. The Waihi is 1261 ft. deep, and it is proposed to sink the shaft whenever troubles from water and labor are overcome. The end of the Great Boulder Proprietary company operating the gold mine at Kalgoorlie appears also to be within measurable distance, for the main orebody has passed out of the boundary into that of the Golden Horse-Shoe between the 2650 and 2800-ft. levels, and the prospecting and development during the past year in other parts of the property have not been promising. The ore reserve on December 31 was estimated by Richard Hamilton, the manager, at 698,662 long tons, averaging 14½ dwt., which should provide another million pounds in dividends spread over four years. During 1911 187,510 long tons of ore was raised and treated, yielding 158,351 oz. bullion, worth £567,639. The working profit was £306,829, out of which £29,855 was paid as taxes, £14,000 written off for depreciation, and £262,500 distributed as dividend, being at the rate of 150%. This company has hitherto been a most regular producer. The first year, 1895, yielded gold worth £107,023, and during the next seven years the output steadily grew. From 1903 onward the yearly production has been practically constant.

A consolidation was made in London on July 8, 1911, of the Zinc Corporation and the Broken Hill South Blocks, two companies registered in Victoria, Australia. The former company had been treating zinc tailing at Broken Hill since 1905 and producing zinc and lead concentrates, at first by the Elmore vacuum plant, and since the end of 1910 by the Minerals Separation process. The South Blocks company owned a mine containing two lodes, one of which is higher in zinc than lead. The issued capital of the new company was 245,692 preference shares of £1 each and 653,139 ordinary shares of 10s. each. Of these, 179,026 preference shares and 453,132 ordinary shares were allotted to the shareholders in the old Zinc Corporation, and 66,666 preference shares and 200,000 ordinary shares to the shareholders in the South Blocks. A report recently issued covers the 5¾ months from the date of registration to the end of 1911. It was desirable to make the company's financial year coincide with the calendar year, as the final settlement of zinc prices is made on the basis of the average price during a calendar year. Special arrangements have had to be made on this account to enable a dividend to be paid on the ordinary shares for the short period under review. During this period, 140,370 tons of tailing drawn from eight separate dumps was treated in the flotation plant, and the yield was 42,350 tons of zinc concentrate, assaying 45.3% zinc, 7.7% lead, and 13.9 oz. silver, and 3865 tons of lead concentrate, assaying 55.3% lead, 16.4% zinc, and 34.4 oz. silver. In addition, 3988 tons of slime assaying 38.6% zinc, 13.2% lead, and 23.4 oz. silver has been dumped for further treatment. At the mine 64,313 tons of ore was raised and treated in the lead mill, yielding 11,846 tons of lead concentrate averaging 64.9% lead and 8.7 oz. silver; also 16,315 tons of zinc tailing, which was sent to the flotation plant. The income from the sale of concentrates and sulphuric acid was £235,661, this being subject to adjustment when the average price of zinc during 1912 has been ascertained, and the net divisible profit was £73,243. Accompanying the directors' report is one by Theodore J. Hoover, who recently made an examination of the mine and the plant. He estimates the ore reserve at the mine at 665,000 tons, averaging 14.6% lead, 9.4% zinc, and 2.3 oz.

ZINC CORPORATION WORKS, BROKEN HILL.

silver. This does not include the lode which is higher in zinc, as that has not been sufficiently developed to warrant an exact estimate, though Mr. Hoover gives a preliminary estimate of 300,000 tons averaging 19% zinc, 8.5% lead, and 1.5 oz. silver.

At a recent meeting of the North of England Institute of Mining and Mechanical Engineers, F. C. Garrett and R. C. Burton read a paper describing their experiments with X-rays for the examination of coal. Coming so soon after James Lomax's paper on the examination of coal by means of the microscope, this paper created unusual interest. The carbon and organic parts of coal are much more transparent to X-rays than the mineral constituents which subsequently form the ash, so that an examination by radiography indicates the presence and distribution of the mineral substances. It is possible in this way to get an idea of the value of the coal from the point of view of ash, and by observing the size of the shadows to estimate whether the mineral can be removed by washing. The authors publish many radiographs of various coals, and of these, one of the most interesting is that of the Victoria-seam coal from Durham. The ash of this coal amounts to only 1¼%. The coal on examination exhibits a columnar structure, and the authors connect this structure with the characteristic of being a good coking coal, though several speakers at the meeting expressed a doubt as to the connection. The authors also state that the X-rays serve to differentiate certain minerals such as calcite and pyrite. Though the paper only gives the results of a tentative series of experiments, it opens up an important field of research.

BOSTON

INFLUENCE OF ZINC MINING ON THE BOSTON MARKET.—LABOR PROBLEM AFFECTS LAKE COPPERS.—ELECTRIFICATION OF BOSTON & PROVIDENCE RAILROAD LINE.

From the Boston standpoint, zinc has been, until recently, a metal which stood at the foot of the list, commercially as well as alphabetically. The importance of zinc ore development in the northern end of the Butte district, and the record high price of spelter—7.3c. per pound, New York delivery—has changed the situation. Now all Butte stocks are in demand, especially as the smaller companies, such as the Butte & London and the Raven, which were unsuccessful in their search for copper, are to be refinanced in the hope of finding zinc ore. The Butte Central Copper Co. reports that the framework of the concentrator is completed, and the officials expect the first two units to be in operation within 60 days. Cross-cutting has been started from the 1000-ft. level to reach the Rarus fault-zone, which is believed to be 200 to 400 ft. from the shaft. The management expects to find large copper orebodies in the fault-zone. The shortage in the labor situation in the Lake country is handicapping drilling and exploration at present, although there is activity in Superior, Isle Royal, and Houghton, due to promising lode development. At one time Boston would not become enthusiastic over any mining boom except those originating in the Lake country. This is now changed, although Cobalt and Porcupine stocks have never been handled here to any extent. Calumet & Hecla, while keeping up its copper production, has poured out a large part of its enormous surplus into investments in other mining companies along the Lake peninsula. Recently the company announced that it will retire $1,000,000 in notes, thereby having paid off $2,700,000 out of the issue of $8,519,000 in notes which it gave in part payment for the Bigelow securities. Having retired $2,700,000 of the notes, the company saves $135,000 per year in interest charges. Calumet & Hecla had hoped to force production and complete the first half of this year with a substantially increased production over the corresponding period of 1911. But the labor situation held up the company's plans, and it not only affected Calumet & Hecla itself, but its various subsidiaries as well. The chances, therefore, of taking full advantage of the present high price for copper metal have failed now of materialization, as far as the Lake Superior companies are concerned. The output record of the several Calumet & Hecla properties for the first six months of 1912, as compared with the first half-year of 1911, presents a very interesting situation. In the eight properties going to make the comparison (Calumet & Hecla, Ahmeek, Osceola, Tamarack, Isle Royale, Allouez, Superior, and Centennial) there were recorded four losses and an equal number of gains. Ahmeek, Isle Royale, Superior, and Centennial recorded the gains. Ahmeek and Isle Royale primarily have been the properties to push forward. Ahmeek has made a remarkable dividend record in the past two years, while Isle Royale, considered for years as a failure, and later as a slightly successful prospect, is now rounding out to that point where dividends are expected before another six months have passed into history. Mohawk is another of the Lake properties which is being closely watched here. Definite action is now going forward to make the company secure against possible low water, which so handicapped the company last year. Mohawk is fast accumulating a substantial surplus above its ordinary treasury surplus, and rumors once again are current that the company, at its next dividend declaration period, will advance the dividend rate.

There is some talk now that Wolverine, which does not take semi-annual dividend action until October, will restore the old rate of $5 per share for the six months, or $10 per share per year. Wolverine is making larger recoveries from its ore than at any time since February, while its output in June was the heaviest for the year past, with the exception of last October. The output for the year from July to July falls about 200,000 lb. under that for the previous fiscal year, but low production costs and high metal prices are making for better earnings. Developments at Wolverine have not been encouraging, and the company is slow in making acquisition of territory, though its property is believed to have reached that point where prolongation of life should be taken up from the standpoint of buying new ground. Wolverine was at one time the lowest-cost producer in the world, but its glory has in a measure waned.

Boston is much interested now in the labor problem of the Lake mines, principally because it affects the local issues from that district. Among those now threatened particularly are the Isle Royale, Calumet & Hecla, Osceola Consolidated, Franklin, Mass Mining, and Superior properties. Franklin has been forced to shut down for several weeks, but is now in a position to start again. Isle Royale has taken a squad of 500 men from points around Boston and shipped them to Michigan.

Followers of copper are interested in railroad electrification at Boston. The New Haven will electrify and four-track the Boston & Providence line for 42 miles out. This will be similar to the electrification of the Mellen system between New York and New Haven. This first actual piece of steam railroad electrification out of Boston is promised at an early date. It will call for a considerable amount of copper and will be a great help in influencing sentiment in behalf of railroad electrification generally. As soon as such electrification has been extensively entered upon, it is believed that copper will be pegged around 17 or 18c. per pound. At this price the metal is not considered to be prohibitory. All things are relative, and the high cost of commodities admits of a higher price for copper. A recent debate in the United States Senate over the building of the new custom house in Boston brought out the point that copper now might be too expensive to put into the building according to the original specifications. Copper is now on the verge of selling at a price which will automatically displace the metal in a great deal of construction and manufacturing plans. But the present price, everything considered, is regarded as conservative and consistent with the higher prices which commodities are commanding.

NEW YORK

REVIVAL OF MINING INTEREST AWAITS RESTORATION OF TRANQUILLITY IN MEXICO.—PRODUCTION OF GUGGENHEIM COPPER COMPANIES FOR HALF-YEAR.

Mining interest in and about New York will hardly experience a general revival until perfect tranquillity is restored in Mexico. There is some sporadic, though largely professional, interest in the Tonopah district, where real mining progress has been made during the past few months. For a long time Mexico suffered by reason of the unduly low price of silver, and unfortunately just at the time when a real advance in the silver market would have placed many of the mines on a paying basis, the Diaz regime passed out and disordered conditions, prevailing since, have rendered impossible the enlisting of new capital in mining enterprises. There has been some progress made in the oilfields in and around Tampico, but the real uplift for Mexico will come when it is in a position to take advantage of the silver market. Statisticians figure that one-third of the world's present supply of silver was mined in Mexico, and present prices will undoubtedly prove an immense stimulus to production. It is remarkable to state that mining properties came through the revolution—if it may be so called—without any particular damage, and so soon as commercial progress is once more in full swing, mining can take up its part without having any serious damages to repair. Promoters with Mexican properties in which to interest capital are now not backward in proclaiming the fact that they can secure better results throughout the West in the United States than they can in Wall Street. The claim is made by many of them that it is not so difficult to place a property in Wall Street as it is to have anything left for themselves or the former owners after it has been so placed. The Englishmen who have had a hand in developing the properties at El Oro, which includes Esperanza and others, and the Camp Bird company which is now in control of the Santa Gertrudis, have probably a larger number of contented adherents throughout the United States than have any American promoters who have been successful in Mexico. If some American promoters could become imbued with English methods, it would greatly benefit the mining industry.

As a leading member of the Guggenheim family of porphyry coppers, the output of Utah Copper is very naturally something of an index as to copper production. The complete figures for the half-year are just available, and expectations of a record output are met with disappointment. The yield in May was 10,163,336 lb. With like figures for June, there would have been justification for those who have been talking much of increase in copper output. The figures for June, however, were just about equal to those of April, when the output was a little above 9,000,000 lb. The half-year showed a total copper production of 53,301,379 lb., some 7,000,000 lb. more than the corresponding period of last year, and 10,000,000 lb. greater than the production for the first six months of 1910. Utah Copper can produce a considerably larger volume of copper than is shown by these figures. The Arthur and Magna mills are capable of turning out 140,000,000 lb. of copper per year if conditions are favorable. At a property such as Utah Copper, temperature has much more to do with the volume of output than in smaller or deep-level mines. Severe stress of winter weather renders difficult the breaking down and shipping of ore to the mills, and intense heat makes it impossible to run concentrators and furnaces at full capacity during a 24-hour day. In other words, the human factor plays no inconsiderable part in the operation of so large a property, even though the ore is so largely handled by automatic machinery. It is quite evident that the Nevada Consolidated mine and the smelter at Steptoe are not being operated at capacity. The June production was 6,000,000 lb., in round numbers, but smaller than any month during the half-year, except February, when the output was less than 5,000,000 lb. The total output for the half-year was 35,670,457 lb., giving the Utah and Nevada a combined production of nearly 90,000,000 lb., or at about the rate of 180,000,000 lb. of copper annually. The Ray and Chino, Guggenheim properties, are making rapid progress. Ray has already climbed up to the predicted mark of 3,000,000 lb. of copper per month, and while extraction at first ran but 59%, the mill management now reports average extraction of 70%. While Chino operations are not so far along, its progress is proportionately as rapid. As to dividends, there is considerable market capital made out of the possibilities of an increase in the rate of the Nevada Consolidated. It is stated semi-officially this week by one of the directors that the dividend will not be increased next month, though, if metal-market prices are maintained, some such action may be taken in November. This practically precludes the possibility of an increase on the part of Utah Copper, as one-half of the Nevada disbursements go into the Utah Copper treasury. Greene-Cananea Copper Co. has been placed upon a quarterly dividend basis, and disbursements will be made hereafter in March, June, September, and December. This move amounts to an increase in the dividend from 50c. to $1 per year. The Yukon Gold Co. reports by cable from Dawson a most satisfactory half-year. Operations to June 30 showed 1,460,400 cu. yd. dredged, against 1,773,917 cu. yd. up to the same date in 1911, with, however, an average recovery per yard of 76c. as against 55c. last year. The bullion output is $1,116,700, as compared with $654,668 last year.

NEVADA CONSOLIDATED MILL.

The reorganization committee of the Nevada Utah Mines & Smelters Corporation has acquired title to that part of the property in which the old company retained an ownership by reason of the confirmation of a sale made by a referee in the United States District Court. All of the stockholders are to be asked to come in on the same terms as those who originally subscribed to the reorganization committee plans. The move of F. Augustus Heinze to 'sidetrack' the litigation brought by the stockholders of the Stewart Mining Co. by transferring the suit to the federal courts has failed. The stockholders originally filed their suit in the state courts in Idaho, claiming that the funds of the Stewart Mining Co. were being and had been diverted to the use of the Ohio Copper Co. and asking for a receiver and other relief. Heinze's application to transfer the suit has been denied, and the state courts will now handle the entire matter. The New York stockholders are trying to form a protective committee to secure a proper administration of the mine and mill. The interests that are opposing Heinze, claim that since the restraining order was first made by the local courts the company has been making about $35,000 per month on a much smaller output than was being produced by Heinze.

General Mining News

ALASKA

Copper River

At the Nugget creek property of the Alaska Consolidated Copper Co. the bornite vein has been reached by the 200-ft. level, and cross-cutting shows it to be as rich as in the upper level. It is expected that development will open enough ore to supply a large concentrating plant. It is hoped to get the pumping and hoisting plant to Strelna in time to be brought to the claim, over the first snow. The Rarus has an iron outcrop over 400 ft. wide in a contact between lime and conglomerate. The surface is decomposed and copper stained. It is expected that the mine will be an active producer next winter. A. B. Iles is manager.

The Silverman Syndicate mines, at Falls Creek, got $1700 from 79 tons of ore. The mill will eventually consist of a Nissen stamp, crushing through 40-mesh screen, a Chilean mill for regrinding, and cyanide plant.

Juneau

The Alaska Treadwell operations for June may be summarized as follows: The 240 and 300-stamp mills worked 29.6 days, crushing 33,012 and 49,168 tons respectively. The estimated gross value of the free gold was $107,152, while the 1580 tons of concentrate saved has an estimated value of $97,425, making a total output of $204,577. The total realizable value was $202,531. Deducting $81,866 for operating and $24,206 for construction expenses, the estimated net profit was $96,458. The yield per ton milled was $2.49. The stock of broken ore decreased by 10,350 tons, and 1256 ft. of development was done on the 1450, 1600, and 1750-ft. levels.

ARIZONA

Cochise County

The tailing dam of the Detroit Copper Co. broke away on December 5, 1905, and several people were drowned and $200,000 damage done at Clifton. A heavy rainstorm partly filled Chase creek before the dam gave way. The company refused to pay anything to the sufferers. A suit for $200,000 damages was begun by 63 residents, and after some delay the jury brought in a verdict for the plaintiffs, which the judge set aside. An appeal was taken to the Spreme Court, which upheld the lower tribunal. In 1910, W. A. Pitt and 19 others again opened the case, and they have been informed that the case was taken up by the present Supreme Court, setting aside the former decision. They are suing for $60,000 this time.

Construction has commenced on the 305-ft. stack for the Calumet & Arizona smelter. The foundation is of concrete and slag, and its diameter is 40 ft. Steel work for the sampler is complete, as well as for the roaster dust chamber. A good deal of work is under way and 270 men are employed.

Gila County

(Special Correspondence.)—The Inspiration Consolidated Copper Co. has appointed H. Kenyon Burch, who built the Miami concentrator, as its chief mechanical engineer. He will have charge of the design and erection of the 7500-ton mill and surface plant generally. The engineering work so far has been in charge of Repath & McGregor, of Douglas, who have done excellent work; but they have their hands full in the construction of the new smelters at Jerome, Douglas, and Clifton, hence the appointment of Mr. Burch. He is also designing the new plant for the Old Dominion mine at Globe, which will double the capacity of the 500-ton concentrator. Since the death of M. E. McCarthy, superintendent of the Live Oak mine, T. R. Drummond, formerly in charge of the Inspiration mine, has been appointed superintendent of both mines.

After reaching a depth of 1015 ft. in No. 3 churn-drill hole on the Barney group, adjoining the Live Oak mine, work has been stopped. No more holes will be drilled, and the Lewisohns will relinquish their option on the property. Three holes, 1450, 600, and 1015 ft. deep, respectively, were drilled without cutting any ore, although sulphides of iron and copper were found in small quantities. No ore has been found in No. 2 drill-hole of the South Live Oak Development Co., which is over 655 ft. deep in granite. No. 5 drill-hole at the Southwestern Miami, which corresponds to No. 3 of the Barney group, has been stopped at a depth of 1015 ft., showing a little mineralized schist. This hole was put down at the junction of the Barney, Southwestern Miama, and Inspiration Consolidated properties, and the three companies shared the expense. Three more holes are being drilled, the deepest being 720 ft., and all are in schist. At the Miami mine two drills are working at the northeastern part of the property, and a large tonnage of low-grade ore is proved. Diamond-drilling is still under way on the 570-ft. level.

Globe, July 25.

Yavapai County

The Buckeye Copper & Gold Co. has been formed to develop a group of 35 claims in the Turkey Creek district, which is said to contain copper and gold ore. One thousand tons of ore is being hauled from S. J. Tribolet's mine, near Goddard, to Phoenix. The Swansea smelter was blown in last Monday. About 200 men are employed at the mine and smelter.

CALIFORNIA

Amador County

(Special Correspondence.)—Sinking has ended at the Hardenburg mine and a west cross-cut is being extended from the 1000-ft. level. This is planned to intersect the vein disclosed in the old workings. It is reported the shaft of the Bunker Hill is to be deepened and a steel head-frame built. The adit connecting with the shaft at the 250-ft. level has been reopened, permitting better ventilation and increasing the safety. In the mill 40 stamps are dropping steadily, treating ore yielding $5 to $5.50 per ton. Most of this is from the 1950 and 1750-ft. levels. July 15 the regular monthly dividend of 7½c. was paid, a total disbursement of $15,000. The Keystone company is sinking its 8 by 20-ft. shaft in hard greenstone. Last month 102 ft. was gained, considered excellent progress under prevailing conditions. A compressor, blower, and other machinery was recently installed. A steam-pump has been placed at the Defender, and unwatering of the property is well under way. The drift from the 1950-ft. level of the Lincoln has almost reached the Wildman mine, according to late reports. The drift is expected to intersect the big vein showing in the bottom of the Wildman shaft. The 10-stamp mill at the Newman mine has begun operation. A compressor and air-drills were recently installed. The mine lies near West Point. The Lockwood, in the same district, is being unwatered. The shaft has a depth of 325 ft. A new hoist was recently erected.

Jackson, July 28.

Inyo County

During the month of June the Skidoo Mines Co. treated 1186 tons of ore for bullion valued at $16,952. Development cost $1399 and operating $7819, leaving a net profit of $7734. Ten days were lost during the period.

Nevada County

An improved grinding pan has been invented by C. D. Tregoning, of Grass Valley, and a patent has been applied for. It is claimed that the new mill will grind one-third more than any mill of a similar type, taking into consideration wear and tear, and horse-power required for operation. One mill will be installed in a plant at Nevada City, and six have been ordered for Mexico. The mills will be manufactured at Grass Valley and Sacramento.

Sierra County

A wagon load of ore valued at $20,000 was delivered at the Lightner mill at Alleghany, and a jar of gold worth $4000 was on exhibition at Downieville last week. This ore and gold was from the Ironsides mine, at the head of

Jim Crow canyon, nine miles from Forest. The claim was taken up about three years ago, and within the past few weeks about $40,000 has been produced. Considerable interest has been shown in the district, and many miners are preparing to stake off surrounding country.

COLORADO

Clear Creek County

(Special Correspondence.)—The Comet mine on Griffith mountain has been sold to Charles Rowlands, of Syracuse, New York. The property will be consolidated with the Ruler holdings and development started. Nels Williams is resident manager. Work has been resumed on the Ready Cash mine at Williams Fork. Shipments will be started early the coming fall. J. T. Johnson, owner of the Merrimac mine on Kelso mountain, has a force of men at work. The adit will be extended to intersect the Merrimac vein. L. Hoery, owner of the Phonolite property on Griffith mountain, has resumed operation. Driving is in progress on a body of lead-zinc ore that is 18 in. wide. A rich discovery has been made on the McClellan mine on Leavenworth mountain, a vein 14 in. wide, assaying 1500 oz. silver per ton, having been uncovered. The shoot is showing for a length of 60 ft., while there is 65 ft. of virgin ground overhead. A shipment of 75 tons will be sent out next week. Farragher & Co., leasing at the Gambetta mine on Republican mountain, started a shipment of two carloads of zinc ore this week. The product will be consigned to Denver. The Clinton property in the Daily district is again receiving attention. Drifting is in progress, while the adit will be continued. Bergen & Co., leasing at the Elephantine property on Covode mountain, have uncovered an 8-in. vein of gold-bearing ore that will yield $18 per ton. The R. E. Deming lode on Democrat mountain is being prospected by J. W. Old. Small veins of ore are cut occasionally. Hummer & Herber, leasing at the Aetna vein, have opened a body of ore 2 ft. wide which returns $25 per ton. Shipments are going to the Combination mill at Idaho Springs.

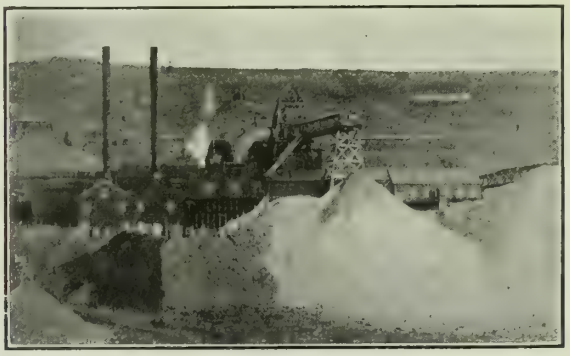
Georgetown, July 27.

Gilpin County

A number of Salt Lake men have formed a company to work the Buckley mine, on Gunnell hill. This mine is equipped with a boiler, hoist, compressor, and air drills, which have been overhauled. It is intended to sink the shaft from 630 to 830 ft., and then open out; also to prospect the upper levels of the lease where pay-ore is said to be showing. B. T. Lloyd is the manager. Operations will be resumed on the Gomer mine, in Russell district, this is an extension of the Rockford and Trail properties, which are producing ore. The Rockford is equipped with mining machinery. Ore is being broken on the 125 and 180-ft. levels of the Trail mine. The former level is in 35 ft. and shows 48 in., while the latter at 25 ft. shows 60 in. of ore. A shipment of smelting ore is being saved, and assays have returned 1.85 oz. gold, 22.2 oz. silver, and 14% copper, equal to $72 per ton. The shaft is now 200 ft. deep. Lessees at the Grand Army mine are doing fairly well. From the 1000-ft. level 10½ tons of ore yielded 1.68 oz. gold and 4 oz. silver per ton. The vein is from 6 to 15 in. wide. The 700 and 800-ft. levels of the Alps mine, Quartz hill, are being opened up. The ore is from 12 to 18 in. wide, assaying 1.25 to 2.20 oz. per ton. The Pierce mine shows 48 in. of ore on the 500-ft. level.

Teller County (Cripple Creek)

Dividend No. 35, of 2c. per share, has been paid by the Mary McKinney company. There were produced during the first six months of the year 4711 tons of ore by the company, and 1895 tons by lessees, for yields of $150,553 and $30,085, respectively, making a total of $181,046 after adding sundry revenue. Treatment and other expenses amounted to $105,072, leaving the net income $75,974. The cash balance June 30 was $88,928. A heavy flow of water came in while sinking to the ninth level, and work will be delayed for about 30 days. The total production to date is $7,450,611. The Petrel claim on Squaw mountain has shipped five cars of ore, which will average about $25 per ton. The vein being worked is from 18 to 36 in. wide. The Midget-Bonanza mine, on Gold hill, is producing nearly three carloads of ore per week. Mine gas has been troublesome at times. The erection of a mill to treat low-grade ore has been considered. The flow of water from the Roosevelt tunnel is 9640 gal. per minute, this being the average during the past six months. The water in the deep shafts of the district is receding about 4 in. per day. From the Strong shaft, below the old water-level, about two cars of high-grade ore is being produced per day. The El Paso company has almost completed sinking the Nicholls shaft to the 800-ft. level. A drift will be put in at this depth which is level with the 900-ft. of the old shaft, and the two will be connected. A new hoist is to be built at the Nicholls shaft. The mine is being examined by T. R. Countryman for certain stockholders who wish to find out the quantity of low-grade ore in sight, before a mill is erected for its treatment. At Stratton's Independence everything is in good order, and over 300 men are working on the property. A dewaterer has been erected at the mill, and the consumption has been much reduced. At Colorado City the United States Reduction & Refining Co. started treating



SHAFT OF EL PASO MINE.

the tailing from the Standard mill. Twenty-five men will be employed in the treatment of about 700 tons daily. There are 90,000 tons in the dump.

The operation of the Colburn mill, where the Moore-Clancy process is used, will be resumed in about 30 days. The rebuilding of the sampler has been delayed somewhat. Electric pumps for the Golden Cycle shaft have arrived and are to be put in at once. These pumps should reduce the present cost of lifting water by steam.

MISSOURI

The Missouri-Kansas-Oklahoma district last week sent out ore valued at $424,282, this total being the second largest return to date. There was 12,023,480 lb. of ore sold at high prices, 5,000,000 lb. coming from the Webb City-Carterville district. The J. R. Underwood mine at Granby shipped 460,790 lb. of calamine, and the yield from Galena and Duenweg was heavy.

MONTANA

Flathead County

(Special Correspondence.)—The Kootenai Power Construction Co. has commenced the construction of the power plant at Kootenai falls, 12 miles west of Libby. It is proposed to develop 45,000 hp. at the falls, and engineers are now in the field estimating the amount of power that can be sold in the district to be covered, making contracts for power, and planning the distributing lines which will have to be constructed. The work to be done includes a dam 118 ft. high and the building of a railroad bridge across the Kootenai river. It is estimated that about 20 months will be required to complete the plant.

Libby, July 29.

NEVADA

Humboldt County

The recent flood at Mazuma has been followed by the destruction by fire of the Mazuma Hills company's mill. There is just now no water-supply in the place. The origin of the fire is unknown.

Nye County

The new mill of the Tonopah Belmont Development Co. was started on July 25, and is working smoothly. Practically the same process is used as at the old mill at Millers, but there are many mechanical improvements. The plant consists of 60 stamps, 8 tube-mills, Dorr classifiers, 12 Deister tables, Pachuca agitators, and cyanide plant, and has a capacity of 500 tons daily. Pay-ore shows in the face of the drift on the Belmont vein at the 900-ft. level east; but the ore in the east drift on the vein in cross-cut 1001, on the next level, is low grade. Work has been resumed in the raise on the Shaft vein at the 1100-ft. level. On the 1300-ft. level the west drift on the Belmont vein found a good deal of water and was temporarily discontinued.

The west working on the 500-ft. level of the Manhattan Big Four company is 130 ft. long, and the northeast cross-cut has been advanced 50 ft. from the shaft. About 200,000 gal. of water is being handled daily. Ore assaying $5.60 per ton was recently cut in the old Joker tunnel. Forty tons from the Lindsay Farrish lease 100-ft. level yielded $14 per ton at the Priest mill.

At the Manhattan-Thanksgiving driving has been done on the levels above water-line. The shaft is down 425 ft. and a pump is working at this depth. A head-frame 36 ft. high has been erected at the Manhattan-Earl mine, while the electric hoist and air-compressor are on the ground.

Storey County

The mines on the Comstock report the following work for the week ended July 27: Nine tons of ore, worth $13.19 per ton, was saved in the stope under the sill-floor sets of the raise, 375 ft. from the entrance of the southwest drift on the 2400-ft. level of the Con. Virginia. The south drift at 2300 ft. is out 187 ft. in quartz and porphyry. Driving was continued on the 2000, 2200, and 2500-ft. levels of the Union Consolidated. The Mexican mill crushed 498 tons, assaying $21.15 per ton. Four bars of bullion were sent to the Selby smelter. The Ophir shipped 339 tons to the Kinkead mill. The various cross-cuts are in porphyry and quartz. Water in the Yellow Jacket shaft is 41 ft. below the 1400-ft. station, and the shaft is being repaired. Other mines are busy, and a good deal of work was completed in the C. & C. and Ward shafts of the pumping association.

A suit of three years' standing, in which the defendants claimed that certain mineral land was open to location and disputed the right of the Union Pacific railroad to transfer it by sale, has been concluded in favor of the defendants. The mining property over which the case arose is in the Peavine district, 35 miles from Reno. This is an interpretation of the disputed law, with regard to mineral lands found on grants by the Government to railroad companies, and holds that title to such lands in instances of that kind, does not rest with the companies to whom it is transferred, irrespective of the transfer by deed of parts of the land by grant. The defendants had opened up ore on land which had been obtained by purchase by the plaintiffs from the Union Pacific. The grant as originally made to this company included every alternate section of land for a distance of 20 miles on each side of its line through Nevada. Most of this land has been transferred by sale or lease to private owners, but this decision will affect titles to mineral land only.

About 265,000 tons of tailing lying near the Cordelli ranch, on the Carson river, has been leased by D. Prentiss from W. Douglass. The tailing is the result of milling Comstock ores many years ago; and is estimated to contain $7,000,000. A cyanide plant will soon be erected.

NEW MEXICO

Grant County

Production from the Chino, for June, amounted to about 1,540,000 lb. of copper, as compared with 1,431,000 lb. in May and 1,415,000 in April. The steam-shovels in the first section of the mine are now in clean sulphide ore, which gives a good extraction in the mill.

Santa Fe County

On July 24 the smelter of the San Pedro Gold & Copper Co. was blown in. At present there are 200 men at the mine and smelter. The company has 3400 acres of property. The smelter, which has a capacity of 100 tons per day, is 21 miles from the Santa Fé railroad and 18 miles from Stanley. The copper matte will be refined at El Paso.

OREGON

Josephine County

Over 3000 acres of placer ground on Grave creek, fourteen miles from Grant's Pass, has been bought by the Oro Power & Light Co., of Oroville, California. Drilling is to be started at once, and it is said that about $250,000 will be spent in prospecting and placing dredges on the property. The furnace at the Almeda mine was blown in last week, but several details are not yet completed, and these will take some 90 days. A fair quantity of smelting ore is ready for mining. Until the 200-ton concentrating plant has been erected it will be impossible to cheapen operations. The completion of the company's road from the mine to Leland should make a saving of about $7 per ton on freight.

Lake County

The Eureka Milling & Amalgamating Corporation was formed last week, with the object of erecting a custom plant for the High Grade district. The site for the mill has been chosen, and work will soon be started.

TEXAS

Brewster County

(Special Correspondence.)—A reawakening of active development in mining operations in the Quitman mountains district has begun with the reopening of the Bonanza mine, a zinc-lead-silver property, which has just been purchased by J. H. Johnson of Parral, Mexico, and associates. The holdings as obtained from the former owners, the Republic Mine & Milling Co., cover an entire section, one mile along the vein. Work has begun on the 300-ft. drift west from the shaft on the 150-ft. level and also on a drift east on the same level. The main shaft of the mine is about 300 ft. deep, with drifts on different levels. A 25-hp. gasoline hoist, superintendent's house, bunk and boarding houses for employees compose the improvements. Zinc and lead-silver ore which is easily extracted by hand is being taken out. Two cars of zinc have just been shipped from Lasca to Neodesha, Kansas. The lead-silver ore is being shipped to El Paso. The zinc ore is sphalerite or zincblende and assays from 40 to 57% zinc. The two carloads averaged 44% zinc. The lead ore is principally galena and averages 65% lead and 45 to 50 oz. silver per ton. The rich pay-streak runs from one foot to 18 in. wide in the upper levels, and as wide as 4 ft. in the lowest. About 30 men are working on the property.

The Bonanza mine was originally discovered in 1884 by T. R. Owen and George F. Miller, and was worked by them to a depth of 80 ft. Shipments were made to Kansas City smelters of ore averaging $40 in lead and silver. These ores were lead carbonates with bunches of galena. In 1885 Bush Stevenson, of El Paso, purchased the property and worked it for several years, sinking a work-shaft 252 ft., hoisting a whim, and doing considerable driving and stoping. It is said that the first owners took out over $1,000,000 of zinc and lead-zinc ore. Much rich ore was thrown over on the dump during this time, as there was no available market for the zinc ores. It was discovered that the mine was on railroad land, the Texas & Pacific

railroad securing title after suing Mr. Stevenson. After lying idle for a dozen years, it was purchased by a Weatherford, Texas, company, which erected a dry-concentrating and separating mill, with gasoline engine, crushers, and two tables, and began working on the dump ores in addition to taking ore from the mine. Operations soon ceased, however, owing to the unsatisfactory results obtained from the mill.

Alpine, July 29.

UTAH

Salt Lake County

(Special Correspondence.) — The electrification of the Parvenue adit of the Utah Apex, a neighbor of the Utah Consolidated at Bingham, is practically completed, and the management hopes to increase the output. For some time 50 tons of concentrate and 100 to 125 tons of crude lead ore was shipped daily, and this has now been increased to about 200 tons per day.

Salt Lake City, July 29.

The Cardiff M. & M. Co. is shipping 40 tons per day assaying $50 per ton. This ore comes from the south drift of the upper adit-level. A winze is now down 85 ft. from this level, and will be sunk 150 ft. farther to connect with the lower adit, which is now in 530 ft. The north drift from the upper adit is out 350 ft., with ore on each wall.

The mines and mining committee of the Commercial Club was last week addressed by E. L. Wolcott, assistant secretary of the American Mining Congress. It is asserted that certain legislation will make it a hard matter to secure patents on mining claims, and a revision of laws is necessary, because, through recent rulings and interpretations, they have become so involved and stringent as to virtually stop extension of mining in the West.

Summit County

(Special Correspondence.)—The Snake Creek adit, which is being driven by a company backed by the Daly-Judge and other Park City interests, is now in about 5000 ft., or about one-third the contemplated distance. A flow of 3600 gal. of water per minute has been developed, and this is being sold for irrigation. The face is in limestone, with indications of mineral.

Salt Lake City, July 29.

Tooele County

The quantity of lead ore being received at the Tooele plant of the International Smelting & Refining Co. is greater than the present capacity, so it is intended to erect a fourth furnace at once. Work on No. 3 smelter is being pushed, and by the end of the year the plant should have a capacity of 1200 tons per day. Five Dwight-Lloyd sintering machines are also being erected, making nine in all. The bag-house is being extended. Further enlargements are expected to meet increasing deliveries of lead ore.

WISCONSIN

(Special Correspondence.)—Business is lively among the zinc mines in the southwestern part of the state. It is expected that the output this year will be worth even more than last. The Mineral Point Zinc Co. is increasing production at the Coker and Rajah. The Fox and the Kennedy are holding out well, and the mills 'pitch' in the Winnebago is proving exceptionally good. The south pitch in the same mine is yielding a lot of milling ore. The company recently bought the mining rights on the Ryan farm, near Galena, Illinois. Next to the Mineral Point company the Vinegar Hill Zinc Co., is the leading producer. W. N. Smith the active manager now has the Vinegar Hill, Trinity, Raleigh, Raisbeck, Wilkinson, and Ellsworth steadily producing, and is drilling on the Scrabble Creek and Hodge. The Wisconsin Zinc Co. is also expanding. The Interstate Power Co. is building rapidly from the south and the Mineral Point Power Co. from the north. There is a lively race to see which shall control the Mifflin fields. Highland is quiet, but producing steadily.

Potteville, July 19.

CANADA

British Columbia

On September 18 and 19 next, there will be a meeting of the Canadian Mining Institute at Victoria. It is hoped there will be a representative attendance, as the main object of the meeting is to afford Western members an opportunity to voice their views on certain business affairs of the Institute, including proposed amendments to the by-laws. Part of the time will be devoted to reading and discussing papers. Arrangements are also being made for a meeting at Lethbridge, in Alberta. E. Jacobs is secretary of the Western branch of the Institute.

Porcupine District

Four shafts at the Dome Lake mine are down 170, 160, 170, and 110 ft., respectively. Two veins are being developed, there being two shafts on each, about 900 ft. apart. These should soon be connected at the 100-ft. level. On the south end of the claim the lode is about 18 ft. wide for a good length, and shows pay-ore. Shafts C and D are on a rich vein, and 500 samples, taken over 800-ft. length, averaged $23.80 per ton. Diamond-drilling has been continued to 500-ft. depth. A trial shipment at the Kingston School of Mines returned $44 per ton. A plant consisting of 10 stamps and tube-mill is to be erected this year. The Porcupine East Lake company has decided to spend $20,000 on sinking shafts and general development. The annual meeting of the Dome Extension company was recently held in Toronto. After paying sundry debts, the credit balance was $15,338, while 199,993 shares remained as a reserve. Four shafts were sunk, totaling 639 ft., the total footage on all development being 2277 ft. On the 100-ft. level, from No. 4 shaft, a large lode was opened, and 30,000 tons, worth $5 per ton, is in sight. Five diamond-drill holes were put down, with an aggregate depth of 3450 feet.

Ontario

A slight mechanical change in the construction of the Deister slime-table has enabled F. Reid, mill superintendent at the Coniagas, to increase the efficiency of this table. An arrangement has been made with the manufacturers of the tables to have them introduced in other centres. It appears that tests have already been made in the Coeur d'Alene and Globe districts. The new table has been patented. The Toronto Metal Chemicals, Ltd., has purchased the old plant of the Electric Steel Co., and 10 acres of ground, at Welland. It is intended to erect a large plant in which Cobalt ores will be treated by a new process. During the week ended July 19, silver bullion weighing 153,888 oz. was shipped from Cobalt, the total for the year to this date being 2,680,100 ounces.

Yukon

There has been a scarcity of water at Eureka creek, consequently only about half of the dumps have been washed. C. Hill and G. J. Stephens have been digging a ditch 5000 ft. long, so as to get water to finish sluicing. The general clean-up on the creek seems to have been satisfactory. One hundred and seventy-seven claims on Dominion creek and its tributaries have been transferred to the Dominion company; 29 on Quartz creek to the Calder company; 22 on upper Eldorado to the Deepvale company; 64 on Dago hill and 22 on Last Chance to the Dago Hill company; and 13 claims on benches on the right limit of the Dominion to the Big Creek company. This business was filed at the gold commissioner's office by A. N. C. Treadgold.

MEXICO

Sonora

The West Cananea mine is employing about 35 men, and is increasing its ore shipments. A new double-compartment shaft is being sunk at the Cananea-Boston property. The Mexican Metals company has 35 men working in the Alacran mine and the 10-stamp mill. The ore contains silver, zinc, lead, and copper.

Concentrates

Most of these are in reply to questions received by mail Our readers are invited to ask questions and give information dealing with the practice of mining, milling, and smelting.

PRINCIPAL air-compressor plants on the Panama canal are at Los Cascadas, Empire, Rio Grande, and Balboa. These furnish air to the Central and Pacific divisions and along the high line around Gold Hill on the relocation of the Panama railroad. For the year ended June 30, 1911, the total output of these plants aggregated 8,261,199,541 cu. ft. of free air, at a cost of 0.0324c. per 1000 cubic feet.

LAUNDERS made of wood are, on the whole, preferable to those of iron or steel, as the latter seem to be eaten away fairly quickly, especially if waters are slightly acid. Hot cyanide solutions also attack them. To prevent a wood launder from being cut out with coarse mill-pulp, tack old belting on its sides and bottom. This lasts a long time, and costs nothing save for the labor of fitting in a launder.

BARYTES occurs in veins as a gangue of metallic ores, also in veins in sandstone and limestone or as a replacement of limestone. The mineral has a wide range in geologic time and an extensive distribution. In the United States the principal sources are, however, limited to two districts, the Missouri and the Appalachian. A single county in Missouri—Washington county—produced about 45% of the total output.

ARSENIC is used mainly in glass-making, in pigments, and insecticides. The use of paris green (aceto-arsenite of copper) in paint is somewhat limited on account of its piosonous quality. As an insecticide it is used largely by gardeners, orchardists, and farmers. If pure, it is comparatively harmless to plant life, owing to its insolubility, but the trioxide is often present in some quantity, and if paris green is then used it is fatal to plants, especially in dry climates, where it is not soon washed off by rains. Experiments conducted by a number of the state agricultural experiment stations have demonstrated the value of arsenic when combined with lime as an effective spray against insect pests.

POWDER SMOKE can be quickly cleared from the face of an adit, where ventilation is secured by the use of a small blower and the usual galvanized-iron pipe, by reversing the direction of the blower. The smoke is thus sucked into the pipe and carried away without becoming mixed with the air of the adit or drift. A method commonly employed where machine drills are used is to turn on the compressed air just before firing the round of shots and allow it to escape continuously while the smoke is clearing away. The disadvantage of this is that the use of compressed air is an expensive means of securing ventilation, and since the smoke must be driven out through the full cross-section of the drift, a much longer time is required to clear away the smoke.

ANTIMONY is used as an adulterant in solder, but is considered an objectionable element, especially if the solder is to be used for sealing cans holding provisions. Antimony trioxide is used as a pigment in place of white lead and zinc oxide. It is also used for making the glass used to coat iron in enameled ware, as a reducing agent in chemical work, and as a detector of alkaloids and phenols. Antimony in various forms is used in medicine. The trichloride, also called antimony butter, is used in bronzing iron, especially gun barrels, as a mordant for patent leather, in coloring zinc black, as a mordant for silver, and in the manufacture of lakes, particularly from dyewoods. In some forms antimony is used in dyeing, and the trisulphide is used in fireworks for making 'Bengal fire.'

Personal

Professional men are invited to send news of their engagements and travels. Such news is interesting to friends.

J. P. KEENE is back from Siberia.

M. K. RODGERS is in San Francisco.

JOHN B. FARISH is in San Francisco.

J. W. WHITEHURST is in San Francisco.

E. H. BENJAMIN has returned from Chicago.

J. H. MACKENZIE has returned from Alaska.

DONALD F. IRWIN is at Pasadena on a holiday.

G. W. SCHNEIDER was in San Francisco this week.

C. W. PURINGTON left London July 20 for Nome, Alaska.

WALTER LYMAN BROWN has left the Gold Coast for London.

HOWARD A. POILLON has returned to New York from Mammoth, Arizona.

H. D. SMITH has returned to San Francisco from the Santa Maria oilfields.

Information is wanted concerning JAMES C. MASON, last heard of at Los Angeles.

JOHN B. E. BELL is engineer for the Ft. Bidwell Con. Co., at High Grade, California.

MORRISON B. YUNG has returned from China and is at the Yale Club, New York City.

ERROL MACBOYLE, who has been in the hospital for appendicitis, is now at home and doing nicely.

DONALD F. FOSTER has gone to Prestea Block A by way of Secondi, Gold Coast Colony, West Africa.

HENRY H. ARMSTEAD has returned to Guanajuato, Mexico, from New York, and will be there about three months.

CHARLES POIRIER has resigned as manager and engineer at the Vipond mine to return to general consulting work.

FRED B. REECE, after spending two years near Quito, Ecuador, is now with the Dome Mines, Ltd., at Porcupine, Ontario.

J. A. CHESTNUT and W. W. WISHON have been visiting the properties of the Corem Mining Co., near Parker, Arizona.

W. S. TANGIER SMITH has removed from Reno, Nevada, to Berkeley, California, and will devote his time to general consulting work in geology.

C. M. EYE, who recently returned from a seven years residence in the Philippines, has accepted the management of the Concheño mines of the Corrigan-McKinney company, situated in the Rayon district of Chihuahua. Until resumption of regular mail service in Chihuahua, Mr. Eye's address will be the Concheño Mining Co., 420 Boberts-Banner building, El Paso, Texas.

Obituary

W. H. SPENCER, a long time mining man, died at Nyack, New York, July 10, and was buried at Haileybury, Ontario.

M. E. MCCARTHY died of heart failure on July 16 while returning from the Inspiration mine to Globe. He was manager of the Hovland and Smith properties for the past six years, and had developed the Live Oak mine of the Inspiration Consolidated from a prospect. He was one of the best liked mine managers in the district.

H. O. PELLHAM, a native of New York state, engaged in mining in Mexico for the past fifteen years, died June 3 at Calabacillas, Chihuahua, of congestion of the lungs. He had charge of several wells at the Lluvia de Oro, Topia, Calabacillas, and other places, was liked and respected by the Mexicans and all Americans.

Market Reports

LONDON QUOTATIONS

(By cable, through the courtesy of C. S. Burton & Co., New York.)

	August 1.
Camp Bird Ltd	$ 6½
El Oro	3⅜
Esperanza	6½
Oroville Dredging	1½
Santa Gertrudis	7½
Tomboy	6⅜

COPPER SHARES—BOSTON

(By courtesy of J. C. Wilson, Mills Building.)

	Closing prices, August 1.		Closing Prices August 1.
Adventure	$ 8¼	Mohawk	$ 68
Allouez	45⅜	North Butte	30½
Calumet & Arizona	75¼	Old Dominion	57
Calumet & Hecla	528	Osceola	116
Centennial	22	Quincy	90
Copper Range	57½	Shannon	17⅜
Daly West	5	Superior & Boston	1½
Franklin	11½	Tamarack	42
Granby	54½	Trinity	5¾
Greene Cananea, ctf.	10	Utah Con	12¾
Isle-Royale	35⅜	Victoria	3
La Salle	6¾	Winona	5⅛
Mass Copper	6⅜	Wolverine	109

NEVADA STOCKS

(By courtesy of San Francisco Stock Exchange.)

San Francisco, August 1.

Atlanta	$ .27	Mexican	$2.60
Belcher	.35	Midway	.61
Belmont	9.50	Montana-Tonopah	2 37
B. & B.	.08	Nevada Hills	2.05
Booth	.08	Ophir	1.00
Chollar	.11	Pittsburg Silver Peak	.97
Combination Fraction	.17	Round Mountain	.40
Con. Virginia	.38	Savage	.10
Florence	.90	Tonopah Extension	2.85
Goldfield Con.	3.90	Tonopah Merger	1.12
Gould & Curry	.05	Tonopah of Nevada	6.80
Jim Butler	.66	Union	.63
Jumbo Extension	.40	Vernal	.13
MacNamara	.22	West End	1.67

OIL SHARES

(By courtesy of San Francisco Stock Exchange.)

San Francisco, July 2.

Associated Oil	43.25	Monte Cristo	$ 1.30
Brookshire	.40	New Pa Pet	.55
Caribou	.75	Palmer	.45
Claremont	.65	Palmer Union	.18
Coalinga Central	.20	Premier	.40
De Luxe	.75	Republic	.33
Maricopa 36	.30	United Oil	99.25
Maricopa National	.18	W. K. Oil	2.00

MINING STOCK QUOTATIONS—NEW YORK

(By wire from C. S. Burton & Co., New York.)

	Closing Prices. August 1.		Closing Prices. August 1.
Amalgamated Copper	$ 82⅛	Miami Copper	$ 29½
A. S. & R. Co.	83	Mines Co. of America	3
Braden Copper	6⅞	Nevada Con	21½
B. C. Copper Co.	5½	Nipissing	7¾
Chino	31½	Ohio Copper	¾
First National	2	Ray Con	20¾
Giroux	4⅛	Tenn. Copper	41⅛
Goldfield Con.	4	Tonopah Belmont	9⅜
Greene-Cananea	10⅛	Tonopah Ex	2⅛
Hollinger	13½	Tonopah Mining	6⅝
Inspiration	18⅝	Trinity	6
Kerr Lake	2⅜	Tuolumne Copper	3
La Rose	3⅜	Utah Copper	61½
Mason Valley	13½	West End	1⅜
McKinley-Darragh	1¾	Yukon Gold	3⅜

ASSESSMENTS ON COMSTOCK MINES.

Company	No.	Del. Board	Sale Day	Amt.
Yellow Jacket	41	July 4	Aug. 12	.10
Chollar	17	July 7	Aug. 5	.10
Union Con.	30	July 12	Aug. 7	.15
Utah	15	July 12	Aug. 6	.05
Confidence	59	July 15	Aug. 9	.20
Gould & Curry	23	July 19	Aug. 12	.05
Con. Imperial	76	July 28	Aug. 21	.01
Con. Virginia	21	Aug. 11	Sept. 5	.20
Belcher	98	Aug. 15	Aug. 30	.10

LOCAL METAL PRICES

San Francisco August 1.

San Francisco is not a primary market for the common metals except quicksilver. The prices quoted below therefore represent sales of small lots and are not such as an ore-producer could expect to realize. Ore contracts usually call for settlements on the basis of Eastern prices, less freight and treatment charges. The prices quoted are in cents per pound, except in the case of quicksilver, which is quoted in dollars per flask of 75 pounds.

Antimony	11—11¾c	Quicksilver (flask)	43
Electrolytic Copper	17¾—18c	Tin	50—51½c
Pig Lead	5.00—5.95c	Spelter	8—8½c

Zinc dust, 1400 lb. casks, per 100 lb., small lots $9.50—9.75; large $7.50—8.50

METAL PRICES

(By wire from New York.)

NEW YORK, August 1.—Copper prices are now stronger and a better demand for the metal in this country is clearly apparent. Lead is easier with no change in immediate prospect. Spelter remains firm and prices are steady.

Average daily prices for the past week, in cents per pound, based on wholesale transactions, standard brands, are given below.

Date.	Electrolytic Copper.	Lead.	Spelter.	Silver, per oz.
July 25	17.48	4.73	7.13	60⅝
" 26	17.48	4.73	7.08	60⅝
" 27	17.48	4.73	7.08	60⅝
" 28	Sunday.	No market.		
" 29	17.45	4.73	7.08	60½
" 30	17.45	4.73	7.05	60
" 31	17.45	4.73	7.05	60¼

SILVER

Below is given the average New York quotation, in cents per ounce, of fine silver for the months indicated:

	1911.	1912.		1911.	1912.
Jan.	53.81	56.25	July	52.57	60.67
Feb.	52.23	59.06	Aug.	52.17	....
Mch.	52.76	58.37	Sept.	52.43	....
Apr.	52.32	59.20	Oct.	53.37	....
May	53.31	60.88	Nov.	55.77	....
June	53.04	61.29	Dec.	54.85	....

COPPER

Daily quotations on copper as published in this column represent average wholesale transactions on the New York market and refer to electrolytic copper. Lake copper commands normally from 1-5 to 1-4c. per lb. more. Below are average monthly quotations in cents per pound:

	1911.	1912.		1911.	1912.
Jan.	12.29	14.09	July	12.47	17.19
Feb.	12.26	14.08	Aug.	12.41	....
Mch.	12.14	14.68	Sept.	12.20	....
Apr.	12.02	15.74	Oct.	12.19	....
May	11.99	16.03	Nov.	12.61	....
June	12.39	17.23	Dec.	13.55	....

COPPER SURPLUS

Figures showing the visible supply of copper at the beginning of each month are now widely available. Below are given the amounts, in pounds, known to be available at the first of each of certain months.

		U. S.	European.
January	1910	141,766,111	244,961,280
January	1911	122,030,195	230,264,280
November	"	134,997,642	176,816,640
December	"	111,785,188	164,151,680
January	1912	89,454,695	178,329,920
February	"	66,280,643	153,820,800
March	"	62,939,988	141,125,680
April	"	62,367,557	137,806,000
May	"	65,295,368	134,176,000
June	"	49,615,643	117,801,600
July	"	44,335,004	107,817,920

UNITED STATES PRODUCTION AND CONSUMPTION

(Compiled from reports of the Copper Producers' Association)

	Production.	Domestic deliveries.	Exports.
June 1911	124,554,312	61,655,561	71,460,519
July	112,167,934	56,982,582	74,880,658
August	125,493,667	59,935,364	69,885,660
September	115,588,950	57,311,584	50,824,011
October	118,255,442	64,068,656	60,084,349
November	111,876,601	68,039,776	67,049,279
December	122,896,697	65,988,474	79,238,716
Total for 1911	1,431,938,338	709,611,945	754,932,733
January 1912	119,337,753	62,343,901	80,167,904
February	116,035,809	56,228,368	63,148,096
March	125,694,601	67,847,556	58,779,566
April	125,694,001	69,513,846	53,252,326
May	126,737,836	72,702,237	69,485,945
June	122,315,240	66,146,229	61,449,650

LEAD

Lead is quoted ordinarily in cents per pound or dollars per hundred pounds delivered at St. Louis or New York. The difference is normally 15c. per hundred pounds, and any larger or smaller difference is promptly met by sales. The daily price in New York is published each week in this column. Below are the average quotations by months:

	1911.	1912.		1911.	1912.
Jan.	4.48	4.43	July	4.50	4.71
Feb.	4.44	4.03	Aug.	4.50	....
Mch.	4.39	4.07	Sept.	4.48	....
Apr.	4.41	4.20	Oct.	4.27	....
May	4.37	4.20	Nov.	4.30	....
June	4.34	4.40	Dec.	4.45	....

ZINC

Zinc is quoted as spelter, standard Western brands, and based upon St. Louis or New York delivery. While New York quotations, as a matter of convenience, are commonly used, relatively little spelter actually goes to or comes from New York. The bulk is shipped direct from the plants in the Mississippi Valley to manufacturers, due allowance being made for freight. New York daily quotations are published in this column each week. Below are given averages by months:

	1911.	1912.		1911.	1912.
Jan.	5.45	6.42	July	5.70	7.12
Feb.	5.52	6.50	Aug.	5.95	....
Mch.	5.56	6.57	Sept.	5.86	....
Apr.	5.40	6.63	Oct.	6.10	....
May	5.35	6.68	Nov.	6.38	....
June	5.50	6.88	Dec.	6.30	....

Zinc-dust is quoted separately, the price being based upon the cost of spelter in Illinois and the cost of preparation. About half the zinc-dust used in the United States is imported through San Francisco. Delivery prices are determined largely by quantities and contracts.

QUICKSILVER

The primary market for quicksilver is San Francisco, California, being the largest producer. The price is fixed in the open market, and, as quoted weekly in this column, is that at which moderate quantities are sold. Buyers by the carload can usually obtain a slight reduction, and those wanting but a flask or two must expect to pay a slightly higher price. Average monthly quotations, in dollars, per flask of 75 lb., are given below:

	1911.	1912.		1911.	1912.
Jan.	44.60	43.75	July	48.00	43.00
Feb.	48.40	46.00	Aug.	50.00	....
Mch.	52.50	46.00	Sept.	47.50	....
Apr.	50.90	42.25	Oct.	46.12	....
May	46.50	41.75	Nov.	45.50	....
June	46.50	41.30	Dec.	44.50	....

TIN

New York prices control in the American market for tin, since the metal is almost entirely imported. San Francisco quotations, averaging about 5c. per lb. higher than New York, are quoted weekly in this column. Below are given average monthly New York quotations in cents per pound:

	1911.	1912.		1911.	1912.
Jan.	41.25	42.53	July	42.40	44.25
Feb.	41.61	42.96	Aug.	43.32	....
Mch.	40.16	42.58	Sept.	39.75	....
Apr.	42.18	43.92	Oct.	41.18	....
May	43.11	46.05	Nov.	43.12	....
June	44.61	45.76	Dec.	44.65	....

Current Prices For Chemicals

(Corrected monthly by Braun-Knecht-Heimann Co.)

Prices quoted are for ordinary quantities in packages as specified. For round lots lower prices may be expected, while in smaller quantities advanced prices are ordinarily charged. Prices named are subject to fluctuation. Other conditions govern Mexican and foreign business.

	Min.	Max.
Acid, sulphuric, com'l, 66°, drums, ℔ 100 lb	$0.75	$1.00
Acid, sulphuric, com'l, 66°, carboy, ℔ 100 lb	1.00	1.50
Acid, sulphuric, C. P., 9-lb. bottle, bbl., ℔ lb	0.13	0.18
Acid, sulphuric, C. P., bulk, carboy, ℔ lb	0.09½	0.12
Acid, muriatic, com'l, carboy, ℔ 100 lb	1.60	3.00
Acid, muriatic, C. P., 6-lb. bottle, bbl., ℔ lb	0.15	0.20
Acid, muriatic, C. P., bulk, carboy, ℔ lb	0.10½	0.15
Acid, nitric, com'l, carboy, ℔ 100 lb	5.25	6.50
Acid, nitric, C. P., 7-lb. bottle, bbl., ℔ lb	0.16	0.22
Acid, nitric, C. P., bulk, carboy, ℔ lb.*	0.12½	0.15
Argols, ground, bbl., ℔ lb	0.20	0.25
Borax, cryst. and conc., bags, ℔ 100 lb	2.75	3.85
Borax, powdered, bbl., ℔ 100 lb	3.00	4.00
Borax glass, gd. 30 mesh, cases, tin lined, ℔ 100 lb	10.00	13.00
Bone ash, 60 to 80 mesh, bbl., ℔ 100 lb	4.50	5.50
Bromine, 1-lb. bottle, ℔ lb	0.55	0.65
Candles, adamantine, 12 oz., 40 sets, ℔ case	3.50	4.15
Candles, adamantine, 14 oz., 40 sets, ℔ case	4.00	4.55
Candles, Stearic, 12 oz., 40 sets, ℔ case	4.95	5.50
Candles, Stearic, 14 oz., 40 sets, ℔ case	4.65	5.20
Clay, domestic fire, sack, ℔ 100 lb	1.50	2.00
Cyanide, 98 to 100%, 100-lb. case, ℔ lb	0.20½	0.24½
Cyanide, 98 to 100%, 200-lb. case, ℔ lb	0.20	0.24
Cyanide, 129%, 100-lb. case, ℔ lb	0.27½	0.28½
Cyanide, 129%, 200-lb. case, ℔ lb	0.26½	0.27½
Lead acetate, brown, broken casks, ℔ 100 lb	8.75	9.65
Lead acetate, white, broken casks, ℔ 100 lb	10.00	10.25
Lead acetate, white, crystals, ℔ 100 lb	11.75	12.25
Lead, C. P., test., gran., ℔ 100 lb	13.00	15.00
Lead, C. P., sheet, ℔ 100 lb	15.00	18.00
Litharge, C. P., silver free, ℔ 100 lb	10.50	13.00
Litharge, com'l, ℔ 100 lb	7.50	9.00
Manganese ox., blk., dom. in bags, ℔ ton	20.00	25.00
Manganese ox., blk., Caucasian, in casks, ℔ ton (95% MnO_2—½% Fe)	42.50	50.00
Nitre, double ref'd, small cryst., bbl., ℔ 100 lb	7.00	8.00
Nitre, double ref'd, granular, bbl., ℔ 100 lb	6.50	7.50
Nitre, double ref'd, powdered, bbl., ℔ 100 lb	7.25	8.00
Potassium bicarbonate, cryst., ℔ 100 lb	12.00	15.00
Potassium carbonate, calcined, ℔ 100 lb	15.00	18.00
Potassium permanganate, drum, ℔ lb	0.11	0.12½
Silica, powdered, bags, ℔ lb	0.03	0.05
Soda, carbonate (ash), bbl., ℔ 100 lb	1.50	1.75
Soda, bicarbonate, bbl., ℔ 100 lb	2.00	2.50
Soda, caustic, ground, 98%, bbl., ℔ 100 lb	3.15	3.50
Soda, caustic, solid, 98%, drums, ℔ 100 lb	2.65	2.85
Zinc shavings, 850 fine, bbl., ℔ 100 lb	11.80	13.00
Zinc sheet, No. 9—18 by 84, drum, ℔ 100 lb	10.00	11.25

*Extra charge for packing nitric acid for shipment to conform to regulations.

Current Prices for Ores and Minerals

(Corrected monthly by Atkins, Kroll & Co.)

The prices are approximate, subject to fluctuation, and to variation according to quantity, quality, and delivery required. They are quoted, except as noted, f.o.b. San Francisco. Buying prices marked *.

	Min.	Max.
Antimony ore, 50%, ℔ ton	*$20.00	$22.50
Arsenic, white, refined, ℔ lb	0.04	0.04½
Arsenic, red, refined, ℔ lb	0.08	0.09
Asbestos, according to length and quality of fibre, ℔ ton	100.00	350.00
Asbestos, lower grades, ℔ ton	5.00	50.00
Asphaltum, refined, ℔ ton	10.00	20.00
Barium carbonate, precipitated, ℔ ton	42.50	45.00
Barium chloride, commercial, ℔ ton	42.50	45.00
Barium sulphate (barytes), prepared, ℔ ton	20.00	30.00
Bismuth ore, 10% upward, ℔ ton	*75.00	upward
Chrome ore, according to quality, ℔ ton	10.00	12.50
China clay, English, levigated, ℔ ton	15.00	20.00
Cobalt metal, refined, f. o. b. London, ℔ lb	2.50	
Coke, foundry, ℔ 2240 lb	13.50	15.00
Diamonds:		
Borts, according to size and quality, ℔ carat	2.00	15.00
Carbons, according to size and quality, ℔ carat	50.00	90.00
Feldspar, ℔ ton	5.00	25.00
Firebrick:		
Bauxite, ℔ M	175.00	
Magnesite, ℔ M	190.00	275.00
Silica, ℔ M	42.50	47.50
Flint pebbles for tube-mills, ℔ 2240 lb	19.50	22.50
Fluorspar, ℔ ton	10.00	15.00
Fullers earth, according to quality, ℔ ton	20.00	30.00
Gilsonite, ℔ ton	35.00	40.00
Graphite:		
Amorphous, ℔ lb	0.01½	0.02½
Crystalline, ℔ lb	0.04	0.13
Gypsum, ℔ ton	7.50	10.00
Infusorial earth, ℔ ton	10.00	15.00
Magnesite, crude, ℔ ton	5.00	7.50
Magnesite, dead calcined, ℔ ton	23.50	27.50
Magnesite, brick (see firebrick).		
Manganese ore, oxide, crude, ℔ ton	10.00	25.00
Manganese, prepared, according to quality, ℔ ton	30.00	70.00
Mica, according to size and quality, ℔ lb	0.05	0.30
Molybdenite, 95% MoS_2, ℔ ton	400.00	500.00
Monazite sand (5% thoria), ℔ ton	150.00	200.00
Nickel metal, refined, ℔ lb	0.45	0.60
Ochre, extra strength, levigated, ℔ 100 lb	2.25	3.25
Platinum, native, crude, ℔ oz	40.00	45.00
Silex lining for tube-mills ℔ 2240 lb	32.50	35.00
Sulphur, crude, ℔ ton	15.00	25.00
Sulphur, powdered, ℔ ton	40.00	45.00
Talc, prepared, according to quality, ℔ ton	20.00	50.00
Tin ore, 60%, ℔ ton	450.00	475.00
Tungsten ore, 65%	390.00	455.00
Vanadium ore, 15%, ℔ ton	150.00	180.00
Wolframite (see tungsten ore).		
Zinc ore, 50% up, ℔ ton	*15.00	20.000

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EDITORIAL

FIRE is one of the ever-present dangers in mining that is all too little considered. Because of the confined circulation a relatively small fire has repeatedly caused large loss of life. Since mine structures are nearly always temporary and are designed for short life only, fire-proof construction is seldom practicable. Added to this is the fact that at many mines water is extremely scarce. All in all, the danger from fire deserves more careful consideration, and the mine manager who does not have well matured plans for fighting fire, as well as efficient apparatus, is criminally careless. We print this week the outline of a proposed comprehensive study of fire risk around mines, and commend it heartily to our readers. If each will send to Mr. R. Y. Williams, secretary of the committee, notes on his experience and suggestions that have grown out of it, an excellent and helpful report should result.

NEVADA was admitted as a state during the Civil War, and as Nevada's vote gave Lincoln a bare majority in Congress in support of his war measures, it became the savior of the nation; a fact that citizens of the state like to remember. The souvenir edition of the *Nevada State Journal* recalls this bit of history and contains much of interest in regard to the resources and industries of the state. The mines of the Comstock Lode had much to do with the early building of the West, by contributing wealth, and by acting as a magnet to attract immigration. The practice of mining as developed in the Comstock mines was carried through all the districts of the West and many successful operators received their early training in the levels and stopes of these famous mines. That mining is still the leading industry of Nevada is evidenced by the long list of producing companies operating within its boundaries. Ely, Tonopah, Goldfield, and Virginia City are all names to conjure with, and any state may well be proud to claim these districts. Reports of the county auditors show the gross value of the yearly production of the mines in the state to be $32,000,000.

ANNOUNCEMENT that Hayden, Stone & Co. have taken an interest in the Alaska Gastineau properties will be read with great interest. The principal mine involved is the Alaska Perseverance, though coupled with it are properties on Sheep creek to the south. The group constitutes the southern part of the great lode that runs through Silver Bow basin back of Juneau. To the immediate north is the Alaska Juneau, and beyond that the Ebbners. The large size of the orebodies has been established. Up to the present none of the properties on this lode have been adequately financed, and with ore worth but $1.50 to $2.50 per ton, large scale operations are imperative. It is proposed to tap the Alaska Gastineau orebodies at depth by means of an adit and to erect a large mill on the channel below Juneau, following essentially the same lines as already adopted by the Alaska Juneau and discussed last week. There is every prospect of success, since failure in the past was due rather to bad financing than poor mining, Mr. John R. Mitchell, the man on the ground, having made the best of a poor situation. With

the death of W. J. Sutherland the properties came under the control of Messrs B. L. Thane and W. P. Hammon, and now that adequate funds are to be provided, another large low-grade gold mine in the Juneau district would seem to be assured.

COLORADO is feeling much encouraged over present prospects. Crops are in good condition and promise an unusually large return. As agriculture is now so large a factor in the business of the state, this means much. While final figures of mineral production in 1911, compiled by Mr. C. W. Henderson for the United States Geological Survey and printed on another page, show a slight decrease as compared with 1910, they do not tell the whole story. It is well known that development of tungsten and other rare-mineral mines has gone on *pari passu* with the fall in output of gold and silver. Zinc production continues to increase, and the copper output, while always small in Colorado, is growing. The rise in the price of silver has helped, and the deeper levels at Cripple Creek are doing their part in augmenting gold production. More important, however, is the progress being made in treatment of low-grade ore. The Independence, Portland, and Ajax mills at Cripple Creek have each shown that ore long thrown over the dump can be made to yield a profit. With perfection of metallurgical processes it should be possible to treat ore in Colorado of as low value as in South Dakota or Alaska. Water, fuel, and intelligent labor are available. Living conditions are excellent, and growth of other industries, while it detracts attention from mining, should in the end bring down costs. No one who knows Colorado doubts that her mountains contain large stores of unfound metal, and no one who knows her people doubts that there will be steady progress in methods. The last few years have been hard, but prospects are now excellent.

ALASKAN conditions were excellently reviewed in a recent address by the energetic and well informed Governor of that territory, Mr. Walter E. Clark. We elsewhere print a part of what he said. It will come as a shock to many, even now, to know to what extent the common functions of government have been neglected, and anyone familiar with the difficulty in obtaining legislation at Washington will hope that at least some measure of self-government will be granted to Alaskans. In so large a territory with so scattered a population any government will be expensive, so that the simple form now proposed at Washington is better than the more complete territorial governments that served in what are now states. Help from the national treasury will be needed in Alaska for many years, but the period of probation will be much shorter if a vigorous and statesmanlike program of railroad building and development be resolutely taken up. We may not all agree as to theories of government ownership, but we should be willing to face facts, and, as we see it, the only practicable means of opening Alaska now is through government building of trunk lines and leasing of the coal lands. Public sentiment will not sanction a return to old conditions of staking as regards the land, or to bond guarantees or land grants in aid of roads. To stubbornly insist on such a rereturn is as fatuous as to refuse to vote money for a railroad line because of a prejudice against government ownership. Trunk line railroads in Alaska, privately owned, do not pay and will not pay except on the basis of exploitation rather than development of the adjacent territory. The America people have had a bitter taste of that in many Western communities and are not likely to repeat the experience. To make new mistakes may be condoned, but to make the same mistakes repeatedly is unpardonable.

Politics and Business

Politics is booming, and so is business. This is an unusual coincidence. Usually activity in politics destroys industry. This year, however, as political wheels revolve, they but keep time to the wheels of industry; and political wires are not more strained than are the more prosaic ones that carry ordinary messages of bargain and sale. The condition demands explanation. Ordinarily the year of a presidential election in the United States is a hard one for business men. No one is ever entirely certain of the result until the votes are counted, and even those who feel sure as to the outcome of the election, are not sure how the public will react. Notable booms and equally notable depressions have followed elections. Four years ago there was no real doubt as to the approaching election of Mr. W. H. Taft. There was, however, great doubt as to the result. He was squarely and fairly on record as favoring a tariff revision, and in popular belief the revision was to be downward. Many business men remained skeptical, and as it proved wisely so, as to any substantial decrease of duties. No one knew the terms upon which business was to be transacted through the succeeding four years, and those who could do so shortened sail. There was in addition a deep resentment among many leaders of industry, against Mr. Roosevelt for his radical and often erratic program. It was felt that a determined effort should be made to capture the new administration and check tendencies held to be dangerous. The effort was made, and was successful; the new administration being promptly heralded as 'safe and sane.' It was to be 'progressive,' but not too aggressive.

The result was hardly what was hoped or anticipated. The general public had looked upon Mr. Taft as having been elected to continue the work begun by Mr. Roosevelt, and whatever may be individual opinion as to his fidelity to the trust, there can be no doubt that he signally failed to satisfy the people. The past four years, as a result, have been spent in constant political turmoil. The conservative element won in framing the Payne-Aldrich tariff act, but thereby precipitated a longer and more bitter fight. With ever present prospect of still other changes, business men kept close to the financial shore. Mr. Taft and the Attorney General, Mr. G. W. Wickersham, instituted and fought through the courts a series of suits dissolving the great corporations popularly known as 'trusts.' By their insistence on the letter of the Sherman act, they scared and worried business men, though in the end accomplishing nothing that appealed to the public as substantial. Dissolving the trusts and thereby restoring competition has become a joke. As one result of the past four years the Republican party has gone to pieces. The leaders have kept the machinery but lost the voters, and at present the party is like a Central American army, composed mainly of generals. Whether it can be reconstructed or not is not now apparent. Mr. Roosevelt was undoubtedly the choice of the majority of Republican voters for standard bearer this year. At Chicago he was defeated in convention by sharp practice; by the same political tricks and devices that have been repeatedly used in the past. Hard names mend no broken bones, and it does little good to shout 'thief.' We have an impression that iteration and reiteration of the term has hurt the progressives rather than helped them. Mr. Roosevelt's most serious limitation, politically, has long been his inability to see that others were traveling in the same direction, if they chanced to be on another road. Many of the men who defeated him at Chicago were quite as sincere in considering it their duty to crush what they believed to be a dangerous movement led by a rash man, as

was he in fighting to secure from the convention the endorsement that was already his by right of expression of the voters at the primaries. The result was inevitable. Any compromise was not only impossible, but would have merely aggravated the situation. The conservatives had their way in the nomination of Mr. Taft, and as a necessary corollary Mr. Woodrow Wilson was nominated by the radical Democrats at Baltimore. Both are men of high character and ability, and with the issue sharply defined it would have seemed that there was no room for a third party candidate, especially in view of the long series of unsuccessful efforts to build up a third party.

This situation has not, seemingly, discouraged Mr. Roosevelt and the men associated with him, and the Progressive party has now been formally launched. Essentially it consists of the more radical part of the old Republican party. Whether it ever comes to include more will be determined by the course of events in the next four years rather than in the next three months. It is hardly likely that the Progressives expect to elect Mr. Roosevelt, though they will undoubtedly carry some states and make a showing in the electoral college. From a political point of view, their play is to thoroughly discredit their late opponents in the Republican party by making Mr. Taft run third in the race. It will be well worth their while to do so, even in the face of certain defeat at the hands of the Democrats, and the attempt to build up a national party free from sectionalism is one in which there is much to commend. As to the immediate result there is every reason to anticipate Mr. Wilson's election. He will lose few votes to the Progressives, since he is as much a radical candidate as is Mr. Roosevelt, and with the loaves and fishes so near at hand, the experienced politicians in the Democratic party are not apt to desert in order to join the Republicans in almost certain defeat. The trouble will come after the election. Mr. Wilson's nomination was notoriously forced upon the managers of his party, and they, as astute politicians, will make the same effort after his election, if he be elected, to control the administration, as was made by 'the organization' in the Republican party after Mr. Taft came to the chair. Whether they succeed or fail, the result seems equally certain to split the Democratic party as it has the Republican. Four years from now the Progressives, as an effective fighting force, will either form the nucleus around which all the radicals may centre, or, in case Mr. Wilson retains control of his party and succeeds in losing Tammany and other undesirable elements, will fuse with the Democrats. In either event it is unlikely that there will be any sharp change in policy or any aggressive program for four years. In other words, business must face at least four more years of substantially the same political conditions as in the four that have just closed. Whoever is elected president, and whatever party may control Congress, there will be tariff revision; but it seems certain that the lowering of the rates, to which majority sentiment has now come to be favorable, will be slow. As to trust legislation there is less certainty. Mr. Taft may 'run amuck' with prosecutions, but little practical harm to business seems to result. Mr. Roosevelt would favor Federal supervision, but has no illusions as to the ability or necessity of the government to dissolve trusts. Mr. Wilson, while protesting against exploitation by 'big business,' will necessarily go slow, and the long record of the Democratic party in favor of state's rights assures that any Federal regulation drafted by it will be slight. Some such bill as that introduced by Mr. John Sharp Williams, and an excellent bill it is, would stand the best chance of enactment by Democrats.

In the meantime, business men are tired of politics. Initiative, referendum, and recall may be all that their advocates proclaim—but a man must make a living. A business man cannot indefinitely stay out of the market either for spite or through fear of what may happen. Nothing very radical has yet come about, and the bark of the radical has been worse than his bite. The country has had a needed rest from speculation, prices are good, crops are good, and a little good nature is all that is needed to set off a veritable boom.

Land Fund of the Institute

An appeal is being made by Dr. James Douglas, as chairman of the committtee of the American Institute of Mining Engineers, for funds with which to discharge the debt incurred when the Institute joined the American Society of Mechanical Engineers and the American Institute of Electrical Engineers, in accepting Mr. Carnegie's gift of an engineering building in New York. The whole matter has again come to the front in connection with the report of the Committee of Five, which we have already discussed. Briefly, Dr. Douglas states that toward the original debt of $180,000, a total of $112,000 has been subscribed and $106,000 paid. To clear the remaining dept, $21.14 is required per paying member. If, however, the amount be paid in five annual installments the contribution of each should be $4.71 per year. Since, however, the mortgage is not due till 1925, an even smaller amount per year would permit the annual payments to be met. For our part, we believe that if the economies in administration already proposed by the committee do not permit the annual payments to be made, such a small temporary increase in dues should be voted. Any attempt to make the increase large enough to pay the whole sum in five years or less, would doubtless lead to many resignations. We have no fear that the money will not be raised, and in due time, but we hope it will come in the form of numerous small subscriptions. There is one phase, however, of Dr. Douglas' appeal that invites comment. The proposal to accept the building and buy the ground was agreed to by an affirmative vote equal to 99.25 per cent of the membership. On the other hand, the money so far subscribed has come from 91 members. Five members have given over half the total, and $93,000 has come from subscriptions of over $1000 each. Clearly, the wealthy members of the Institute have, in the main, done their part. Another surprising fact is that $95,000 of the total has come from members residing in New York and Pennsylvania. Western members, while voting enthusiastically for the project, have not generally subscribed to the fund. Colorado is the only state west of the Mississippi from which as much has been subscribed as has been given by members resident in England, Australia, and Mexico. Utah, Nevada, Arizona, South Dakota, New Mexico, Oregon, and Washington have given nothing, unless they have a part in the $64.67 credited to "scattering U. S." California has a proud total of $450, while Montana has contributed $100. We think that when Western members see these figures and realize the situation they will wish to wipe out the inequality in the showing, regardless of the final action that the Institute may take. Any scheme for temporary raising of dues and any funds derived from economies in operation, will fall alike on those who have given and those who have not, but we do not believe that Western members want the record to stand as it is, and we urge all who can do so to send checks to Dr. Douglas at once. The Institute is going through a period of reorganization. It is certain to be a much more vital organization in the future, and the keynote of the new régimé is to be active participation by all the members. This is an excellent time for a little advance participation.

Gold Placers of Arizona—Dry Washings of Value

By T. Lane Carter

Arizona is known as one of the greatest copper districts of the world. It now leads in the United States, having left Michigan and Montana far behind. It will be a surprise to some that this great copper state is also a large producer of gold, amounting in recent years to from $2,500,000 to $4,300,000. A large portion of the gold of Arizona comes as a by-product from copper smelting. There are some free-milling gold mines of considerable value, and with the recent improvements in cyaniding, it is possible now to treat auriferous ores that until lately were useless.

The amount of gold taken from placers in Arizona is comparatively small. Scattered over the state are thousands of acres of gold-bearing material which could produce millions if Arizona were well watered instead of semi-arid. The scarcity of water has been the main drawback to the development of this industry in Arizona. Many men have been at work on the problem of getting the gold out of these placers without the use of water. In some parts of the state the problem is complicated, as it is in Sonora, Mexico, by the fact that the gold-bearing material is held together by a calcareous cement, necessitating the disintegration of the gravel before the gold can be taken out.

Machines such as the Quener disintegrator have been designed, to break up the gravel before it is treated by a 'dry-wash' process. It is only recently that the idea of using these refined methods of extracting the gold from the Arizona placers by 'dry washing' has been taken up. For many years individual miners, both the peons of Mexico and the white men, have been getting out gold from the placers of Arizona without the use of water. The methods used were most crude, requiring material of very high grade to make it worth while. I have inspected stretches of gold-bearing gravel in Arizona and noticed here and there small excavations showing where the dry-placer men had been 'high-grading' the country. On occasions in the past there has been a regular rush to certain districts of Arizona where the ground was reported to be rich, and individual miners could get out a high daily wage by simply 'rocking' the material.

On the Hassayampa river there have been several such local excitements in the past. At one time there was a camp of about 100 men on the banks of the river about 60 miles north of Phoenix. These men were busy picking out the rich spots in the placer ground and working them in a crude way by 'dry washing.' While none made fortunes, a great number of gold nuggets were found, and the majority of the men did very well as long as rich ground was found. To work the material successfully it had to be perfectly dry. A slight shower would so dampen the earth that the men could do little or nothing for many days. Their working time was, therefore, rather uncertain and limited. Now and then one comes across a couple of lonely miners in Arizona trying to make a living by 'dry washing' the placers. Many of these men are Mexicans, and they stick at the work far better than the white men because they are more easily satisfied and generally have a flock of children and relatives to help in the work. A photograph accompanying this paper gives a view of a small hand machine used by the Mexicans in Arizona. There are few finer mining climates in the world than that of Arizona. In placer mining, the climate is of large importance, as all know who have tried to carry on placer work in northern Alaska or Siberia. There will never be trouble in the Hassayampa district from freezing water or burst pipes.

Until the engineer becomes acquainted with the peculiarities of the placer ground along the Hassayampa river he is liable to be much mistaken in the value of the ground.

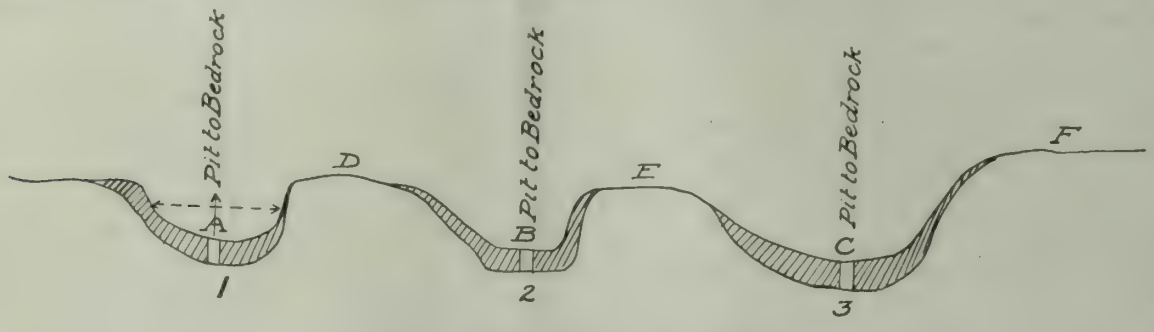


Fig. 1. Cross-section of the placers.

As a general rule the country is full of small, narrow passages or 'washes', down which the water rushes to the river after a torrential rain. This peculiarity is illustrated graphically in Fig. 1. To the engineer going up the 'washes' *A*, *B*, and *C*, and examining the ground, he will find, perhaps at 1, 2, and 3, very rich placer ground if he puts down pits to bedrock. On testing the ground up these 'washes' he will find that the depth of the material rapidly pinches out on either side of the 'wash' until it gets to the top, where, as at *D*, *E*, and *F*, there is no pay-dirt at all. As these 'washes' are far apart, it will be seen that there is a comparatively small tonnage at any one place. For this reason a number of capable engineers have condemned the region around the Hassayampa river in the past, saying that while there are rich spots of high-grade placer ground, the tonnage at any one place is so small that it will not pay to work it by modern methods. While this in general is true, there are exceptions to the rule, as at a property which I recently investigated on the Hassayampa river.

Instead of the narrow 'washes' as illustrated in Fig. 1, I found there a stretch of placer ground in 'washes' averaging 1200 ft. wide, and about 2½ miles long. The average depth to bedrock of this material is 10 ft., and the average value per cubic yard, as determined by hundreds of pits sunk to bedrock and thousands of pannings of the material, is 40 cents. As these 'washes' contain about four to five million cubic yards of placer ground, it is obvious that this property is in an entirely different class from many of the other Arizona placer properties which have been examined and condemned.

The property is about 45 miles northwest of Phoenix, Arizona, and five miles from the station of Morristown on the Santa Fé railroad. The mine is well situated at an elevation of about 2000 ft., and, as is usual in Arizona, the health conditions are ideal in spite of the excessively high temperature in the summer. The property consists of nearly 4000 acres of placer ground. As the roads lead-

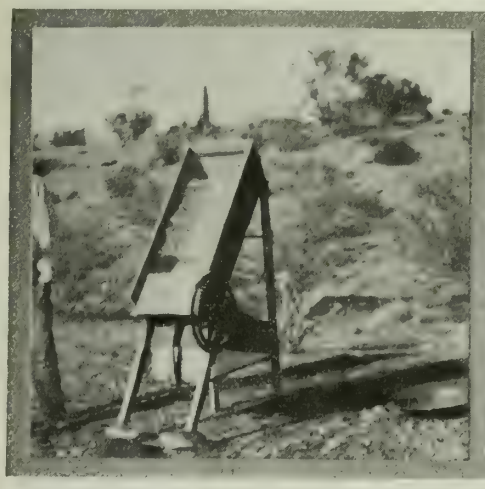
ing from the station to the mine are good, there is no difficulty in transporting freight from the railroad. The water runs away so rapidly after the heavy rains that the roads are never muddy for more than a few hours.

This placer ground is situated in a rolling country, the highest point in the immediate neighborhood being San Domingo mountain or hill, about a mile or so from the mine. The surface is scarred by frequent watercourses, down which the water runs in torrents after a heavy rain to the Hassayampa. The watercourses are so steep that this water stays only a short time after a heavy storm. The property, which is called the Lotowana mine, was found a few years ago by John Sanger, who noticed a few Mexicans working here and there, 'dry washing' the rich spots of the ground, but only obtaining from one-quarter to one-third of the gold. To his experienced eye it was obvious that here was the making of a big mine, if modern methods were introduced. He wisely gave up all attempts to mine the gold by the crude method generally adopted, and devoted all his attention to staking out and buying claims, feeling that if he could show up a large profitable tonnage it would be practical to get water to the ground and treat this gravel.

The geology of the district is most interesting. There has been considerable denudation. Many of the rocks in the mountain and hill to the rear of the placer carry gold in minute quantities. The placer ground which it is proposed to work on this property has been formed in the accumulation of débris coming down from the low mountains, composed of pre-Cambrian schists, gneisses, and granites. The limestone, which in some places cements the gravel, is of Paleozoic age. The mineralizing agents are the intrusive rocks, granites, and porphyries. Micaceous schists which outcrop in the northern part of the property dip to the south. In the schists near the property are numerous quartz veins, most of them barren, but in the surrounding country are large quartz veins and schists assaying high in gold. It is possible that profitable auriferous quartz veins will be found in the mountains back of the Lotowana ground. What strikes the visitor, is the enormous amount of quartz of all kinds scattered around the country, not only in the placer itself, but on the top of the hill. The district is distinctly a gold-bearing one, and from a high point the engineer can see in the distance several famous mines, the nearest being the Vulture, which is entering upon a new period of prosperity.

In most placer deposits the rich parts of the dirt are found near bedrock, but here there is a remarkable uniformity of gold content. I found that the mineral carried gold from the grass roots to bedrock. In one pit sampled, about 15 ft. deep, it was noticed that the first 7 ft. went 16 'colors' to the pan, while the lower 8 ft., which ordinarily would carry the most gold, had 11 'colors' to the pan. The reason for this is that the gold has been deposited in these 'washes' very gradually, and there has not been a concentration of the gold on the bedrock such as is generally found in placers that have been formed by swift-flowing rivers. That the gold has not traveled far is proved by the fact that it is very angular; entirely different from the round water-worn nuggets seen in the placers of California and elsewhere. The majority of engineers, on examining samples of gold from the Lotowana mine, would declare it came from a vein rather than placer ground.

As is usual with gold from placer mines, the fineness of the metal on this property is high, being 900 and over. There is practically no 'float' gold, and the percentage of recovery in washing operations will therefore be high. Most of the gold will be caught in the riffles near the top of the sluice-boxes, but as a precaution mercury should be used at the lower end of the boxes. The question of the physical character of the gold is, of course, a most important one in placer mining. Many a property which has shown gold in profitable quantities has proved a failure in working conditions because the gold was in 'float' form and could not be caught in sluice-boxes, even when mercury was used. If the gold is coated or greasy, it also frequently runs away when sluiced. I know of several placer properties in the United States on which large amounts of capital have been spent which have been dismal failures because the question of whether or not the gold could be caught by ordinary methods was not considered.



HAND MACHINE USED IN ARIZONA DRY PLACERS.

DRY PLACERS ALONG THE HASSAYAMPA RIVER, ARIZONA.

Another interesting point in regard to the gravel on the Lotowana mine is the absence of clay. The material is more or less sandy, and is easily disintegrated. There are no big boulders. As the rocks in the 'wash' have not traveled far, they are angular. To handle this material, either with mules and scrapers or machinery, will be simple. Near the Hassayampa river the thickness of the 'wash' increases, and in a few places it is formed into a conglomerate by means of lime infiltration, but as there is a huge tonnage of more available material, this conglomerate need not be touched for many years. Another important feature is the character of the bedrock. When the bedrock is hard it causes much annoyance and damage to machinery; also, there is the danger of losing gold. The bedrock of this placer ground is good, being rather soft and even. It will probably be found that the gold has sunk into the interstices of the bedrock for a distance of nearly six inches, and it will no doubt pay to work off the top of the bedrock. A large amount of black sand is present in the dirt and consists of magnetite and other iron minerals as well as pyrolusite. The black sand is not auriferous.

About 350 to 400 acres of the Lotowana ground has been thoroughly tested by pits to bedrock. The tested area is known as 'Rogers Wash.' There are a number of

other similar 'washes' in the 4000 acres owned by this company which have not yet been tested. One good pit to bedrock for every five acres is often considered sufficient to test placer ground. This would mean that only 60 or 70 pits would be necessary to prove up 'Rogers Wash', but several hundred pits have been in fact sunk. By cutting out a cubic yard of the material and measuring it, it was determined that 140 pans make a cubic yard. By washing a panful of dirt and catching the gold and weighing it, the value per cubic yard is readily calculated. In testing this ground track was kept of all pans, noting the 'colors' to each and carefully saving the gold. The gold was dried with a small amount of black sand and then cleaned by blowing until only the gold was left. This was weighed, and, the amount of material panned to get this gold being known, the value per cubic yard was calculated. The usual method of sampling is to catch all the gold with mercury, then dry off the mercury, and weigh the remaining fine gold. This method would give a higher value than the one used.

In quartz mining it is customary to divide the ore into three heads; positive, probable, and possible. The same division may be used in placer mining. In the Lotowana mine the part known as 'Rogers Wash' can be considered positive ore. It is about 2½ miles long, averages 1000 ft. wide, and about 9 ft. deep, varying from 1 ft. at the head of the 'wash' to nearly 20 ft. at the foot. In it there is approximately 4,395,600 cu. yd. of material. The average of hundreds of pannings made on this ground is 40c. per cubic yard. There are strips which go far higher, and if the material were selected a large tonnage running 70 to 80c. could be found. But the whole tonnage is profitable and should be worked.

The question as to what the cost will be to work this material is one on which there might be considerable difference of opinion. I estimate it at 10c. per cubic yard. For a few months after starting operation, the cost will be higher, but when the Ledgerwood machines, which it is proposed to use on this ground, get into full swing, the cost should be below rather than above 10 cents.

The 'probable' ore in the Lotowana mine amounts to millions of cubic yards of material. The placer ground in the other 'washes', as already mentioned, has not been proved, but judging from the indications of 'dry washing' and the few tests that have been made, the expenditure of a comparatively small amount of money to dig pits to bedrock would give proof of gravel worth several million dollars. As regards the 'possible' ore, it is my opinion that some day it will pay to hydraulic the high gravel banks on each side of the 'washes'. As there is sufficient material proved to last for years, it is premature to consider the 'possible' ore at this time.

As already intimated, the gold-bearing ground of this property is ideal for sluicing. The only problem to solve to make the mine a big producer is that of water supply. Had water been available, this ground would have been worked long ago. The problem is a difficult one, but can be solved. There are two ways to get water: (1) by building a reservoir and storing the water behind a dam; (2) either by pumping water from the Hassayampa river or building a dam in the river so that the water can be brought to the placer ground by gravity.

The Transvaal is probably the most striking example of the results that can be obtained by storing rain-water for mining operations. Few people unacquainted with the Rand realize that all the water used in that great district is obtained by storing. The same thing has been done in the United States. The success already demonstrated in Arizona in the Roosevelt dam shows what can be done in Arizona. Compared with the Transvaal, Arizona has some disadvantages in the storing of water. In the first place, in Arizona the summer heat is terrific, temperatures of 110 to 120°F. being common during the hot season. Then the dry season is somewhat longer than in the Transvaal. The watershed in the Hassayampa River district, however, is better than the catchment area in the Transvaal. Being thoroughly familiar with the conditions in Arizona and the Transvaal, I believe in the case of the Lotowana property that the problem can be solved, an ideal site for a dam being available. There are stretches of placer ground in other parts of the Hassayampa River district which cannot be worked with water, for there is no dam-site for miles around. Even if operations could only be carried on for six or eight months at the Lotowana mine with stored water, the running time would still be longer than is obtainable in cold climates like northern Alaska and British Columbia. In my opinion this particular deposit on the Hassayampa river will pay well, even if worked only for eight months out of the year.

There is a good dam-site for the proposed reservoir about 9000 ft. from the head of 'Rogers Wash', and the elevation of the lowest point of the dam will be about 90 ft. above the 'wash', so that all the water will run to the ground by gravity. To build the dam will cost about $15,000 and the reservoir, when finished and full, will contain between 90,000,000 and 100,000,000 gallons. The path for the pipe-line to 'Rogers Wash' will be sinuous, and a riveted pipe of 10 or 12 in. should be used. During my examination there were three days of almost continuous rain in the district, and I calculated that with the enormous watershed that would direct the water into such a reservoir, the dam would have been running over before the three days' rain had ceased.

Although a small start has been made on the Lotowana property by handling the material with mules and scrapers, it is proposed to install Ledgerwood excavators. These machines have proved most successful in several other parts of the world, as in Siberia and California. The scheme is to run the water from the dam to 'Rogers Wash' by gravity, excavate with the Ledgerwood machine, wash the screened gravel, and catch the water in a small reservoir below the workings and then pump it back to be used over. The same idea is employed in the Transvaal, where the water is pumped back to the mill and used repeatedly.

The question of the cost of power is most important. Fortunately, the conditions for power are good; the Santa Fé railroad running within a few hundred feet of the property, it will be possible to deliver fuel oil by rail. It is proposed to use the Diesel engine for pumping.

A far more ambitious scheme is to throw a dam across the Hassayampa river and use this water for washing the ground. This will be expensive, but feasible. It is locally believed the Hassayampa river cannot be dammed, because years ago an incompetent man put a less competent dam across the river and the floods carried it away; but there would be no difficulty whatsoever in damming the Hassayampa. In order to carry out this scheme, it would be necessary to go up the river eight or nine miles and bring the water through pipes to the Lotowana ground. This scheme will take a lot of money, but it is worthy of careful investigation. From what I saw I believe that it is practicable, and that in the long run it would pay better than to build a reservoir. If the total cost of working can be cut down to 5 or 6c. per cubic yard, there are millions of tons of material running from 12 to 18c. per cubic yard which can be treated.

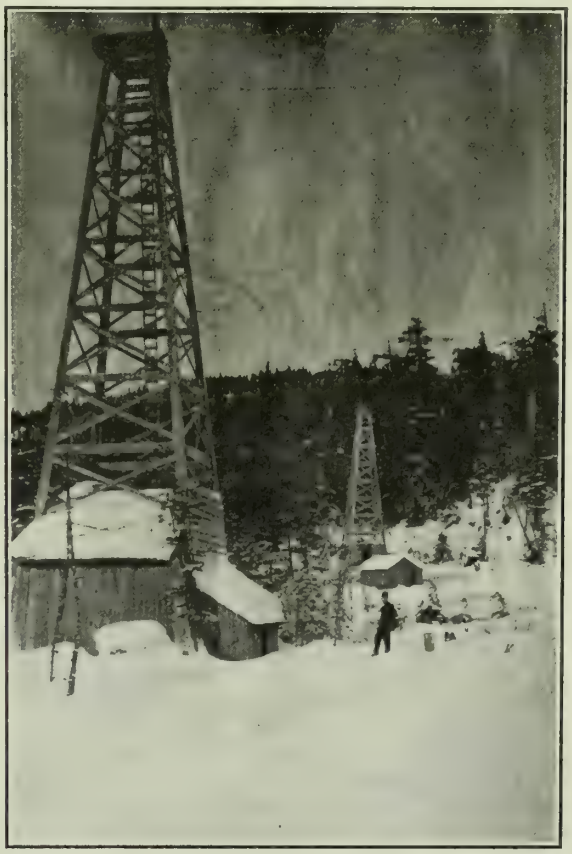
I fully realize the task of solving the water question in this part of Arizona where the rainfall is never over 15 inches annually, and the evaporation during the summer months is so excessive. While it is true that most of the placer ground along the Hassayampa river is so scattered that there is not a large enough tonnage in one place to justify the expenditure of large sums of money, I know that in the Lotowana and surrounding claims there is sufficient gold to warrant the solving of the water question. If a dam is built on the Hassayampa river, there will be water not only for placer work, but for irrigation as well. Before a careful survey is made, one cannot state the cost of such a project, but the amount of gold in sight is large enough to justify this careful survey. It is my belief that it will show that the scheme of getting water from the Hassayampa river is feasible.

The Katalla, Alaska, Oilfield

By Arthur Thompson

Few people in the United States know that there is an area extending along the coast of Alaska for more than a hundred miles which contains pertoleum. In fact, the Alaska coast land eastward from the Copper river delta almost to Icy bay, at the foot of Mount St. Elias, is underlain with oil-bearing strata. Hundreds of seepages of oil are scattered along this belt and extend some distance back from the sea. It is not generally known, even in Alaska, that there are producing oil wells at Katalla, near the western end of this oil belt, and that these have been yielding petroleum of an especially high quality for more than a year, and that a little refinery situated near

OIL SEEPAGE NEAR KATALLA.



OIL WELLS AT KATALLA.

the wells has been making gasoline and kerosene from this oil. The westerly or Katalla part of this oil belt was reconnoitred by G. C. Martin, of the U. S. Geological Survey, in 1906, and was reported as oil bearing and favorable for exploration. This report,* including maps of the region, was published by the Government, and may be obtained of the United States Geological Survey at Washington, D. C. The larger area to the east has never been explored by the Government geologists. In it are many large seepages and other favorable indications of oil.

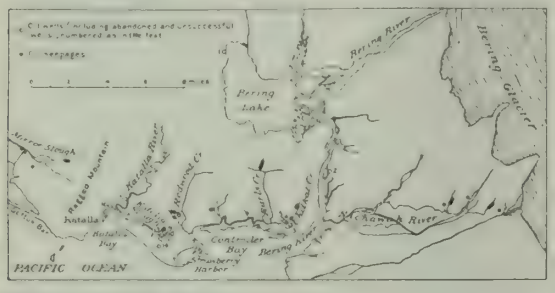
Analysis of the oil shows that it has a paraffine base and contains about 38.5% naphtha and gasoline, and about 31% of kerosene, the remainder being paraffine and lubrication oils of high quality. The petroleum produced from these wells contains such a high percentage of the lighter volatile oils that persons sending out samples have been accused of 'doctoring' the oil. Gasoline produced at the local refinery is shipped to the coast towns, Katalla, Cordova, and Valdez, where it is in great demand for use in launches and in gasoline engines on account of its high efficiency, being preferred to the gasoline imported from the states. Valdez, which is the centre of a prosperous gold and copper mining region, has a dock controlled by the municipality, where the Alaska gasoline is given a half rate, the wharfage charge being 50c. per ton on local gasoline, and $1 on the imported article.

These facts are significant. They indicate that the coal of the Bering river and the Matanuska fields, when finally put upon the market, may have a strong competitor in the native oil of this same region. This crude oil is too valuable to use as a fuel as it comes from the wells. Two-thirds of its content may be taken out in gasoline for use in gas-engines and kerosene for lighting, and the remainder may be sold for fuel purposes, or it may be still further refined, yielding valuable lubricating oils, heavy greases, paraffine, and many by-products. It is worth several times as much per barrel as the fuel oil of California. While the oil world may look more or less complacently upon the opening of a new field in California producing a heavy asphalt oil, there will be a great oil excitement and an unprecedented period of development in this part of Alaska when further exploration shall demonstrate, as I believe it will, that there is a vast oil belt in Alaska which contains an incalculable amount of the finest petroleum in the world.

The Alaska coast, along which this oil belt lies, is skirted by a low range of mountains from 1000 to 2000 ft. high, which rise abruptly from the coastal plain a few miles from the sea. Along the base of this range, upon the seaward side, and extending up the 'draws' and gulches to the top of the range, are hundreds of seepages of oil. It

*"Geol. and Min. Res. Controller Bay Region, Alaska,' Bull. 335, U. S. Geol. Survey.

is thick and dark green in appearance, the volatile gases having largely evaporated. It will burn fiercely when a match is applied, but this is a rather dangerous experiment on account of the large amount of gas around these seepages. They are numerous on each side of Katalla, for a distance of about 30 miles; also for about the same distance eastward from Yakataga, at the eastern end of the belt. The mountains of this range are composed of alternating strata of sandstone and shale, with a few strata of conglomerate. The mountains in the Yakataga section rise somewhat precipitously from the coastal plain on the seaward side, and the alternating strata of white sandstone and dark shale rock, having a strike parallel with the range itself, give the range a beribboned appearance for miles which is very striking. The territory between the Katalla and the Yakataga sections is occupied in part by the wide alluvial deposits of several glacial rivers, which issue through brakes in the mountain range and have their sources in the main Alaska range, 30 to 50 miles back. The evidences of oil are not so abundant here, although



(Martin, U. S. Geol. Surv.)

KATALLA OILFIELDS.

seepages are found in these river valleys upon the farther or northerly side of the coast range, some 10 or 12 miles from the sea.

Along certain portions of this range for miles seepages occur in every gulch and 'draw,' forming small pools and dribbling rivulets of oil. In places whole mountain-sides at the base seem to be saturated with the oil, evidences of which can be found by digging to bedrock almost anywhere. Some streams, such as Johnson creek, carry so much oil down to the sea that its irridescent colors can be seen on the surface of every pool and eddy, and the peculiar odor of the oil can be detected half a mile distant when approaching the stream. There is a little lake of oil near the head of this stream. In winter the freezing of the water causes the stream to rise and fall between its banks of snow, which become saturated with oil for a distance of two or three feet, vertically, giving a peculiar yellowish color to the snow. In places gas rises with the oil, and in many places there are gas seepages where no oil appears.

The inhabitants of this section find the oil useful for many purposes. At Yakataga an auriferous sea-beach has afforded a living for a little community of miners for many years. Some of these men have set barrels in the seepages, which are so arranged that the water is discharged and the oil remains. They find the oil convenient for building fires; they also use it for lubricating and other purposes.

At Mirror slough, in the extreme western part of the Katalla region, there is a large gas seepage, which, when lighted, will continue to burn till the tide comes in and extinguishes it. The fresh oil from the wells is very explosive, and may be lighted with a match held at some distance from the oil.

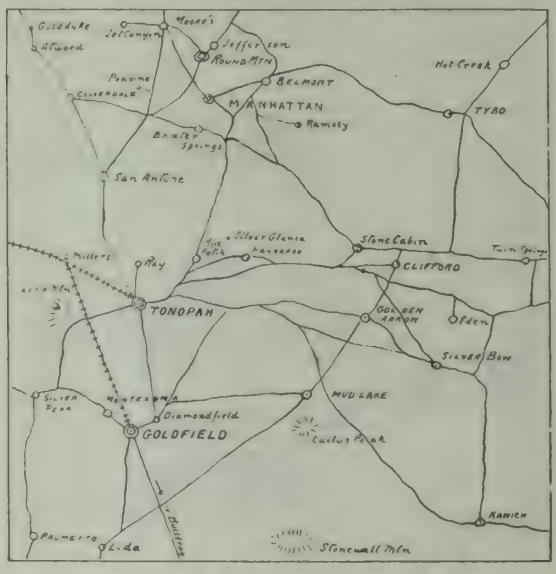
Preparations are being made at Katalla for a more extensive prospecting of the field. The oil thus far obtained comes from a stratum not far below the surface of the ground, though some of the wells have penetrated below this. It is thought by many that this oil has worked its way up through crevasses and cleavage in the formation and has spread its way through the receptive sandstones near the surface. It is believed that deep drilling will be necessary to determine the source of the oil supply. Owing to the large amount of gas made by the wells, and the pressure, it is thought that when the oil is found at depth, it will be under great pressure. It seems certain that an oil belt of this extent, where probably hundreds of barrels of oil are thrown off by seepages every month, must have a large body of oil behind it.

Antelope Mining District of Nevada

This district, which takes its name from an important group of springs, is about thirty miles east of Goldfield, in the southern part of the Cactus mountains, one of the desert ranges, between 6000 and 7000 ft. in elevation. It is connected with Goldfield by good wagon, automobile, and stage lines. The district was examined last January by F. C. Schrader, and the U. S. Geological Survey has just issued a brief report (Bull. 530-J) upon the district, written by him.

Gold was discovered here in 1903, when the region was visited by a wave of prospectors that followed in the wake of the Tonopah boom. Since that time several isolated prospects have been held, but the discovery of high-grade ore which caused the formation of the present camp was made in November 1911. Soon after that date there were more than 150 men in the district prospecting and making locations, and by the close of the year, a $15,000 five-day option had been taken on the discovery claim.

When Mr. Schrader visited the district two townsites were being developed, supplies and machinery coming in,



MAP SHOWING SITUATION OF CACTUS PEAK.

some ore was being hauled out, and considerable ground had been opened, but development was still confined to the 'oxidized' zone. The discovery shaft at that time had reached a depth of 23 ft. and practically all the material excavated from it—about 30 tons—was ore that averaged about $200 per ton, and contained some rich bunches. The deposits are silver and gold, which are found in or associated with veins and fissures in the rhyolite. The veins are about 20 in number, ranging in width from 1 to 20 ft. Some of them are persistent and have a known extent of 2000 or more feet. The valuable ore minerals are chiefly horn silver, argentite, and gold. Four-fifths of the value is in silver and one-fifth in gold. Some of the ore contains considerable free gold, which may be extracted mechanically in panning. The light color of this gold indicates that it is alloyed with native silver. According to latest accounts, received in April, the outlook for the district is encouraging. The 'main strike' shaft had at that time attained a reported depth of 85 ft., with continuation of the ore favorable in amount and grade. Good ore has also been found at several other places, and plans are made for the early building of a mill.

Mine Fire Protection

Serious consideration of the problem of protecting mines from fires has been undertaken jointly by the National Fire Protection Association and the United States Bureau of Mines. The inquiry is under the direction of a committee consisting of H. M. Wilson, R. Y. Williams, Albert Blauvelt, J. Parke Channing, Washington Devereux, B. W. Dunn, Ira H. Woolson, J. W. Paul, and R. V. Norris. Appointment of this committee was authorized at the fifteenth annual meeting held in New York, May 23, 1911. The committee held its first or organization meeting in Pittsburg, Pennsylvania, November 1, 1911, and a second meeting in New York, January 16, 1912.

When the National Fire Protection Association entered the field of mine fires through the appointment of this committee, it found the United States Bureau of Mines actively engaged in field investigations, study, and tests relative to this subject. The composition of this committee was carefully considered with a view to securing among its membership engineers of the United States Bureau of Mines, prominent mining engineers in private practice, and fire protection engineers familiar with what has been done in this field of endeavor in connection with fire risks in buildings and factories.

In view of the above condition, it seems to the committee desirable at this time that the entire problem be completely outlined, and this has been done in the following schedule with a view to having this committee consider and report upon those features toward which the experience of its several members can most readily contribute, leaving to the United States Bureau of Mines to consider those problems which call for statistical inquiry, field investigation, or laboratory test, and toward which the expert knowledge of the mining and mechanical engineers and chemists employed in that Bureau can best contribute.

With a view to making recommendations which will call for the outlay by mine-owners of the least sum in protecting their property, the committee has prepared the schedule below, arranged in such manner that the details will be easily apparent to the busy mine manager and will indicate to him those things concerning which he may seek further information of this Association, and those things regarding which this Association is not qualified to help him and on which he shoud seek advice from the Federal Government. Suggestions and recommendations on any of the points mentioned will be welcomed and should be addressed to the secretary of the committee, R. Y. Williams, at Urbana, Illinois.

In presenting the following outline, this committee disclaims any right or authority to speak for the United States Bureau of Mines other than to indicate those matters which this committee believes it can best investigate and which it proposes, with the consent of the Association, to investigate and report on in greater detail hereafter, and on the other hand, those things regarding which it should give no further consideration, believing that it has not the facilities to investigate them and believing that the United States Bureau of Mines is better qualified to consider them.

Statistics

By Committee.—Recommendation as to the nature of inquiry, character of data desired on loss of life, injury to life, loss of property, losses inside and outside, losses in mineral matter, origin of fire, etc.; also a comparison of mine fire statstics, foreign and domestic.

By Bureau of Mines.—Collection, tabulation, discussion, and publication of statistical data.

Protection of Surface Plant

All surface works are capable of precisely the same treatment as other non-mining property. Any works built at mine openings should unquestionably be non-combustible; all works should be protected, probably most advantageously by automatic sprinklers.

By Committee.—Building materials to be classified in a general way only, as (1) non-combustible buildings with non-combustible contents, and (2) other buildings, whether combustible, or not containing combustible contents. Danger from outside fires: Brush and timber should be cleared to a distance of at least 100 ft. from opening. Inflammable buildings should be at least an equal distance from opening. If possible, area immediately over opening should be fire-protected by construction of non-inflammable structures in such manner as to isolate the opening from inflammable structures. Such structures over opening to have permanent metal awnings protecting window and door openings against blown firebrands. Grouping of buildings to be dependent on materials of construction. Distance of explosives magazine from nearest building and from opening to be based on recommendations published by Bureau of Mines. Water-supply for outside protection to consist of a big tank or storage reservoir of a capacity of from 30,000 to 100,000 gallons and placed on a tower or hillside at elevations from 125 to 200 ft. Such elevations will furnish constant service and good pressure for hose for fire-pumps. If domestic water is taken from such tank, it should be taken from a pipe from a domestic outlet near the top, so as to leave at least 80% of the tank as a constant head for fire-protection reserve. Where the condition of the buildings permits, the most positive means of fire protection is by automatic sprinklers, and their installation and operation is fully covered by regular sprinkler rules of this Association. Self-inspection of buildings is recommended by the display of information printed in large type and posted in protecting frames after a manner recommended by the Factory Insurance Association.

By Bureau of Mines.—Construction of special devices for preventing spread of serious fires to underground workings, as special steel doors, protection against introduction of fire through surface caves or outcroppings, protection against incendiarism.

Construction of Mine Openings

By Committee.—Extent, amount, and head of water-supply; automatic sprinklers for shaft protection; automatic sprinkler systems probably less expensive than elaborate cut-offs or fireproofings for combustible stables, store places, engine-houses, etc. These, however, if placed in shafts or shaft bottoms, would doubtless reverse the draft and would be beneficial if down-draft were desired, but fatal if up-draft were desired, to the safety of the men.

By Bureau of Mines.—The nature of materials best suited to the requirements of mine operation through the shaft or opening, having in view fire protection, safety of exit, etc. Such openings should be incombustible throughout, in order to obviate the need for and danger inherent with sprinklers.

Underground Works

By Committee.—Water-supply for fire protection; possible quantity required; head desirable. Water-supply for surface works and water-supply for underground works are dissimilar problems, and should preferably be separately provided for and not be interconnected. For underground works, the water-supply should be ample and preferably stored underground, thus avoiding trouble from hydraulic head, signaling service, or freezing.

Water-supply for the automatic sprinklers proper may be limited in quantity if stored in a pressure tank under high pressure. For limited spaces such as store-rooms and stables, there is no record of fires which 3000 gal. of water under pressure has failed to extinguish. Including the necessary air, a pressure tank of 4500 to 6000 gal. should be adequate. This, applied to local pieces of sprinkler equipment as for store-room or stable, would call for space ranging from 5000 to 10,000 sq. ft. area.

For pump supply which may be called upon to supply hose streams for long periods, the quantity of water is a different matter. As much as 250,000 gal., which amount may be stored in a relatively small space, will run a number of hose streams as heavy as can be handled by one man

for a number of hours; for example, 125 gal. per hose stream per minute would mean a 7/8-in. nozzle for 2000 minutes, or 10 such streams for more than 3 hours.

By Bureau of Mines.—Consideration of inflammable underground works and structures; relation to fire originating outside, relation to fire originating inside. Consideration of types of construction with cost data for fireproof construction and for fire-resistant construction, inflammable construction; handling and storing combustibles, such as hay, oils, explosives, and cotton waste. All inflammable material should be listed, quantities allowable in the mine at one time stated, nature of containers specified. Methods of storing oils, protection of steam-pipes, electric wires, design and construction of special fire-doors, possible use of fusible links for doors, even though of wood, use of fusible plugs for holding doors open. Doors, if closed and automatically wet by a sprinkler, may serve as a fire stop.

LIVE WORKINGS

By Bureau of Mines.—General rules and precautions for protection from lamps and lights, candles, wicks, careless handling of oils and explosives, gas-blowers, black powder flame, electric wires, and ignition of coal dust.

ABANDONED AREAS

By Bureau of Mines.—Isolation from live workings by separate return air ventilation, or by sealed fire-resistant walls; type of construction of same; precautions and special inspection for gob fires and from accumulation of gas and of water.

SPECIAL UNDERGROUND CONSTRUCTION

By Committee.—Fire extinguishment; consideration of relative efficiency of various pumps; possible centrifugal pump taking water under head and operated by induction motor will give better satisfaction because it is easiest operated by unskilled men, and may be put in service from a distance by signal wire or telephone. Study should be made of quantity of water required, size and construction of pipes, nozzles, and styles of fitting. For working in confined space of a mine in presence of heat and gases, heavy hose streams would seem impracticable, probably nothing in excess of 1¾ to 1½ in. taken off a 2-in. line, or from long distance from source of supply, 3 or 4-in. line, as indicated by distance and friction head. Consideration of extra parts and their availability; protection from frost near surface entries and supervisory inspection of fire service; fire extinguishers and chemical engines and trucks should be considered. Probably small extinguishers of portable type, and many of them, most useful in incipient fires; a few larger chemical engines desirable for fighting fire after it has gotten under headway.

By Bureau of Mines.—Mine timber; dangers incident to the use of wooden timbering, and the possibility of replacement of these by such fireproof timbering or lining as brick, reinforced concrete, or steel; question of fireproof paint or solutions for timber, though these are not believed to be effective; possibility of coating wood timber with cement gum.

Power; rules for use; electricity for lights, motors, and machines; steam locomotives and engines, boilers, and heating furnaces; compressed air, oil, and gasoline engines.

Stoppings; classify by fire resistance and action on same of explosions, namely, wood, gob, tamped clay, dry walls, wood fibre coatings, metal lath and plaster, reinforced concrete, brick, and masonry.

Overcasts; classify with cost data: wood, masonry, concrete, brick, and combinations. Fire-fighting materials; life of various kinds of hose in mines and method of installing and protecting underground; use of air-pipes as emergency water mains; friction developed and quantity of water discharged through pipes and nozzles; head of water for varying depths; efficient throttling and reducing valves for great depths; relative efficiency of various pumps for underground use.

Fire-fighting methods: by smothering; by surrounding or cutting off; flooding; loading out hot ashes, etc.; flushing with sand, earth, etc.; refuge chambers and safety supplies; equipment; possible advantages of chambers, their design, location, and number; use and types of rescue apparatus; extent of supply and training.

Fire corps: special training of corps for rescue, first aid, and fire-fighting; rules and methods of training; volunteer fire corps; organization, stations, and drill.

Fire alarm signaling systems; telephones probably best; alarm duty by workers; escape maps, their construction, scale, objects to be shown, and their location and availability.

Alaska: A Condition and a Program

By WALTER E. CLARK

*Greatly as we may deplore the present conditions, we cannot expect a remedy by merely denouncing them. A great many Alaskans and the leading members of the national administration realize this. At the beginning of the controversies produced by the application of a counterfeit policy of conservation to the coalfields, residents of the territory were far from being agreed as to the remedies to be applied. At first, the proposition to lease the coal lands was a bone of contention; and the proposal to build a Government railroad was opposed by many. Very recently there has been a distinct precipitation of public sentiment in the territory favorable to any plan upon which the authorities at Washington may agree. With the majority now the desire is not to dispute as to just how the fuel and transportation questions should be settled, but that those questions be settled somehow and quickly.

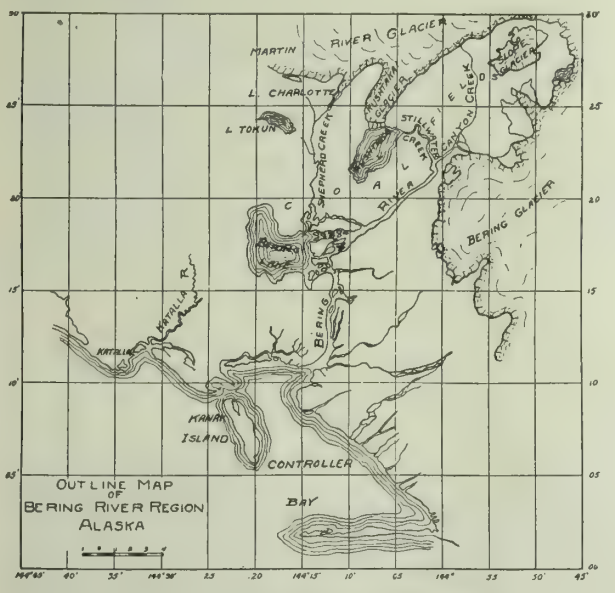
A program of legislation to relieve the present disheartening condition in Alaska has been pretty thoroughly worked out by the administration. I refer, first, to certain minor measures of proposed legislation. It is a singular fact, not at all creditable to the nation, that nearly 45 years after the occupation of Alaska by the United States, there are wanting for the government of this territory several elementary provisions of law which are found in every other part of the civilized world. There is no means of establishing a quarantine in Alaska, except by the means of a somewhat strained construction of the laws governing the Marine Hospital Service, and no adequate means of preventing the spread of contagious diseases; there is no law providing for the supervision and control of banks and banking, although there are many banks in the territory; there is no provision for the registration of births, marriages, and deaths, although the absence of such records often causes grave injustice and human suffering; there is no public means of relieving indigent persons. It is a part of the program of the present national administration to fulfil these wants, and it is hoped that the Congress at Washington will pass the necessary measures, which have been urgently recommended. Through the lack of such ordinary and usual provisions of law as these, the development of the territory is discouraged to a considerable extent, although the greatest obstacles are due, of course, to the failure to provide certain more important measures of legislation.

The larger measures—those pertaining to the coal lands and to transportation—are now, as they have been for too long, the subject of much difference of opinion. It is not necessary to decide which of these subjects is the more important; both are vital. The coal is worthless without railroads to transport it; the railroads would be far less profitable without the coal for tonnage as well as for engine fuel. If one must choose, the transportation question is probably the more vital of the two; but nobody doubts that the settlement of either will lead speedily to the settlement of the other.

The President, Mr. Taft, has endorsed the proposal of

*Abstract of a recent address by the Governor of Alaska, as printed in the *Cordova Daily Alaskan*.

the Secretary of the Interior, Mr. Fisher, that at least one trunk line of railroad, tapping one of the principal coalfields and connecting one of the navigable rivers with tidewater, be built by the Federal Government. Within a few months after he took charge of the Interior Department, Mr. Fisher visited the coast of Alaska and one of the principal coalfields as well as the upper navigable waters of the great Yukon river, and there received visual testimony as to the importance of both transportation and the fuel problems. His conclusion to recommend that the United States should construct one arterial line of railroad in Alaska was not reached without a very deliberate and painstaking study of the subject, and not without consideration of the fact that many persons doubtless are constitutionally opposed to Government ownership of transportation lines. The conditions in Alaska he regards as peculiar, and moreover, he pertinently cites the fact that the Government owns and operates the Panama railroad and will own and operate the Panama canal. As to the instrumentality by which the proposed Government railroad in Alaska shall be operated, the administration has



ONE OF THE ALASKA COALFIELDS.

not expressed an opinion. The question whether the Government shall operate the railroad or lease it to an operating company may be left to Congress. My own opinion is that many of those persons who are opposed to Government ownership and operation of railroads, on general principles, may look with complacency upon the building of a Government road in Alaska, in consideration of the special conditions there, especially if it be decided that the Government shall leave the operation of the road to a private company under the terms of a lease acceptable to the Government and calculated to conserve the interests of the public. Federal aid for the construction of railroads has been extended in various forms, notably in the form of land grants and by a guarantee of interest on bonds of indebtedness within a certain maximum limit per mile. If the Government itself should build the main trunk line in Alaska and then lease the line to an operating company, the cost of construction might reasonably be regarded as another form of Federal assistance for such construction, not differing in the first principle from a land grant or an interest guarantee. Unquestionably, the selection of a route for the proposed railroad should be left to a board of engineers to be appointed by the President; and our treatment of the Panama canal question might be followed further by placing the construction of the road in the hands of the Corps of Engineers of the United States Army. Mr. Fisher, who has recently visited the Isthmus as well as Alaska, has made the suggestion that a part of the equipment used in building the canal be transferred to the scene of proposed railroad building in our northern territory and used in construction.

Views as to the settlement of the coal-land question have been somewhat clarified in the past six months, although these have not yet crystallized into action. Described in general terms, there are but three possible means of opening up the Alaska coalfields so that this rich store of fuel may be available for the people of Alaska and the several uses of the Pacific Coast, including the United States Navy. First, private ownership of the coal-bearing areas in fee simple, under the terms of a reasonable law of Congress yet to be enacted; second, continued public ownership of the lands, and the mining of coal under leases by private persons; third, continued public ownership and Government operation of the mines. It is pretty generally recognized that Congress is not likely to pass an improved law authorizing the patenting of any more coal lands—at least not unless there should be a decided and unlooked-for change in the present state of public opinion. Government operation of coal mines plus ownership of the lands is hardly likely to be adopted as a national policy, in the near future at least. This leaves the leasing system as the only practicable means likely to find favor with the representatives of the people. At this writing no bill fully representing the administration's views regarding a leasing system has been introduced in Congress. Presumably, such a measure will be introduced as soon as there is a prospect that it will obtain consideration. Then the problem will be to reconcile the views of those who entertain the fear that a monopoly will result under any plan which may be adopted for the mining of Alaska coal and the wishes of those who believe that almost any condition would be better than the present state of stagnation and deprivation.

While the interests of the public must be regarded as paramount, it is well to bear in mind that a due regard for the rewards which capitalized enterprise is entitled to obtain from its operations must be observed in the framing of any coal-land law for this territory.

As I have already indicated, the *sine qua non* of early prosperity and settlement in Alaska is a more considerate attitude on the part of the Congress of the United States, and to some extent on the part of the press and people of the United States, toward the territory. This improved attitude should consist, among other things, of a clearer discernment of the rights of highly capitalized interests. The main resources of the district were so securely locked up by the forces of nature at the beginning of the world that they never can become productive unless expensive means of operation are provided. To keep capital out for fear of monopolies is not worthy of American courage in the first instance, and in the first and last instances it is to beg the whole question of territorial development and progress.

The great territory comprised in the Seward purchase will in the years to come be the abiding place of a people much more numerous than those who reside there at present, although I am not among those who prophesy a population of several millions. The natural conditions do not promise great density of population, and will never encourage it unless the circumstances affecting human migrations and modes of life shall be greatly changed during the progress of the world in the next century. But the territory is a healthful place of residence, whatever may be the popular misconceptions regarding its climate; the mines and the forests and the fisheries are at the beginning of their productiveness; the agricultural lands invite settlers as hardy and thrifty as millions of those who inhabit northern Europe; the opportunities of the future in many walks of life will be countless for those to whom work is gospel. A territory with such riches and opportunities, but so sparsely settled as it is at present, does not need many new laws; but further neglect to enact those few primary measures which alone can cause the proper development of the natural resources and bring to the territory a larger number of happy and prosperous people to enjoy them, must be regarded as discreditable to the nation.

The Situation in the State of Chihuahua

By An Occasional Correspondent

The city of El Paso, Texas, is at present (July 30) filled with people who are keenly interested in the Mexican situation. Refugees, mostly women and children who have been sent out for safety, and men who have been on vacations in the states and are on their way back to work, soldiers, secret service men, and newspapermen are all anxiously waiting for news from across the river. The number of refugees is being daily augmented by the arrival of families of Mormon colonists. Although authentic news is scarce and much misinformation is given out, the facts of the situation seem to be that a trip from El Paso to Chihuahua is a very uncertain and difficult undertaking. A few men have managed to get through by way of Eagle Pass and Torreon, while others have returned after getting as far as Torreon. Between that point and Chihuahua there have been frequent interruptions of traffic from raids of small rebel bands left behind the main Federal forces. A few parties have gone through by automobile, equipped with passes from Orozco, but not many can get these passes. Orozco is still in possession of Juarez with a few hundred men. He derives what revenue he can from the customs, and what assistance he can from his agents in El Paso, which is probably very little on account of the vigilance of the United States authorities. Orozco is supposed to be watching his chance to slip across the border, but he is likely to be foiled if the attempt is made, as the secret service men are watching closely for him. His only chance for escape is to get into Sonora before the Federal forces arrive at Juarez. To delay the advance of the Federals as much as possible, the Mexican Central midway between Chihuahua has been completely demolished. From excellent authority I have learned that not a vestage of the track remains for 50 kilometres. The ties and bridges have been burned, the rails twisted, and the fishplates, bolts, and spikes carried away and hidden. It will be months before traffic can be resumed on this line.

Trains have been running regularly on the Mexican Northwestern through Juarez as far south as Madera, and an occasional train has gone on to Tamosachic. Between the latter point and Chihuahua the rebels have burned and dynamited a number of bridges. The Federal forces, which are slowly advancing northward from Chihuahua along the lines of the Central and Northwestern, are repairing these roads. The smelters of Chihuahua are closed for lack of coke, and the mines are very short of explosives. I do not consider the lives of American men in danger, and their personal property outside of livestock and firearms is not likely to be molested. On account of the uncertainty, however, most of the women and children have been sent out of the state. The situation of the rebels is desperate, and they are helping themselves to what they need. Armed resistance on the part of Americans to such depredations is worse than useless, as the Mormon colonists are finding to their sorrow.

Desertions from the rebel army must have been heavy during the past two weeks, as it is difficult to account for more than half of the force that retreated northward from Bachimba. The largest force seems to be at Dolores, where Rojas has about 2000 men. Garrisons of about 200 each remain at the towns of Casas Grandes, Pierson, and Madera, with a few at the stations farther south, while several hundred have gone into the Ocampo district over the Greene wagon-road. These forces have stocked up on clothing and supplies, and taken the available horses and mules from the towns en route. In some cases they have seized pack-trains and dumped off loads of high-grade concentrate by the trail, and Rojas, on his arrival at Dolores, seized one store and blew open and rifled the safe. All this resembles banditry more than warfare, and renders it impossible to carry on any business while it lasts. The revolution might have been ended before this, if the Federals, after their victory at Bachimba, which was largely due to the use of artillery, had followed closely on the retreat of the rebels northward, giving the tired and hungry fugitives no time to recuperate or stock up with supplies. Instead, the rebels have been allowed to get into the mountains, where they can carry on brigandage until they are hunted out. It seems to be significant that these various bands are getting near to their old haunts again, so when they are hot pressed it will only be a matter of changing clothes, and hiding their guns, until they become plain *hombres* again. They can then seek work at the very mines they are now trying to despoil. The strongest hope for a speedy settlement of the trouble lies in the reported appointment of Gen. Trucy Aubert to the command of the northern Federal forces. Gen. Aubert, who is part French, has the reputation of being the best fighter in Mexico, and a strong hand will be needed to end the brigandage.

The present situation is so exasperating to those interested in the welfare of Mexico that almost any move that would end this hopeless rebellion would be welcomed.

Examination For Mine Technologist

The United States Civil Service Commission announces an examination to fill a vacancy in the position of mine technologist in the Bureau of Mines, field service, at a salary ranging from $1800 to $2400 per year, and vacancies requiring similar qualifications as they may occur, unless it is found to be in the interest of the service to fill the vacancy by reinstatement, transfer, or promotion. The duties of the person appointed to this position will be a general study of mine conditions with reference to economic problems with a view to the improvement of these conditions, especially in the coalfields of the United States, and a study of these conditions as affecting the welfare of the miners. Qualified persons who desire to be considered for this position should apply for Form 304 and special form to the United States Civil Service Commission, Washington, D. C.; the secretary of the board of examiners, postoffice, Boston, Mass., Philadelphia, Pa., Atlanta, Ga., Cincinnati, Ohio, Chicago, Ill., St. Paul, Minn., Seattle, Wash., San Francisco, Cal.; custom-house, New York, N. Y., New Orleans, La., Honolulu, Hawaii; old custom-house, St. Louis, Mo.; or to the chairman of the Porto Rican Civil Service Commission, San Juan, P. R. No application will be accepted unless properly executed and filed with the Commission at Washington, in complete form, with the material required, prior to the hour of closing business on August 24, 1912. In applying for this examination the exact title as given at the head of this announcement should be used in the application.

Sulphur is found in Colorado, and some effort has been made to work the deposits, according to a report issued by the U. S. Geological Survey (Bull. 530-O). The principal deposits are in Mineral county, Colorado, about 25 or 30 miles southwest of Creede. One of these deposits is on Trout creek, about 25 miles southwest of Creede, and is reached by wagon-road that is good over most of the distance. The available data on the deposits as exposed in the tunnels indicate that it is a surface deposit about the opening of a series of hot springs. The greatest observed thickness of sulphur rock was about 16 ft. A mill was operated for only a short time and it is believed that little or no sulphur was placed on the market. The other deposit in this section is about five miles south of the workings on Trout creek, and is similar in all respects to the sulphur-bearing mass at that locality. The deposits are believed to have been made by the hot springs.

There were 661 mines producing gold, silver, copper, lead, or zinc in Nevada in 1911, compared with 608 in 1910. Of these, 72 were placer mines. The total quantity of ore sold or treated in Nevada in 1911 was 4,132,721 short tons, an increase of 476,946 tons.

The Waihi Company in 1911

The twenty-third annual report of the above company contains a mass of interesting information in its 83 pages; and while details are full, the report is not overdone. Year after year the output had increased until 1909 showed £959,594, and another year or so at the same rate of increase would have seen a total of £1,000,000. In 1910, the ninth level became poorer, and the yield dropped to £926,100 from 442,020 tons. The year under review showed a drop to £679,113 from 350,669 tons. The main features of the report may be summarized as follows: The development of the tenth level has been disappointing, especially on the Martha lode, but an active exploratory campaign will be continued. The shafts in working order were 1080, 1150, 1181, and 1023 ft. deep, respectively. Seven filling passes were in use, and 250,738 tons of material was put into the stopes. Waste rock hauled amounted to 12,160 tons.

THE MAIN STREET AT WAIHI.

WAIHI, NEW ZEALAND, NOW BEING DEPOPULATED ON ACCOUNT OF THE STRIKE.

The two mills of 90 and 200 stamps, respectively, were operated during the year, the Union mill of 40 stamps being sold after working 26 days. The Waihi mill averaged 5.14 tons per stamp daily, and the Victoria 4.94 tons through a standard 10-mesh screen. An average of 3.8 tube-mills worked in the first, and 8.2 in the second mill. In all, 5368 tons of concentrate was produced, representing 1.53% of the total ore crushed. The average value of this product was £21 13s. 9d. per ton, and its residue after tube-milling, air agitation, and filter-pressing was worth £1 1s. 7d. per ton, showing 95% extraction, at a cost of 25s. 1d. per ton of concentrate.

The head assay of the ore was 42s. 10d. per ton, the residue 4s. 8d, showing 89% extraction. The proportion of silver to gold in ore was about 7 to 1. From 1,067,432 oz. bullion recovered from all sources, the refinery produced 137,195 oz. gold, and 939,621 oz. fine silver. Many experiments were tried during the year, and the assay office dealt with 17,475 samples of various kinds. The foundry at Waikino dealt with 301½ tons of iron castings, 77 tons of steel, and 4¼ tons of gunmetal, and repairs are effected quickly and cheaply. The Hora Hora hydro-electric power works were pushed on as fast as the weather and delivery of parts would allow. The erecting of the steel towers for the 51 miles of transmission lines is under way. It is expected that power will be delivered within twelve months. At the time of writing, the Waihi mine and mills are shut down, as the result of a difference of opinion between the engine drivers and miners' union, and an attempt to drag the company into the argument. The water is not rising very fast in the mine. The strike may be a long one, and being so trivial it is very unfortunate for both the shareholders and the majority of the men employed.

Footage of development (highest on record), feet	20,694
Broken ore in shrinkage stopes, tons	70,123
Ore on surface, tons	40,064
Mine output, tons	381,873
Shipped to mills, tons	367,414
Ore treated, tons	350,669
Water pumped from mine, gallons	727,355,799
Total value of yield	£679,113
Total to date	£9,785,431
Dividends paid in 1911	£311,611
Total to date	£4,563,166
Stores on hand, and in transit	£44,079
Investments value at date of report	£327,000
Bullion in transit	£31,632
Cash at bankers and in hand	£130,294
The head assay of the ore was	42s. 10d.

Costs Per Ton	s.	d.
Mining, including pumping	6	8.8
Development	1	8.0
Transport of ore	0	3.7
Crushing	0	5.3
Milling	1	9.7
Treatment of ore (cyanide, zinc, power, wages, etc.)	3	1.7
Treatment of concentrate (cyanide, power, wages, etc.)	0	4.6
Refining	0	1.5
Assaying and melting	0	5.0
Maintenance of plant and water, flumes, and ditches	0	7.0
Salaries of staff at mines and Auckland, taxes	0	11.7
Export duty on gold, and rent paid to New Zealand Government	0	11.2
Realization of bullion	0	3.0
Stamp duty, directors, and auditor in London	0	5.0
London office expenses, and incidentals	0	0.8
Total	18	3.0

White arsenic was produced in the United States in 1911 to the amount of 3132 tons, valued at $73,408, against 1497 tons, valued at $52,305 in 1910, according to a report on arsenic by Frank L. Hess, of the U. S. Geological Survey. The arsenic was obtained as a by-product of smelting operations. This output is much the largest ever made in this country, but owing to the low price and the distance of the smelters from New York, the freight charges absorbed a large proportion of the profit. During the year 4996 tons of white arsenic, metallic arsenic, and arsenic sulphides, valued at $247,323, were imported. Of this amount, 1921 tons was white arsenic, with a value of $116,948.

Transvaal Mine Supplies

By Francis Drake

The annexed list of some of the supplies consumed in the Transvaal during 1911 should prove of interest to all those connected with mining. Probably the quantities will be somewhat of a revelation to many. The list is not complete; only items of special interest are included. The total values are: for gold mines, £11,707,286; for diamond mines, £271,219; and for coal and other mines, £481,776; making a grand total of £12,460,281.

In the gold mines during the year 24,456,821 tons of ore was milled, yielding 8,237,723 oz. of fine gold worth £34,991,620. In doing this, an average of 205,000 natives were employed. Taking these figures with those in the tabulation, it will be seen that for each ounce produced $6.90 was spent in supplies. Working it out at per ton milled, the amount paid out in supplies comes to $2.30. Just under one-half pound of candles was consumed per ton milled, and almost the same weight of cyanide was consumed. Somewhat over 0.6 lb. of shoes and dies was used per ton of ore milled. Slightly more than one-half pound of drill steel was used per ton milled, but it must be remembered that this material was also used in doing various kinds of 'dead' work. This remark will also apply in considering the quantity of explosives used, which amounted to nearly 1.4 lb. per ton milled. The quantity of zinc consumed per ounce of output was slightly over 1 lb. This does not represent the quantity used per ounce recovered in the cyanide process, however, as a large portion of the gold output is recovered by amalgamation. The feeding of the native workers was quite an undertaking, the total amount spent under this head being £1,033,625, a little over 20c. per ton milled. Note also the expenditure for beer-making materials and medicines, these amounts being for natives.

Turning to the diamond, coal, and other mines, it is worthy of consideration that they used explosives of a lower grade than the gold mines, and that the diamond mines had no rock-drills, although they used a notable quantity of hand-drill steel.

The Oregon and pitch pine was supplied from the United States, and this is of interest when sea and land transport is remembered. Many other items on the list give food for thought, as does the total amount for all supplies for all mines, which is equal to over $200,000 per day, taking 300 for the number of working days in the year.

Mine Supplies Consumed in Transvaal in 1911

	Gold Mines.		Diamond Mines.		Coal and Other Mines.		Totals.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
Belting	.....	£ 138,208	.....	£ 3,498	.....	£ 3,902	.....	£ 145,608
Bolts, nuts, washers, and rivets (lb.)	3,800,814	43,217	261,476	2,826	136,619	1,875	4,198,909	47,918
Candles (lb.)	12,384,255	222,294	1,004	23	595,950	11,522	12,981,209	233,839
Carbide (lb.)	3,909,326	40,432	3,358	38	120,325	1,457	4,033,009	41,927
Cement (imported), casks	18,536	28,419	145	211	708	1,155	19,389	29,785
do (local), bags	165,953	88,076	2,679	1,342	3,070	1,847	171,702	91,265
Chemicals and assay materials	.....	159,429	.....	517	.....	1,006	.....	160,952
Coal (tons)	2,420,285	1,464,900	67,599	33,010	7,431	4,405	2,495,315	1,502,315
Cyanide (lb.)	11,610,268	482,069	.....	.....	55	3	11,610,323	482,072
Disinfectants	.....	14,062	.....	848	.....	743	.....	15,653
Blasting gelatine (cases)	504,077	1,142,681	18	47	3,017	7,090	507,112	1,149,818
Gelignite and gel.-dynamite (cases)	177,784	303,520	518	869	2,326	4,176	180,628	308,565
Dynamite No. 1 (cases)	263	449	60	100	2,225	2,827	2,548	3,376
do No. 2 and Ligdyn (cases)	703	1,028	36,957	46,193	18,050	23,701	55,710	70,922
Other explosives (cases)	81	118	.....	.....	1,792	2,319	1,873	2,437
Detonators (boxes)	277,300	31,704	18,856	1,872	27,511	2,906	323,667	36,482
do electric	.....	.....	47,925	360	313,450	1,571	361,375	1,931
Fuse (coils)	7,054,643	128,936	457,998	10,529	535,785	9,044	8,048,426	148,509
Iron, bar and angle (lb.)	10,389,907	83,573	358,788	2,823	233,817	2,169	10,982,512	88,565
Lead, pig (lb.)	154,445	1,484	3,357	27	425	5	158,227	1,516
Lubricating oils (gal.)	978,061	114,141	74,131	5,472	57,335	7,382	1,109,527	126,995
Lubricating greases (lb.)	3,931,725	60,938	232,104	3,561	281,835	3,276	4,445,664	67,775
Beans and rice (lb.)	11,488,478	85,763	31,933	286	299,665	1,510	11,730,076	87,559
Meal (maize and kaffir corn), bags	560,651	297,792	1,931	1,123	50,705	25,560	613,287	324,475
Malt and cereals for beer	.....	17,406	.....	78	.....	115	.....	17,599
Meat (lb.)	29,577,210	446,277	107,772	2,111	1,451,968	23,270	31,136,950	471,658
Salt (lb.)	1,136,583	1,983	5,700	12	106,534	271	1,248,817	2,266
Groceries, coffee, sugar, etc	.....	31,590	.....	339	.....	3,560	.....	35,489
Sundry food, including bread	.....	125,145	.....	3,559	.....	2,858	.....	131,562
Vegetables	.....	44,715	.....	54	.....	2,687	.....	47,456
Medicines	.....	28,610	.....	2,267	.....	2,400	.....	33,277
Rock-drill spares	.....	180,030	.....	.....	.....	518	.....	180,548
Shoes and dies (lb.)	15,147,003	136,852	.....	.....	69,827	681	15,216,830	137,533
Stationery	.....	55,364	.....	2,604	.....	3,164	.....	61,132
Steel (sheet), lb.	11,374,990	79,216	654,102	5,046	236,998	2,042	12,266,390	86,304
do (hand drill), lb.	4,942,036	73,874	79,140	804	214,884	1,496	5,096,060	76,174
do (rock drill), lb.	7,349,017	110,388	.....	.....	28,174	536	7,377,191	110,924
Timber (Oregon and pitch pine), cu.ft.	1,600,622	304,041	23,804	4,372	27,566	5,261	1,651,992	313,674
Waste (lb.)	796,814	16,920	24,659	554	42,893	820	864,366	18,294
Zinc and zinc discs (lb.)	9,572,917	158,033	614	8	296	6	9,573,807	158,047

High Grade

A recent visitor to this district in Modoc county, California writes:

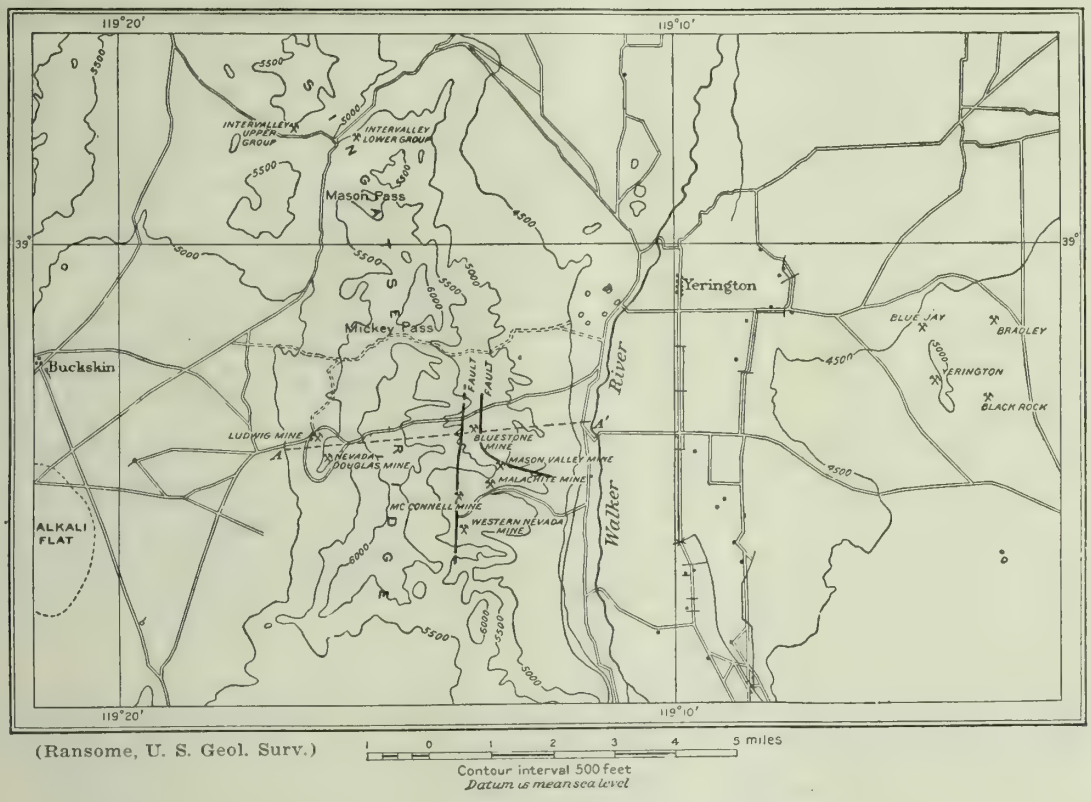
"The High Grade district is in a prospective state at present, and it is rather hard to tell what the result will ultimately be; but the surface looks very favorable to me, and I am of the opinion that with some systematic development it will make a mining camp. There are at present several very likely-looking prospects. The Consolidated has recently opened a vein 160 ft. below the surface, which shows 4 ft. of ore averaging over $150 per ton. At the Lucy Dutchman lease there is ore which assayed as much as $1480. The average across 3 or 4 ft. will probably be about $60. The Modoc has 2 ft. of $50 ore at a depth of 50 ft., and is situated 3½ miles from the Consolidated. This makes the mineral-bearing area fairly extensive. At the Sunshine they are following a stringer about 6 in. wide which is very rich, and especially is this true of the mud ore found with the quartz. I think I am safe in saying that the ore from this vein will average $400. Mining facilities are almost ideal. Timber, water, and produce are procurable in abundance. It certainly looks good to one who has had a few years on the desert."

Mines of the Yerington District

STAFF CORRESPONDENCE

The principal mines of the Yerington district are the Nevada-Douglas and the Mason Valley. Each of these mines is now shipping about 350 tons of ore per day to the smelter at Thompson, Nevada, and each expects to increase its output in the near future. These properties are comparatively well known, but there are also less prominent mines nearby which ship altogether 100 tons per day or more to the smelter, and show promise of developing into good mines with further work. A brief description of the more important of these will be of interest.

The McConnell Copper Mining Co. is shipping 60 to 75 tons per day from its mine about one mile southwest of the Mason Valley mine. This is an old property which produced high-grade ore some years ago, but after the rich bodies near the surface were exhausted, work on the property ceased. At one time it was under option to the Nevada-Goldfield Reduction Co., which sunk a 400-ft. shaft. Unfortunately, the shaft was started at a point where each foot in depth took it farther from the orebodies. Recently the control of the company has passed into the hands of O. H. Sonne and S. B. Elbert, and extraction of the large quantity of low-grade ore blocked out in the former workings has begun. The ore occurs in a narrow belt of limestone, which according to F. L. Ransome (Bull. 380, U. S. Geol. Survey) is bounded on the west by grano-diorite, on the east by schists, and is 300 to 400 yd. wide. There are two sets of workings, a western set, first opened many years ago, and an eastern one, across a narrow gulch, more recently driven. In both cases open-cuts have been made on the surface and adits have been driven in the hillside to cut the ore in depth. In the old workings narrow bodies of high-grade ore have been stoped; the present owners have shipped several hundred tons of 4 to 5% copper ore from the old waste dumps and are beginning to take out the low-grade ore left exposed in the old stopes. This ore is so strongly oxidized that it much resembles the soft hematites of the Lake Superior region. In the easterly workings the ore consists of carbonates and sulphides of copper in a limestone which is in places comparatively little altered, and in others contains much garnet and epidote. Much less oxidation has here taken place. There is an adit penetrating the hillside 60 to 100 ft. below the open-cuts, and another about 70 ft. lower. Near the surface the ore contains carbonates of copper with enrichment sulphides, while the ore exposed in the lower adit consists of sulphides which are primary or due to alteration, but not to enrichment. As is characteristic of the district, the ore is extremely irregular in detail, but regular as a whole; large masses of low-grade ore have been developed, and it is not improbable that other equally large masses will be discovered. With cheap methods of mining, 3 to 4% ore can be shipped and smelted. The best way of dealing with the ore of about 2% copper content has not yet been settled. Concentration offers difficulties because of the heavy silicates present in the gangue; magnetic separation, as developed at the Bluestone mine, requires large capital expenditure to permit handling a large tonnage; leaching methods offer the same difficulties here as elsewhere, and it is doubtful whether the smelter can greatly reduce its treatment charges for low-grade ore. The present successful working is due to the use of cheap methods of mining (most of the ore being 'glory-holed' in open-cuts, and only 18 men being employed), the down-grade haul to the railroad, and the reasonable smelting rates accorded.



(Ransome, U. S. Geol. Surv.)

YERINGTON DISTRICT.

The Malachite, of the Yerington Malachite Copper Co., in the same gulch as the McConnell, but nearer the railroad, is immediately south of the Mason Valley on the extension of the Mason Valley orebody. O. H. Sonne is in charge and has about 10 men at work. Through an adit in the same gulch as the McConnell, 15 to 25 tons of ore per day is being shipped, while development work is being carried on at a lower level through the Mason Valley workings. I did not visit the workings, but have been told by well informed persons that the prospect of developing large orebodies in the mine is bright.

Not shown on the map, but covering the group of six small hills seen just to the west of the Walker river, near where the road from Yerington to the Nevada-Douglas mine crosses the river, is the group of 11 claims of the Empire-Nevada Copper Mining & Smelting Co. This

property is now being operated under lease by Alvin J. Smith. About 75 tons per week of 10% ore is being shipped to the smelter, the higher grade being secured by sorting.

The ore is taken from pits and shallow open-cuts scattered over the orebodies, which form hills rising above the general level of the plain because of the greater hardness of the garnetiferous limestone of the ore zones. The character of the ore of this mine is essentially similar to that of the properties mentioned. The ore at the surface has been slightly leached and almost completely converted into carbonates; sometimes cuprite is present. At a few feet in depth sulphides of enrichment occur in association with carbonates. By selective mining and sorting, considerable quantities of ore of good grade can be obtained. Probably primary sulphides will be found at inconsiderable depth, but this is not known, as the 100-ft. shaft is not in ore, though a drift is being driven to cut the ore to the east of the shaft.

East of the Walker river are several properties, of which two are shipping ore. The Yerington Copper Co. has 12 claims five miles east of Yerington. The ore here occurs in grano-diorite. There is a 400-ft. shaft on the property, and drifts have been driven at higher levels; a larger hoist and compressor are now being installed to permit more extensive work. Twenty miles southeast of Yerington is the Northern Light, where lessees are shipping small amounts of ore from surface workings.

There are a number of other properties in the district, some of which are shown on the map, which are not producing as yet. One not shown on the map, but situated north of the Bluestone, near where the road shown in dotted lines crosses the 5000-ft. contour, is the Native Copper, where work has been in progress for a few months, and some native copper is being found, together with the normal carbonates and sulphides. Mr. Ransome has summarized conditions in this district so well that his conclusion is worth quoting.

"The total quantity of oxidized ore exposed in the district is small, and there is no indication of any extensive sulphide enrichment. The quantity of gold or silver in the ores is practically negligible. The future of the mines depends on the working of low-grade primary deposits. The conditions are in some respects favorable for cheap mining and concentrating; a railroad could be constructed from Wabuska along Walker river with very little difficulty, water is more plentiful than in most other parts of Nevada, and many agricultural products can be grown in Mason valley. On the other hand, water, tailing, and smelter fume are subjects concerning which miners and farmers usually find agreement difficult."

Since then the railroad has been built, and the mining and smelting of the low-grade ores is in progress. The towns of Mason and Ludwig have developed into busy communities, and the smelter at Wabuska is working at high capacity. Smelter fume has proved a negligible question; the sulphur content of the ores is so low that all the sulphur present is required to carry the copper into the matte, and no deleterious elements, such as arsenic, are present. Concentration presents many difficulties, chief of which are the heavy silicates present in the ore, and the limited water supply, which is doubtless already fully appropriated for agricultural purposes. Leaching offers possibilities, but both sulphides and oxides are present in nearly all of the ore, and it is as yet doubtful whether any process can be developed to treat both at once.

ANTIMONY ORE, according to the U. S. Geological Survey, was not produced in the United States in 1911, but considerable quantities of antimonial lead were made as a by-product in smelting precious metals, and there was a large recovery of antimony from secondary sources, such as scrap, bearing, and type metals, antimonial lead, drosses, and solder; 14,078 tons of antimonial lead containing a total of 2254 tons of antimony, valued at $386,786, was produced.

Tungsten Mines Near Spokane

By AN OCCASIONAL CORRESPONDENT

Tungsten mining in Stevens county, Washington, has accumulated appreciable impetus during the past two years, both east of Loon lake and in the Deer Trail district west of Chewelah. The most important deposits, or at least those upon which the greatest amount of development has been done, are in the latter district and are now owned by the American Tungsten Consolidated Corporation through recent reorganization by which it is understood control has been assumed by German capital. Development has been resumed under the management of William Scheck, who has recently returned from Germany. A recent visit to the property of the Tungsten Consolidated companies, ten miles easterly from Loon lake on the Spokane & Northern railroad and forty miles north of Spokane, permits the following description.

The formations in the district include granite, quartzite, and metamorphosed shale. The main tungsten-bearing vein is a white brittle quartz lying in the contact between quartzite and granite, with a general course slightly north of west,

MAP OF WASHINGTON.

and carrying hübnerite in large crystals which are easily and cleanly released from the enclosing quartz. Several smaller stringers, all apparently bearing northerly toward the contact, have been found in the quartzite, while in the northerly extremity of the developed area, on what is known as the Blue Grouse claim, pay-ore, which occurs in every instance in the form of hübnerite, is found in a vein of granite, with perfect cleavage separating it from the footwall granite and which seems to have replaced the quartz vein in which the mineral is found farther to the north. All veins and stringers dip to the southwest in degrees varying from 30 to 50.

The company's ground, which covers the entire eastern slope of Blue Grouse mountain and a considerable area on the west side, has a maximum elevation of about 4000 ft. and is capable of development by adits to a maximum vertical depth from the apex of the mountain approximately 1000 ft. It is liberally bestrewn with quartz float carrying hübnerite and ranging in thickness from a few inches to as much as three feet. The mountain is covered with deep wash and dense undergrowth, rendering surface prospecting difficult. The principal exposure of mineral in place occurs in an adit in quartzite at a vertical depth of approximately 100 ft. from the summit of the mountain. Here two stringers, from 6 to 10 in. wide, have been developed, the dump showing about 50 tons of good ore. At a farther vertical depth of 300 ft. another adit has been commenced with the object of developing the main contact vein and 400 ft. lower down the eastern slope of the mountain yet another adit has been started for the same purpose. Work has, however, been discontinued just now at both the latter points owing to lack of available funds. The lowest adit is designed as an eventual outlet for all ore

and is 110 ft. above the 60-ton mill building erected last winter and which now awaits the installation of concentrating machinery.

For the purpose of securing immedite funds the company recently leased the 5-ton experimental concentrator of the Tungsten King Mining Co. on the western slope of the mountain, and milling was commenced in July. The ore is conveyed in wagons from the upper level on the eastern slope to the ore-bins and is fed by hand to a Dodge crusher. Thence it passes automatically through ¼-in. rolls to King screen classifiers, jigs, and two Mondell tables. By this process, necessarily more or less imperfect, the manager claims a saving of 80%. Last year ten tons of crude ore was shipped for experimental purpose to Boulder, Colorado. This showed an average of 7½ tungstic acid per ton. In addition to the 60-ton mill building previously mentioned, the company has erected substantial office and domestic buildings sufficient to take care of a large staff of employees. The equipment of the new mill, designed by the Union Iron Works of Spokane, will include Blake crusher, Allis-Chalmers rolls, three King screen classifiers, 2000-lb. stamp for regrinding, three James tables, and one slimer. The underground work has been done in a substantial manner and all buildings are of excellent construction. Drift work costs about $4 per foot. Miners' wages are $3 per day. The ground is covered with a plentiful supply of fine timber and sufficient water has been developed, aided by a 200,000-gal. reservoir.

The manager, Mr. Brockway, is authority for the statement that the company will use the Wolfram-Neron refining process for the treatment of its mill product and that it has secured the exclusive rights for North and Central America from John C. Wichmann, now of Los Angeles and formerly refinery manager of the Wolfram Laboratorium, Berlin, in exchange for stock holdings in the Tungsten Consolidated companies. Upon some other authority, Mr. Wichmann's associates in Berlin are reported to be now making financial arrangements for the erection of the refinery equipment. The company is composed of Columbia City, Indiana, and Spokane, Washington, stockholders, with a capitalization of $5,000,000 in dollar shares, of which 2,500,000 shares were originally held for development purposes, and about 500,000 since sold. The management is in the hands of W. A. Brockway, formerly engaged in tungsten mining in Boulder county, Colorado, and for one and a half years superintendent in that state for Philip Bauer & Co., German tungsten buyers and refiners. The company controls one and a quarter sections of patented timber lands by virtue of a bond for $100,000, running from last year to August 1917 and entailing equal yearly payments.

Cost of the Santa Ramona Shaft

By Bennett R. Bates

Santa Ramona shaft, at Guadalupe y Calvo, Chihuahua, Mexico, was sunk by the Rosario Extension Syndicate, Ltd., a subsidiary to the Mexican Gold & Silver Recovery Co., Ltd., of Mexico City. It was sunk in an attempt to pierce the capping rock covering the extension of the celebrated Rosario vein. It was started March 11, 1911, and sunk to a depth of 42.30 metres with a windlass, thence driven to a depth of 131.30 metres (430.78 ft.) with a No. 1 Davis horse-whim. The bottom remains in the capping. Water was found at 42.30 metres and gave considerable trouble. At times the water hoisted equaled the waste. Sinking was stopped once for a week and two sets of timbers were placed. The timbers were 5 ft. apart and 8 by 8 in., with 6 by 8-in. centre piece. The shaft has two compartments, one 4½ by 4½ ft., the other 4½ by 3½ ft., making 8½ by 4½ in. inside the timbers. The shaft was closely lagged and filled in behind lagging; split-pole lagging being used. The rock was a tough rhyolite. The time consumed in sinking was ten months, two of which were lost waiting for arrival of whim held up by Revolutionists. The timber cost ₱30 per thousand. Ordinary freight cost 8c. from Parral per kilometre. Freight on the drum of the whim alone, which weighed 156 kg., cost ₱120, which accounts for the high price of the whim. The wages paid were: labor-drillers, ₱2 per day; shovelers, ₱1.25. There was one American foreman with an American Indian helper, a part of the time, and during the remainder, the American Indian alone. The wages were ₱8 and ₱5, respectively, per day. The total cost was $664.87, equivalent to $20.11 per foot. The following costs tabulated do not include the time of the mine superintendent.

OPERATING COSTS.

LABOR

	Total.	Per metre.	
Foreman	₱3,005.90	₱22.89	
Drillers	3,406.50	25.95	
Blacksmith shop	210.17	1.60	
Framing timbers	228.00	1.75	
Timbering	860.33	6.54	
Shoveling and hoisting (waste)	1,578.04	12.02	
Baling and hoisting (water)	924.44	7.04	
Miscellaneous, surface laborers, cleaning up, etc	90.61	0.69	
Total labor	₱10,303.99	₱78.48	₱78.48

SUPPLIES

Blasting material:			
Powder, 41,625 cases 60% and 17,741 cases 40%	1,380.72	10.52	
Caps, 6,115 (4X)	57.17	0.44	
Fuse, 24,250 ft.	252.96	1.92	
Timber (at ₱30 per M):			
Mine timbers	778.12	5.93	
Lagging	403.87	3.08	
Ladders	81.62	0.62	
Lining bucket-way	202.43	1.54	
Misc., blocks, platforms, etc.	84.34	0.64	
Illumination:			
Candles and oil	334.00	2.54	
Steel:			
Drill steel	65.50	0.50	
Miscellaneous supplies:			
Charcoal, nails, ropes, etc.	260.65	1.99	
Total supplies	₱3,901.38	₱29.72	29.72

GENERAL

Mules:			
Rent of mules	578.87		
Fodder, corn, and shoeing	548.39		
Rent of barn and corral	66.33		
Care of mules	123.00		
Total for mules	₱1,316.59	10.30	10.30
Grand total, labor, supplies, and general	₱15,521.96		₱118.23

CAPITAL EXPENDITURE

Tools and general equipment, including whim ₱500, cables ₱166, ore car ₱110, and miscellaneous items	₱1,315.85		₱10.01
Buildings, including blacksmith shop, whim shed, head-frame, and runway for water	333.10		2.54
General expense, erection, watchman, etc.	158.76		1.21
Totals	₱1,807.71		₱13.76

DISTRIBUTION OF COSTS

BREAKING ROCK

	Total.		Per metre.	
Labor:				
Drillers	₱3,406.50		₱25.95	
Blacksmith shop	210.17		1.60	
Supplies:				
Powder, fuse, and caps.	1,690.85		12.88	
Steel	65.50		0.50	
Illumination	143.00		1.09	
Misc. sup., charcoal, etc.	120.00		0.91	
		₱5,636.02		₱42.93

SHOVELING AND HOISTING

Labor:				
Waste	1,578.04		12.02	
Water	924.44		7.04	
Supplies:				
Illuminants	143.00		1.09	
Misc. supplies	30.00		0.22	
General (mules):				
To waste	831.00		6.33	
To water	485.59		3.70	
		3,992.07		30.40

TIMBERING

Labor:				
Framing timbers	230.00		1.75	
Timbering (placing timbers)	858.33		6.54	
Supplies:				
Timber	1,550.38		11.81	
Illuminants	48.00		0.36	
Misc. supplies	20.65		0.16	
		2,707.36		20.62

GENERAL

Labor:				
Foremen	3,005.90		22.89	
Misc. labors	90.61		0.70	
Supplies:				
Misc. supplies	90.00		0.68	
		3,186.51		24.27
Grand total operation		₱15,521.96		₱118.22

Total operation	₱15,521.96	₱118.22
Total capital expenditures	1,807.71	13.76
Grand total cost	₱17,329.67	₱131.98

Mine Production in Colorado

The value of the output of gold, silver, copper, lead, and zinc recovered from placers, gold-silver bullion, and from ore sold or treated in 1911, from Colorado mines, according to Charles W. Henderson, of the U. S. Geological Survey, was $32,418,218, as compared with $33,673,879 in 1910, a decrease in value for 1911 of $1,255,661. These figures are compiled and tabulated strictly as a mine report and with reference to the locality of each individual mine, and not with reference to the locality of the shipping point of the product. The production of gold showed a decrease in value of $1,505,083; the output of silver one of $710,194 in value; the production of copper, another of $58,600 in value; and the production of lead, a similar decrease of $211,568 in value. The output of zinc (figured as spelter and zinc in zinc oxide) showed an increase of $1,229,784 in value. Details are given in the table below.

Cripple Creek supplied 56% of the total gold yield of the state, with an output of $10,562,653, as compared with $11,002,253 in 1910. Conditions in the Cripple Creek district were much the same in 1911 as in 1910, for the subsidence of water through the Roosevelt tunnel was so slow that it was not possible to increase operations. At the close of the year, after the tunnel had been driven farther, the water drained more rapidly. The gold yield from the San Juan region fell off considerably, San Juan and Ouray counties contributing chiefly to the decrease. Counties showing an increased output of gold were Boulder, Costilla, Gilpin, and Mineral. The placer output of gold was $319,759, a decrease of $75,706 from the output for 1910.

Leadville (Lake county) continued to be the chief silver district, with an output of 3,007,296 oz., which represents 41% of the state yield. There were notable decreases in production of silver in La Plata, Mineral, San Juan, and San Miguel counties. Notable increases in output of silver were shown in Eagle, Gilpin, Ouray, and Summit counties. The chief silver-producing counties in Colorado in 1911 were Lake, San Miguel, Mineral, Ouray, Pitkin, Clear Creek, San Juan, and Gilpin, in the order named; these counties combined furnished 90% of the total state production.

Copper production was reported from 21 counties in 1911, and of these, Lake, San Miguel, Gilpin, Clear Creek, Ouray, and San Juan counties, in the order named, were the most important producers, Lake county alone furnishing 50% of the total output, San Miguel and Gilpin each 12%, and the six counties combined, 95%. While copper in Colorado is of subordinate importance to gold, silver, lead, and zinc, the total recovered copper from Colorado ores in 1911 had a gross value of $1,003,061.

There was a material decrease in the output of lead in 1911. Large decreases in output were made in San Juan, Pitkin, San Miguel, Park, Lake, Mineral, and Hinsdale counties. Increases of note were made in Clear Lake, Dolores, Eagle, Gilpin, and Summit counties. Lake county ranked first, and was followed by Pitkin, Mineral, San Juan, San Miguel, and Summit counties, in the order named.

Of the Colorado zinc output of 94,607,456 lb., Lake county yielded 76%, with an increase in output for the year of 15,243,011 lb. Leadville zinc carbonate shipments, which were only 8059 tons in 1910, amounted to 83,905 tons in 1911, while the tonnage of zinc sulphide ore decreased from 163,218 tons to 79,981 tons. Increased production of zinc was also made in Clear Creek, Dolores, Eagle, Gunnison, San Miguel, and Summit counties. Heavy decreases were made in Mineral and San Juan counties, and appreciable decreases were made in Chaffee and Park counties. Zinc in concentrates in 1911 amounted to 41,262,830 lb.; in crude ore, 53,344,626 lb. In 1910 zinc from concentrates was three times that from crude ore.

The number of deep mines producing metals in 1911 was 861, against 856 in 1910. The average total recoverable value per ton of ore produced decreased from $13.67 in 1910 to $13.50 in 1911.

There were 2,377,936 short tons of crude ore from Colorado sold or treated in 1911, a decrease of 56,728 tons from the output of 1910. Of this total, 1,373,879 short tons went to gold and silver mills, 465,283 tons went to mills for concentration only, and 538,774 tons went crude to smelters.

MINE PRODUCTION OF GOLD, SILVER, COPPER, LEAD, AND ZINC IN COLORADO IN 1911, BY COUNTIES

[By Charles W. Henderson, U. S. Geological Survey.]

County.	Ore treated.	Gold.a	Silver.a	Copper.	Lead.	Zinc.	Total value.
	Short tons.		*Fine ounces.*	*Pounds.*	*Pounds.*	*Pounds.*	
Boulder	15,816	$163,174	53,753	27,752	145,955	.....	$201,700
Chaffee	7,459	65,714	92,098	88,448	1,001,651	200,509	182,085
Clear Creek	105,774	519,207	437,841	650,368	3,325,222	1,417,544	1,062,994
Costilla	.....	21,832	96	.....	.....	.....	21,883
Custer	3,670	5,560	13,179	1,640	17,511	.....	13,538
Dolores	3,276	7,565	56,202	3,288	701,244	525,333	99,263
Douglas	.....	166	.....	.....	.....	.....	166
Eagle	33,177	41,160	116,109	66,608	855,889	5,097,597	440,102
Fremont	382	178	1,345	13,976	19,904	140,526	11,544
Gilpin	103,038	778,774	292,659	950,240	1,239,356	23,088	1,109,750
Gunnison	11,926	145,039	32,541	9,928	631,933	557,456	223,739
Hinsdale	723	3,830	7,753	21,696	118,645	36,439	18,067
Lake	438,419	1,133,442	3,007,296	4,017,504	18,499,089	71,610,456	8,143,752
La Plata	10,058	286,937	69,438	73,728	1,511	.....	333,023
Mesa	.....	28	.....	.....	.....	.....	28
Mineral	65,932	179,196	545,319	33,384	7,674,556	1,258,561	889,481
Montezuma	1	16	6	183	.....	.....	42
Moffat	.....	4,942	21	.....	.....	.....	4,953
Ouray	133,252	1,952,958	512,800	564,273	3,949,822	.....	2,473,018
Park	5,780	58,832	69,072	24,216	923,089	407,772	163,249
Pitkin	88,823	542	450,772	7,408	11,084,334	.....	739,172
Routt	.....	1,173	26	.....	.....	.....	1,187
Saguache	184	512	4,664	4,984	74,556	46,561	9,616
San Juan	108,088	336,463	325,604	470,912	6,933,822	2,224,351	1,006,707
San Miguel	429,354	2,447,841	1,000,834	971,064	6,456,333	3,386,088	3,583,208
Summit	55,904	284,241	182,957	22,888	6,024,867	7,675,175	1,092,673
Teller	756,900	10,562,653	57,783	.....	.....	.....	10,593,278
Total	2,377,936	19,001,975	7,330,168	8,024,488	69,679,289	94,607,456	32,418,218

a Includes placer production.

SILVER production in Montana in 1911 was 11,985,196 fine ounces, against 12,162,857 oz. in 1910, according to the U. S. Geological Survey. In the silver output of the United States, Nevada takes the leading place, which Montana held in 1909 and 1908. Eighty per cent of the silver output of Montana came from copper ores and nearly 14% from silicious ores. Bullion at gold and silver mills produced only 122,823 oz., concentrate 7,751,426 oz., and crude ore shipped to smelters 4,105,092 oz. Silverbow county furnished 85.5% of the state's production. There were 430 deep mines producing metals in Montana in 1911, as against 423 in 1910.

Discussion

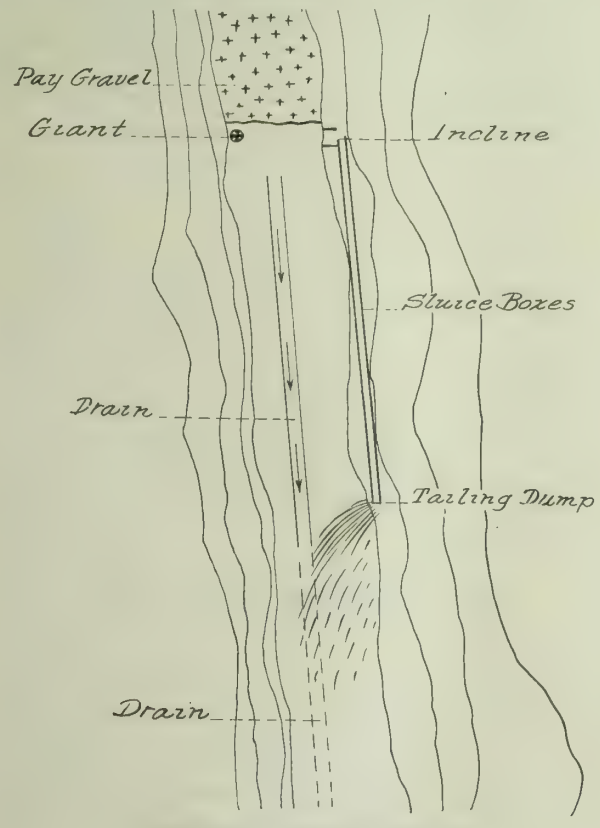
Readers of the MINING AND SCIENTIFIC PRESS are invited to use this department for the discussion of technical and other matters pertaining to mining and metallurgy. The Editor welcomes the expression of views contrary to his own, believing that careful criticism is more valuable than casual compliment. Insertion of any contribution is determined by its probable interest to the readers of this journal.

A Unique Scheme of Elevation

The Editor:

Sir—I had occasion to observe a method of handling some rather low-grade gravel recently in northern California which rather impressed me by its simplicity. The mine is on Grouse creek, in Trinity county, and it had been run at a loss before the present owners operated it.

The method of operation is shown in the attached drawing. The sluice-boxes are laid along the side of the hill, some distance above the creek bedrock. Enough space has



ELEVATING TO HILLSIDE SLUICE.

been gained in the creek to dump tailing, and self-drainage had been established. As the tailing runs from the end of the sluices the drain is continually covered over, to prevent it from filling up. The gravel is worked crosswise, from bedrock, and driven up an incline to the head of the boxes. Of course, local topographical features have a good deal to do with the choice of method, and if the slope was too steep or the gravel too deep, it would be impossible to work in this manner.

C. S. HALEY.

Newark, California, July 15.

Alaska Problems

The Editor:

Sir—I regret to observe that the *Mining and Scientific Press* is becoming more loyal to the Roosevelt-Pinchot system of unbridled bureaucracy than it is to those who find mineral, and develop mines. Here in Alaska we have borne the burden of this un-American bureaucracy until we have become galled and raw. I do not believe you have been subsidized. I believe you are honest, but I submit that when you advocate a policy which places the public domain and natural resources in the hands of a bureau to become the spoils of bureaucracy, that you are promoting bureaucracy at the expense of the industry named in your title. I am willing to concede that there is sometimes an honest difference between the views of the theorist and the victim. But, if we are to continue finding and digging ore in the face of bureaucratic hindrance which you indorse and encourage, then you will serve the industry chiefly as an illustration that the pick is more potent than the pen in winning the minerals of the earth for the use and benefit of mankind.

U. S. RUSH.

Kasaan, Alaska, July 24.

[We value the good opinion of our friends in Alaska highly, and while it is too much to expect at present complete agreement as to plans, we are at least one in purposes. We have advocated strongly the bill for railroad construction in Alaska framed by the Alaska Committee of the American Mining Congress, and we have favored a leasing system as applied to the coal lands, not only as correct in principle but as the only solution of present difficulties that commands enough public support to raise reasonable expectation of its being enacted into law. It may be noticed that the Governor of Alaska and many other Alaskans have come to occupy the same position. We admit, sadly, the danger of bureaucracy incident to the leasing system, but we believe that a properly framed leasing law will minimize this danger, and from long and personal acquaintance with men in the Government service, we have an unhesitating belief in the possibility of securing in Alaska as honest and efficient enforcement of law as, for example, in the Canal Zone. Incidentally, we would call attention to the fact that under any leasing system there could not be less coal mined in Alaska than now. It may also interest our correspondent to know that but a few days before his letter came we received another from a valued friend protesting with equal energy that we were unfair to Mr. Roosevelt and calling attention to the fact that many, or as he thought "most", of our readers are Roosevelt partisans.—EDITOR.]

Tin at Grants Pass

The Editor:

Sir—In the interest of the mining development in southern Oregon, I feel constrained to write you concerning the alleged presence of some of the less common metals, such as tin, tungsten, and platinum.

In January 1911 T. A. Rickard wrote a letter to the Southern Oregon and Northern California Mining Congress which convened at Ashland, asking that steps be taken by said congress to verify or deny the reports continually coming from the vicinity of Grants Pass with reference to the tin question. A few weeks later the Commercial Club of Grants Pass officially requested the State Bureau of Mines to make investigation of the same. This request was again repeated at the meeting of the Oregon Mining Congress at Portland in May 1911. In response to these requests, the Bureau of Mines took it upon itself to make a brief preliminary investigation. Accordingly, in the latter part of June 1911, Mr. Swartley, my assistant, and myself proceeded to Grants Pass and first interviewed some of the prominent citizens of that city, asking them to cite us to the parties who claimed to have the high tin values. We visited four different properties which were claiming the highest amounts of tin, and took samples ourselves of what was claimed to be the highest grade tin ores. These samples we brought to the laboratories at Corvallis and made a very careful investigation, both mineralogically and chemically. Our report was made at the Mining Congress held at Grants Pass July 5, 6, and 7, 1911, and was to the effect "that while it would be unscientific to state that there is no tin in the district, we, however, found no tin in the samples which we procured from these alleged tin properties." We found also, that some of the minerals claimed to be tin minerals were tourmaline, horn-

blende, magnetite, and chromite. We also found, while in the Grants Pass vicinity, that the tin reports originated with certain assayers in Grants Pass, who in order to make business good, appeared to give out promiscuously, encouraging reports in which tin was given in very generous quantities; platinum was reported in large percentages from base ores, as well as tungsten.

We had supposed that our verbal report given at the Mining Congress at Grants Pass would be sufficient to convince the truth-seeking public. However, since that time, we have found that there are certain parties in the Grants Pass vicinity who have been doing all in their power to discredit our report, and since I have noted from time to time certain articles in your periodical with reference to certain development work that is being pushed by some of these tin, platinum, tungsten (?) properties, it has seemed to me that in order to further the interest of the mining development in southern Oregon, we should make the foregoing statement, both for your information and for publication.

H. M. Parks.

State Bureau of Mines, Corvallis, Oregon, July 29.

[We are grateful to Mr. Parks for his letter. Such examinations as he has made lie in, we believe, one of the most useful fields for state geological surveys and mining bureaus. News of development and of reported discoveries from many districts comes in regularly, and as Mr. Parks says, it would be unscientific to deny them without specific evidence. For that very reason it is all the more important to have such information as contained in his report, periodically reprinted.—Editor.]

Research in the Mining School

The Editor:

Sir—According to a recent editorial in the *Mining and Sicentific Press*, mining schools, as a whole, need galvanizing into activity in the matter of research. This is especially true as regards the departments of metallurgy. I have in mind two of the leading mining schools in the western part of the United States, where, for the past ten years, as far as I am able to ascertain, nothing in the nature of research has been published. In these cases, the duty to the state which supports them has not been fulfilled—for two reasons: (1) they are not doing the research which should be done by institutions supported by the government; (2) the instructors are not giving the best that is in them in the way of instruction; for no one will deny that if a man uses his mind to a certain extent for original work he will be much better fitted to train the student to grapple with the practical problems to be met with later in his professional activities.

The reasons that more research is not done are several: (1) lack of time; (2) lack of inclination; (3) lack of money; (4) lack of encouragement from the powers that be; (5) lack of ability. Of these, lack of inclination and ability are the most valid, though the others are always given. If the administration forbids research, there is no remedy except a new administration, which is, as a rule, out of the reach of the instructor. He can, however, change his location. Lack of time, lack of help, and monetary considerations can be remedied in most cases by the man himself, provided he possesses the inclination and ability for the research. Interesting monied people outside the institution, is a comparatively simple matter for the right man.

We need more original investigation—not the testing of an ore new to the experimenter, by several old 'cut and dried' processes, but the devising of new and original processes and research. The instructor doing such work will be a better man himself. He will be worth more to the student, to the institution, and to the public at large. Any school administration would do well to require a certain amount of productive research from the instructors. For it will be found to be true, almost without exception, that the technical schools which have the best reputation and whose diplomas are 'worth the most' are those at which the most research is conducted.

R. C. Benner.

Pittsburg, July 24.

Nevada Consolidated Copper Company

During the quarter ended June 30, the mill of the above company treated 813,141 tons of ore averaging 1.66% copper. Of this, 731,299 tons was from the open pits, and 81,842 tons from the Veteran mine. The production of copper amounted to 18,092,439 lb., against 17,578,450 lb. for the first quarter of the year. The Steptoe plant milled 26,924 tons of ore for the Giroux Consolidated Mines Co. during June, but the copper from this ore is not included in the above yield. Development work to prove the existence of ore at depth in the Eureka pit will be carried on in August and September, when conditions in the bottom of the pit will be favorable for deep drilling. The work will have then been carried farther west, and will give a larger area for drilling below the bottom of development holes.

The profit and loss account shows the following for the past quarter:

Earnings from mines, investment, and miscellaneous		$1,628,859
Dividend No. 11		749,784
Net surplus for quarter		$ 879,075
Less depreciation for Steptoe plant	$141,160	
Less ore extinguishment	134,603	
		275,764
Net credit to undivided profits		$ 603,311

Production by months has been: Jan., 6,309,228 lb.; Feb., 4,888,790; March, 6,380,432; April, 6,115,095; May, 6,063,462; June, 5,913,882. The quantity and value of copper in transit materially increased, as did also the copper on hand at the Steptoe plant. The total increase in value of metals on hand was $702,611.

Tin Shipments and Prices

According to L. Vogelstein & Co., domestic deliveries of tin for the month of July are estimated by the Metal Exchange at 5150 tons. The average consumption for the first seven months of the year is 4000 tons per month. If this rate is maintained for the year a new high record will be established, the largest deliveries heretofore being 45,350 tons in 1910. The increase to date over last year is 3400 tons. These figures include Atlantic ports only. European deliveries are small, due to strikes abroad and the lateness of the Banca sale on July 31. The total London, Holland, and Continental deliveries in July were about 3000 tons, and the average for the first seven months is 3500 tons per month. The total foreign and domestic deliveries for the year to date show an increase of 6800 tons over the preceding year.

Straits shipments show an increase of 3200 tons for seven months, but Bolivian shipments, and those from Australia show a slight falling off, and arrivals of non-statistical brands in the United States are also smaller than last year. Hence there is a decrease of 3000 tons in the visible supply on July 31, as compared with December 31.

The outlook for a future increase in supplies is not encouraging. Even the Straits have exported 1800 tons more than was produced and imported into the district. The Dutch Government has announced that Banca sales will be reduced to 1500 tons per annum. This was necessary, as sales were in excess of production. July closed with 1339 tons on hand and about as much afloat to arrive in August. The large consumption of the United States will compel this country to draw freely from foreign reserves, where stocks are already depleted. The situation is strong, and a continuation of high prices expected.

Special Correspondence

NEW YORK

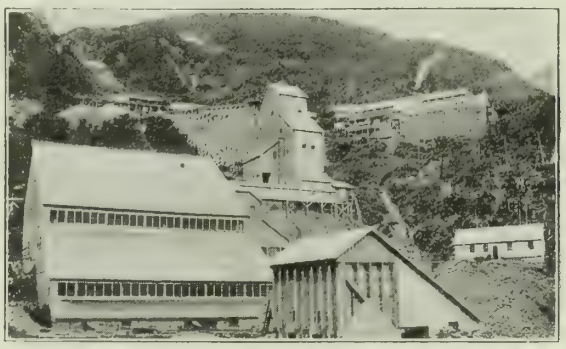
CONSOLIDATION OF MINING COMPANIES.—FORMATION OF ALASKA GOLD MINES CO.—PRODUCTION OF TUOLUMNE COPPER CO. A DISAPPOINTMENT.

The market in copper metal has been unusually quiet. The buyers and selling agencies alike seem, for the moment, inclined to mark time. There are many reasons for believing that a much larger movement may be seen within the next 60 to 90 days, but the situation will hardly right itself fully until the producers see fit to show their hand in regard to the blister copper piled up in the yards of the various smelting plants. Some of the large copper producers are evidently looking forward to an increased demand, and are planning some interesting deals. The Phelps-Dodge company is negotiating for the property of the Chemung Copper Co., in Grant county, New Mexico. This latter company is controlled by a group of Pittsburg capitalists. John K. Tener, Governor of Pennsylvania, is president of the company, and 'Cap'n Jim' Hoatson is one of the directors. The company is a reorganization of the old Tyrone Development Co. and owns 55 claims in the Burro Mountain district near Silver City, New Mexico. The company's stockholders are to meet in Duluth, Minnesota, on August 15, to act upon the offer made by the Phelps-Dodge people, which is said to be $1,350,000 cash for the property. The purchase of the properties partly developed by the Chemung Copper Co. is illustrative of the hold which the various groups of copper producers, now working in harmony, have over the whole situation. The management of the Chemung company has expended some $2,000,000 in development of its ground, in the hope that it would be able to secure some degree of co-operation from adjoining properties, and so be enabled to extract its ore at a profit. The company's funds have been exhausted, and the orebodies as now developed are not large enough to justify borrowing funds or the erection of an independent reduction plant. There are not many copper properties now partly developed to which this state of facts does not apply to some extent. Copper production is becoming essentially an operation in which only very large capital with experienced engineers can be employed profitably. The individual as an individual is practically eliminated from all opportunity of making money out of copper production.

The recent statement prepared by J. F. Callbreath, secretary of the American Mining Congress, and laid before the U. S. Senators and Members of the House of Representatives, is in part along these lines: Mr. Callbreath makes particular mention of the fact that the number of men employed in mining, milling, and smelting in Colorado decreased more than one-half during the period from 1900 to 1910. Speaking of the effect upon the industry of the employment of large organizations, Mr. Callbreath says in part: "A solution of the problem of economical treatment of low-grade ores is the one method through which this great fundamental industry can be revived. This problem is too great for private enterprise, and whenever improvements are made by private effort the results are kept secret and do not serve the general good. The West has a right to expect Federal aid in the solution of these problems." It has always been the boast of the mining industry that primarily it depended upon the individual—the prospector with his burro, shovel, pick and hammer, and tiny camp outfit—and the elimination of the individual is very apt to be followed by just the state of affairs reported by Mr. Callbreath. In the development of natural resources it is the individual that must be encouraged.

The Guggenheim interests are said to be in negotiation for the property owned by the Lake Superior & Arizona Mining & Smelting Co., which consists of 17 claims, 30 miles west of Globe, Arizona. The property has produced a small quantity of copper with a little silver and gold, but was idle from 1907 to 1910, when the development of the property was undertaken by the Magma Copper Co., which at that time took a bond and lease on the Lake Superior & Arizona ground. The present control is said to contemplate development by the Guggenheim people on a basis of payment of $400,000 cash and 40% of the stock of the company to be organized to hold and develop the mine; or to acquire the property by the payment of $800,000 in cash at the end of one year, or $1,000,000 in cash at the end of two years.

The general attitude of the public toward precious-metal mining has always justified the maxim that it is impossible to make a boom camp without high-grade ore. The general public loves the spectacular in mining. The excitement and the romance that made history in so many spots on both slopes of the Rocky Mountains was in nearly every case due to rich ore. Some of the older countries on the other side of the water have long ago outgrown this feeling, and have come to prefer low-grade properties of large known orebodies. Education in this direction is making progress in Eastern financial centres. Hayden,



MINE AND MILL OF THE ALASKA PERSEVERANCE.

Stone & Co., who have long been identified with the financing of the Guggenheim porphyries, have for some time been making search for a low-grade gold-mining property, and have just recently secured a group of claims lying next to the Alaska Juneau ground at Juneau, Alaska, known as the Alaska Gastineau property. The present organization is a consolidation of three groups of mines, known as the Alaska Perseverance, which has figured in three or four deals during the past five years; the Oxford and the Sheep Creek. The present company has a capitalization of $12,000,000 in stock, and $3,500,000 in bonds. D. C. Jackling, head of the Guggenheim management, together with A. F. Holden, are just returning from an examination of the property. Contemplated operations will be on a very large scale, and will involve an outlay of some $5,000,000 in the erection of a 6000-ton mill with a cyanide plant. The 80% interest which Hayden-Stone have under option is to be placed in the treasury of a holding company, to be known as the Alaska Gold Mines Co., the stock of which latter company will, in accordance with the usual custom of Hayden-Stone, be offered to their clients. At present the engineers estimate the property to have an earning power of $1,500,000 per year.

The action of the Tuolumne Copper Co. has been most disappointing to Eastern shareholders, most of whom have waited for three years through the earlier stages of development and equipment, and then through a dull copper market, to see the mine fully equipped with a big Nordberg hoist, and copper at better than 17½c., only to be confronted with a monthly output of less than three-quarters of a million pounds. Tuolumne's output for July was 605,000 lb. of copper, made from 7500 tons of ore. The company has a new smelting contract covering the treatment of its second-class ore, of which a large tonnage has been developed, and it is said this can now be mined at a good profit.

Two suits have been filed against the United Copper Co.

praying for a receiver for the Heinze concern. One by Paine-Webber of Boston and one by T. H. Ball of Philadelphia. There is apparently some little activity in mining ground in Butte adjoining the Butte & Superior. The Butte & Superior management has obtained options on some claims, and it is expected that a new company will be formed and the shareholders given the opportunity to subscribe, provided they ratify the plan of acquiring the ground.

The International Smelting & Refining Co. is eventually to make a bid for a large share of the business of lead refining. A fifth furnace is to be added to the plant at Tooele, Utah, and it is stated that there is a sufficient amount of lead ore under contract to keep the four 400-ton furnaces in steady blast. The East Chicago plant of the International company is going up as rapidly as possible; the steel work is nearly all in and it is expected that the first furnace will be blown in in October. It is understood that the International Smelting & Refining Co. has some important development in the way of new reduction processes, details of which are not as yet obtainable.

So far as the Eastern market is concerned, interest is in large part centred in the Tonopah district. The activities of the various properties at Tonopah are closely followed and such market activities as prevails is mostly in these stocks. Montana-Tonopah is spreading out to build a mill for the Common Wealth property at Pearce, Arizona, which it recently acquired. Tonopah Merger continues to be active, and the market interest, which for some time was centred altogether in Tonopah Mining and Belmont, is spreading to other properties in the district as having large possibilities.

BOSTON

Copper Shares Nearing Top Prices.—Brokerage Houses Inspect Mining Properties.—Canadian Interest in American Mines.

The progress of the copper market has not entirely stopped with the summer heat. There is a feeling in Boston that a price of 20c. per pound may be reached for the metal before the end of the year, and with this hoped for advance is expected a better distribution of copper shares to the public. It is noteworthy, however, that a number of Boston coppers have been already pushed to the level of their highest prices in the last three years. Some others which have not reached the price paid in the speculative boom in 1909 are within a few points of that mark.

William F. Bartholomew, of Thompson, Towle & Co., and George L. Walker, editor of the *Boston Commercial* and *Walker's Weekly Copper Letter*, have been recently visiting in the Lake Superior copper district. Both of these men are very optimistic over the bumper crops in the Northwest, the copper situation in the Lake country, and the prospects of record business. Mr. Walker believes that the lodes of the Calumet district will be profitably operated for hundreds of years. It is becoming customary for members of brokerage houses specializing in copper to visit the mining districts periodically. The broker has a different viewpoint from a mining superintendent or engineer, and even where he has full access to their reports he wants to see conditions for himself. The Chicago, Milwaukee & St. Paul railroad has been advertising in the Boston papers its special service to the "copper country," Lake Superior. Interest is not confined to this district, however, and Boston is watching Butte, and the Arizona, Utah, and Nevada districts with equal eagerness. A bid of $1000 per share for stock of the old Standard Oil Co. of New York, reminds brokers of the time when Calumet & Hecla sold at exactly $1000, which is believed to be a record for the stock of a mining company. Some Canadian capitalists are now becoming interested in American mining. It was recently announced that Frank Armstrong had acquired control of La Rose. Mr. Armstrong is himself interested in Cobalt, and his business associate, D. Lorne McGibbon is president of La Rose. In the Butte, such Canadian bankers as Sir Henry M. Pellatt; Sir Frederick W. Borden, and Sir Rodolphe Forgot, of Montreal, are heavily interested in Butte Central, which company is now building a mill. American capital has led in building up the mining industries of Ontario and British Columbia, and it is a good sign when financiers of Canada reciprocate by assisting in the development of properties in established districts such as Ely and Butte.

BUTTE, MONTANA

Settlement of Wage Question at Smelters.—Mining Claims in Demand.—Hoisting of Ore Resumed in the Anaconda Shaft.

The smeltermen of Anaconda and Great Falls have accepted the offer of the Anaconda company of an increase of 25c. per day in wages. This is a compromise. Some time ago the Great Falls smeltermen's union decided to ask for an increase of 50c. per day, and afterward the smeltermen's union of Anaconda joined with the Great Falls men in the demand for the increase. When the question came before the officials of the company, through a committee, the wage question was thoroughly discussed, and in due time the company gave an answer declining to accede to the request, but offering an increase of 25c. per day so long as copper remained at 15c. per pound or over. The two unions referred the offer to a referendum vote of the members, and they accepted. The condition of the offer was that a contract should be signed for at least three years, to date from July 1. Final figures of the U. S. Geological Survey credit Montana with a production of 272,847,705 lb. copper in 1911. All but 589,253 lb. of this came from Butte.

Mining claims which have been regarded as next to worthless for several years in the northern part of the Butte district, are bringing high prices. The Ready Cash claim, which a year ago could have been secured for $10,000 or even less, recently changed hands for $110,000, there having been $10,000 paid in cash with an agreement to pay the rest in a year. The Narragansett, which was sold a few years ago for $2.64 at sheriff's sale, to satisfy delinquent taxes, is now under option for $75,000, while there are several other instances of claims selling all the way from $80,000 to $135,000 which a few years ago could have been secured for the payment of the taxes. This boom was started by A. B. Wolvin, president of the Butte & Superior Copper Co., and John M. Hayes of the Utah Copper Co. purchasing claims adjoining the Butte & Superior property. Then Duluth people secured options, and the fever to secure claims spread. Prominent among the people who are buying up claims is Chester Congdon, and he is said to have associated with him Thomas F. Cole. Mr. Cole and his associates have six claims just east of the North Butte and north of the North Butte Extension, and have options on other claims in the vicinity, although no record has yet been made of an agreement for a sale. Bruce McKelvie of Hayden, Stone & Co. is said to be carrying on negotiations of some kind for the financing of the Butte & London Copper Development Co. There is also a report that an effort is being made to finance the Butte & Bacorn M. Co. and resume development. When work was stopped on this property it was said that the prospects of opening up good orebodies were excellent, but lack of money and unfavorable market conditions compelled the closing of the mine. Henry Turrish, of Duluth, has secured options on eleven claims in the northern part of the district through John McBarren, who has held them under option for years. The claims assigned to Mr. Turrish are known as the Blane, Copper King, Washington, Peoria, Robert Emmet, Sarah Alice, William J. Bryan, Rising Sun, Arctic, Sundae, and Christie. In the struggle for mining claims the courts will reap some benefit, as two options on one piece of property have been given, one to Arthur V. Corry, representing A. B. Wolvin and John M. Hayes, and the other to Eugene B. Milburn, who represents the Cole-Congdon syndicate.

The Anaconda shaft has been used for hoisting since

August 1, for the first time in four years. During this time the fire in the orebody has been completely enclosed by cement bulkheads, the workings put in good order, and the shaft completely retimbered. B. B. Thayer, president of the Anaconda company, after being in the city for the past six weeks inspecting the various properties of the company, has completed his work and left for a short visit in California. Mr. Thayer not only made an inspection of the mines of this district, but he also made an examination of the Washoe smelter and the plant at Great Falls, together with the lumber properties in different parts of the state. The mines were found to be in first-class condition and capable of responding to any emergency. Some improvements are being made to the smelter at Anaconda which will be completed about the middle of the month, and this will mean that the Washoe will have an increased capacity. Mr. Thayer regards the copper situation as highly satisfactory, and says that sales now being made are for October delivery.

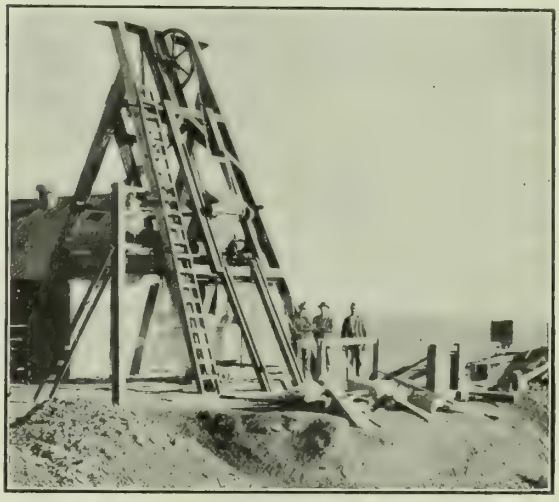
Directors of the Tuolumne Copper Co. are not disposed to tell when dividends will be resumed. The greater portion of the ore going to the smelter is second class, and with copper around 17¾c. per pound, it is a good time to get clear of the large amount which has been allowed to accumulate for the past two years. It is stated that in the course of two or three weeks the shipping of first-class ore will be resumed in larger quantities than at present.

SALT LAKE CITY, UTAH

JULY PRODUCTION OF COPPER COMPANIES.—ENLARGED LEAD SMELTER PLANNED BY INTERNATIONAL S. & R. CO.—AMERICAN S. & R. CO. MAY MOVE MURRAY PLANT.

The month of July will show record production for the Utah Copper Co., Ray Con. Copper Co., and Chino Copper Co., according to D. C. Jackling, general manager for the companies. Mr. Jackling claims that before long the Utah property will be producing at the rate of 150,000,000 lb. of copper per year. The Chino, he says, treated on an average of 3000 tons per day, and Ray Con. 4500 tons per day during the month. The complete official figures on all these properties will be forthcoming later. Mr. Jackling and A. F. Holden, managing director of the United States Smelting, Refining & Mining Co. have returned from a trip to Alaska, where they went to inspect the Alaska Perseverance and adjoining properties held under option by Hayden, Stone & Co. If the option is exercised as a result of this examination, it is understood that both the Guggenheim and the United States mining interests will have a hand in the operations. The Perseverance is a neighbor of the Treadwell, and now has a 100-stamp mill in operation, which works only four or five months a year, when the streams which furnish the water supply are not frozen.

The plant of the International Smelting & Refining Co. at Tooele was built primarily as a copper smelter, but the treatment of lead ores has assumed greater importance. The production of the Utah Consolidated Copper Co. has fallen off, and the supply of ore from other sources has not been all that was anticipated. On the other hand, the strength of lead and the establishment of favorable smelting and railroad rates for low-grade ores have combined to stimulate lead production, so that the receipts of lead ore exceed the present capacity of the lead furnaces. The Prince Consolidated of Pioche now has railroad facilities and is shipping a good tonnage regularly, while other new contracts have either been signed or are being negotiated. Three furnaces are already in operation, and a fourth has been ordered. Following a visit to the plant in company with Dennis Sheedy, of Denver, vice-president, E. P. Mathewson, general manager for the company, announced that the directors had been requested to make an appropriation for two additional furnaces. This will make a total of six, with a daily capacity of 1500 tons. The American Smelting & Refining Co. is reported to be contemplating moving its Murray plant into a location where the town and the entire surrounding territory can be directly controlled by the company, as is the case at Garfield. In fact, if the move is made, it is altogether likely that the lead smelter will be erected close to the copper smelter at Garfield. The Murray smelter is now directly in the town, which is independent, and close to a large number of farms whose owners are constantly claiming damages on account of smoke. Before the Garfield copper smelter was started, the company purchased the land for miles around, and fortified itself still further by taking photographs of all farms for a still greater distance, so as to be ready with evidence in case suits were started for ruining formerly valuable



SHAFT OF PRINCE CONSOLIDATED.

farms by smoke and fumes. As a result, the 'smoke farming' industry has not thrived so well around Garfield as it has around Murray. The company also owns and controls entirely the town of Garfield.

JOHANNESBURG, TRANSVAAL

FAILURE OF THE WAY-ARBUCKLE PROCESS.—DISCUSSION AT ANNUAL MEETING OF THE BENONI CONSOLIDATED MINES COMPANY.

The principal mining topic of interest here is the failure of the Way-Arbuckle process at the Benoni Consolidated Mines. The details of this process were published in the *Mining and Scientific Press* of May 25, and the failure predicted. During the week the annual meeting of the Benoni Consolidated has been held, and as the result of disclosures made at this meeting the failure of the Way-Arbuckle process has been brought to the front. The Benoni mines are owned by the Anglo-French Exploration Co., Farrar Brothers, and the Jumpers company. The Anglo-French company supplies the consulting engineer, E. J. Way, and the Jumpers company the mine manager. This involves a dual management from the start. The Benoni Consolidated had £280,000 in cash available to buy a neighboring property, and to develop and equip the mine. After carrying out this work the company had an actual cash deficit of £195,000, a fairly well developed mine, but only half an effective equipment. When it came to equipping the mine the directors found themselves short of working capital and with a heavy loan from the bankers staring them in the face. The Way-Arbuckle process was recommended by the consulting engineer on the grounds that its secondary treatment would involve a saving of £31,000 in the first cost, would treat the sand and slime in as many hours as the ordinary treatment required days, while giving a very high and satisfactory extraction; features of importance to the Benoni company. All these promises have, however, proved delusions. At the outset troubles arose in connection with the Arbuckle screw elevators belonging to the de-watering and de-solutionizing

cones, and they were replaced by ordinary centrifugal pumps. The centrifugal pumps failed to remove the settled slime as anticipated, and the process at once became an intermittent rather than a continuous process. The next trouble arose with the Brown treatment-tanks, owing to a sufficient and uniform supply of air not being available, with the result that the slime was discarded and thrown aside for future treatment, and a larger tonnage of sand put through the tanks in the hope of making up for the loss of the slime. Still the process was intermittent, as, on the slightest stoppage of the air or power supply, the agitating-tanks immediately silted up, involving much loss in cleaning out and restoring them to working order. The operating costs were also found to be abnormally high, and after working several months in an intermittent and experimental manner without profits or prospects of success, although the screen values were consistently satisfactory, it was decided to close down the plant rather than go on exhausting the ore reserves without any prospects of making profits to reduce the company's liabilities. Laurie Hamilton was called in by the Jumpers company to report on the mine. He confirmed the action of the directors in closing down the plant. F. L. Bosqui was also consulted. He advised that, as the plant stood, the cyanide portion could not possibly be operated in a successful manner, and recommended wholesale additions and alterations, which the company did not in its financial condition see its way to make. Since then consolidation with the adjoining Apex property has been proposed and considered, but at the time of the meeting negotiations had failed. At the meeting of the shareholders held the other day the consulting engineer was severely called to task by the representatives of the Jumpers mine for his recommendation to the board of the installation of a worthless method of treatment, and for his inability to work the plant to advantage although it was left entirely in his hands. The consulting engineer, in reply, blamed the mine manager, the reduction employees, and the patentee for failing to render the necessary assistance in the matter. They in turn all deny any responsibility, owing to the consulting engineer taking the whole control into his own hands. Here the matter rests, the mine standing with a liability of £200,000 and those interested having such conflicting views that it is difficult to see the result. Perhaps by co-operation the mine may be put on its feet, but it will be some time before the shareholders regain the losses caused by the introduction of the Way-Arbuckle process.

LONDON

Operation of Russian Copper Company.—Organization of Subsidiaries to the Northern Copper (B. S. A.) Co., Ltd.—Operation of Company in Rhodesia.

The Kyshtim group of copper producers in Russia is of special interest in America, for the mining and metallurgical work has been largely in the hands of Americans. R. Gilman Brown is consulting engineer, H. W. Turner geologist, E. J. Carlyle and W. G. Perkins metallurgists, while H. C. Hoover and A. Chester Beatty had a hand in providing capital. A review of the recent operations will therefore be of interest. The English company was formed in October 1908 to acquire the share capital of the Kyshtim Mining Works Co., the Russian company which owns and operates copper, iron, and gold mines in the Perm district of the southern Urals. In addition, the company has made loans to the Russian company amounting to £761,152, for the purpose of reorganizing the mining and metallurgical work at the copper mines. The capital is £1,000,000 in ordinary shares, and there are £650,000 debentures. During 1911, 247,102 long tons of ore was raised from the Koniukhoff, Smirnoff, and Tissoff mines, averaging 3.19% copper. The amount of ore treated at the new smelting plant at Karabash was 218,310 tons, and at this plant and at the old Kyshtim works, where matte, flue-dust, etc., are still treated, the total production of blister copper during the year was 5020 tons. At the electrolytic refinery, 4033 tons of copper was produced, together with gold and silver slime that sold for £55,321 or £13 14s. per ton of copper. The cost of operations, including mining, smelting, transport, and general expenses, was 15s. per ton of ore or £34 per ton of blister copper. The reserves as estimated by R. Gilman Brown in June of this year amounted to 1,699,000 tons averaging 3% copper, 2 dwt. gold, and 1 oz. silver per ton. At the Karabash smelter, a third blast-furnace was started in May of this year. The dust-chambers have been enlarged, and the main chimney heightened by 60 ft. A second reverberatory has been started at the Kyshtim works to treat the flue-dust and fine ore. It is probable that the output of copper during 1912 will be of 7000 to 7500 tons. The Russian company made a profit of £172,394 on the copper production, £23,439 at the iron works, £29,651 in the timber business, and £4919 from the sale of pyrite for sulphuric acid manufacture. The general expenses, taxes, and interest on mortgages and bankers loans absorbed £119,135, and £30,033 was written off for bad debts, while £65,200 was remitted to the English company. Out of the latter, £23,657 has been paid as debenture interest, £9289 was paid as directors' fees and London expenses, and other amounts debited for formation expenses and discount on new debentures, etc.

Besides the Tanganyika Concessions, there are other companies operating copper mines in tropical Africa. One group is that of the Northern Copper (B. S. A.) Co., Ltd., that was formed in 1895 to acquire prospecting and mining rights in northwest Rhodesia. Percy Tarbutt & Co. are the consulting engineers. Almost all the properties so far developed are old native workings. In 1902 a number of the properties were handed over to a subsidiary, the Rhodesia Copper Co., which in turn, acting in concert with the parent company, floated three separate organizations, namely, the Rhodesia Broken Hill, the Kafue Copper, and the Bwana M'Kubwa Copper. The Rhodesia Copper Co. also has a financial interest in the Rhodesia-Katanga Railway & Mineral Co., which is under the control of the Tanganyika Concessions and owns the Kansanshi copper mine. Northern Copper still holds 363,000 shares in the above-named companies, valued at £116,120, and also a number of mineral concessions that are awaiting development. The Rhodesia Copper & General Exploration & Finance Co. owns shares in the subsidiary companies valued at £156,790, and has investments in other companies and in government stocks of £127,446, and many other extensive properties awaiting development. At the Bwana M'Kubwa, 12,552 ft. of development has been done to date. Above the 350-ft. level the ore reserve consists of 120,000 tons of 14% ore, and 750,000 tons of 5% ore, all oxidized. Experiments have been conducted in London with a view to finding the best process for the treatment of this ore, and an electrolytic leaching method has been adopted. The first part of the plant, having a capacity of 75 tons of high-grade ore per day, has been ordered, and should be at work before the end of the year. Further exploration at depth has disclosed large masses of sulphide ore, 'disseminated chalcocite,' and between the 350 and 550-ft. levels it is estimated that the probable ore is 2,500,000 tons of unspecified grade. The Kafue Copper Co. owns a number of properties in the hook of the Kafue river, the Sable Antelope and the Silver King being the principal claims. A 25-ton smelter erected at the former started work in August 1911, and during the eleven months to June 30 produced 1990 tons of matte averaging 72% copper, and containing 70,000 oz. silver. Owing to the cost of transport this matte has not yet been shipped. The reports as to the future of these properties are not quite reassuring. The results of development at the Silver King are not hopeful and work has been suspended. At the Sable Antelope the development disclosed 7000 tons of ore averaging 16% copper and 5000 tons averaging from 4 to 5%. The high cost of operations, and of transportation, together with the royalty payable to the British South Africa company make it doubtful whether work can be continued.

General Mining News

ALASKA

Cordova

At a depth of over 100 ft., sylvanite, a telluride of gold, assaying high, has been found in the claim owned by D. Ross, J. Foster, J. C. Clarkson, and C. Garwood, near Teikhell, on the Valdez-Fairbanks road. The vein has well defined walls, and is from 12 to 24 in. wide. Up to this time, only free gold had been found in the ore. A number of teams, loaded with provisions and mining supplies, have started for the new camp. Ten to twelve feet of pay-ore has been opened up at 200-ft. depth in the Mayfield properties. About 400 tons has been stored. It is proposed to erect a plant consisting of a crusher and Chilean mill. At Katalla the Amalgamated Development Co. is drilling to a 4000-ft. depth to test for oil-sand. About 35 bbl. is being produced daily from three wells. The Royal Development Co. intends to drill 3500 feet.

Fairbanks

From two clean-ups on the Biglow ground, on the left limit of Goldstream, $55,000 has been won. One of the winter dumps has been sluiced, while the other dump contains a fair tonnage. Water conditions are not very good. It is estimated that the claim will produce $500,000 this year. A four-stamp mill is being erected at the Fey Quartz claims at the head of Chatham creek. This mill will be the fifth on the Cleary divide.

Kenai Peninsula

The ground along the Kenai river is to be thoroughly prospected for dredging purposes by Milnor Roberts and Wernecke, who have brought an Empire drill for the work. The Towle ground will be tested first, this being below the Cunningham group, between the lakes. Several promising properties on Mineral creek, known as the Big Four group, have been sold to California mining men, the purchase price being $100,000. Within 70 days, $4000 is to be paid, the balance to be paid in royalties at 25% gross yield. Little work has been done on the claims.

Juneau

During June, the 120-stamp mill of the Alaska Mexican worked 29.73 days, driven by water-power, and crushed 19,299 tons of ore. The gross value of the free gold saved was $30,289, and the yield from 384 tons of concentrate being $34,619, making the month's production $64,908, of an estimated realizable value of $64,259. After deducting operating, $28,399, and construction expenses, $7705, there remained a profit of $28,155. The yield per ton was $3.36. Development totaled 190 ft., and the stock of crushed ore increased 12,948 tons. The Alaska United Ready Bullion mill worked 29.73 and the 700-Ft. Claim mill 29.60 days, and crushed a total of 37,252 tons, from which 855 tons of concentrate was saved. The free gold was valued at $49,988, and the concentrate yielded $53,418, making a total of $103,406. Deducting operating and construction expenses, the net profit was $48,714. The yield from the Ready Bullion claim was $2.79, and the 700-Ft. Claim $2.76 per ton. Development in the former totaled 206 ft., and in the latter 471 ft., the stock of broken ore increasing 9553 and decreasing 2019 tons, respectively.

ARIZONA

Cochise County

A smelting plant to cost about $500,000, with 400-ton capacity, is to be erected near Douglas by the Shattuck-Arizona company. Mine development continues encouraging.

Gila County

(Special Correspondence.)—Drill-hole No. 2 of the South Live Oak Development Co., three miles west of Miami, is over 775 ft. deep, and is in granite. It is stated that silicates and carbonates of copper have been found in small quantities, but no chalcocite is reported. At the Southwestern Miami, churn-drill holes No. 6, 7, and 8 are 725,615, and 540 ft. deep, respectively, and are all in mineralized schist, carrying more or less silicate of copper. Hole No. 8 is the one nearest to those already drilled, and it is in this hole that ore is first expected, though the chalcocite zone will probably not be reached for another month. The main west working shaft at the Inspiration Consolidated mine is over 200 ft. deep, and is being sunk at the rate of 5 ft. per day. During July it was sunk 164 ft., which is said to be the state record for a three-compartment shaft. Sinking the Scorpion shaft has been discontinued at a depth of 545 ft., and the Live Oak No. 2 at a depth of 1181 ft. A pumping station is being cut at the 1160-ft. level. Live Oak No. 1 shaft is being sunk, and is 496 ft. deep. Development is proceeding at the rate of about 4200 ft. per month. The new dormitory and mess-house for the members of the staff are nearing completion, and a new office building will be erected near the millsite. H. Kenyon Burch is working on the plans for new construction.

At the Superior & Boston mine a new stope is being opened on the sixth level, and it is reported that samples assay from 15 to 16% copper. Two stopes are being worked on the Limestone vein, one on the second, and one on the third level, the vein being from 3 to 4 ft. wide. It is stated that the mine is in better condition to make regular shipments than at any time since shipping was resumed. On the twelfth level, the east cross-cut, 500 ft. from the shaft, is in schist, and the cross-cut being driven south toward the Limestone vein is in 410 ft. in dabase. At the Iron Cap mine on Copper Hill, driving is being done on the 650-ft. level, from the Williams shaft, on what is believed to be a continuation of the Old Dominion vein. The west drift is in 310 ft., and the east drift 95 ft. On the 800-ft. level the drift is being continued west, and is in 110 ft. Jones & Danum have taken a lease on the claims of the Sleeping Beauty Copper Co. in the Sleeping Beauty mountains, seven miles northwest of Globe. There are 20 claims in the group, and the ore found carries gold, silver, and copper.

Pinal County

The Magma Copper Co. at Superior has just finished the erection of the last two boilers in the power plant, and as soon as the compressor is erected, operations will be conducted on a more extensive scale. Development continues to show rich ore. The American Smelting & Refining Co. is repairing the power-plant at the Lake Superior & Arizona mine, at Superior, and will soon begin unwatering and an examination of the mine. The Calumet & Arizona people, of Bisbee, are reported to have taken an option on the Cobre-Verde group of 81 claims at Superior, one mile south of the Magma mine. The option calls for a total payment of $500,000.

Globe, August 1.

CALIFORNIA

Plumas County

(Special Correspondence.)—The Crown Point, on Squirrel creek, has been taken on option by O. A. Eckman, of Denver. A thorough examination is being made, and if satisfactory a first payment will be made on August 15. C. A. Huntington has commenced work at the Comstock quartz property on the Winters creek. New York and New Jersey people are interested. The property was located three years ago by H. Kling, of Greenville. The vein is reported to average $3 to $20 per ton in gold. The Greenville Bullion Mining Co. is arranging for vigorous work at the recently bonded Bullion mine. Near the surface, veins averaging about 6 in. wide have been opened which assay from $10 to $45 per ton. A shaft at the mouth of the old adit is said to have cut 3 ft. of pay-ore at 18-ft. depth. The vein has been traced on the surface about 1000 ft. Credited as being the first quartz claim in the county, the Bullion has produced considerable gold in past years which was extracted from gravel and lodes. It is reported that a 10-stamp mill, hoist, and pumps will be erected soon. Electric power will be used. The mine is

situated about a mile west of Greenville, and residents of the town are chiefly interested. The 10-stamp mill recently erected at the Gruss mine is now working. Fox riffles are being used and are reported to be giving an excellent gold recovery. An electric generator and complete pumping plant have been erected. The mine is operated under lease by the Johnson-Locke Mercantile Co. of San Francisco. A R. Seymour recently shipped 1500 lb. of ore from his find to the Selby smelter. According to the owner, its value is estimated at about $8000.

Quincy, August 3.

SHASTA COUNTY

(Special Correspondence.)—The Bully Hill Copper Co. is experimenting on the treatment of copper ore by electricity. A small plant has been erected at the Delamar smelter and tests are reported as encouraging. It is probable that an effort will be made shortly to treat the ore on a commercial scale. The Bully Hill ore carries a considerable percentage of zinc, and assays show it to contain gold and silver. The company was formerly one of the largest producers of copper in California, but the smelter has been idle since July 1910, owing to complaints that fume was damaging Government timber. The Bully Hill company later conducted tests to determine the feasibility of electrically extracting copper and zinc at the Heroult plant of the Noble Electric Steel Co. D. M. Riordan is at Delamar inspecting the process. A new furnace is nearing completion at the Heroult electric iron smelter. Several improvements have been made and the company is arranging for steady production. A silver prospect known as the Silver King is being developed near Ono. A small quantity of good-grade ore has been opened. It is stated that the buildings recently destroyed by fire at the Little Nellie mine will be rebuilt at once. The property is idle at present. Attempts of certain farmers to cause the Mammoth Copper Co. further annoyance have so far been defeated. The company continues to liberally compensate for all proved damages resulting from smoke, and the majority of the farmers appear to be satisfied.

Redding, August 5.

COLORADO

CLEAR CREEK COUNTY

On Columbia mountain the Animosa mine has opened a galena lode, which averages $25 per ton. The mine is worked by an adit 1000 ft. long, and the ore is about 400 ft. from the surface. Electric power is used, as well as an air-compressor and machine-drills. Work at the Mineral Chief property is generally satisfactory. More men have been put at work on the Malm plant. The Kelly tunnel mill has started, and will be worked one shift only for a time.

SAN MIGUEL COUNTY

At the Smuggler-Union the company is erecting a large gyratory crusher at the mouth of the Bullion tunnel. The crusher will stand on a concrete pier about 18 ft. high. The Lewis mill, in Bridal Veil basin, has been started, and will work until the snow gets too deep to haul concentrate to Pandora. The shaft is down about 500 ft. at the mine, and 60 tons daily is being sent to the mill. An accumulation of over 300 tons of concentrate has been nearly removed. The Carbonero mine at Ophir is shipping five cars of ore per month to the smelter. Fifteen men are working at the alterations and additions to the Suffolk mill, worked by the Ophir company. The ore will be broken in a Blake crusher, and crushed by stamps through ¼-in. mesh screens. The pulp will pass a Dorr classifier, the oversize ground in a Hardinge tube-mill. All classifier overflow will be pumped to a Dorr thickener, the thick slime agitated with cyanide in a modification of the Pachuca agitator, further thickening, and the gold solution will be decanted. Zinc-dust precipitation will be used. The plant will have a daily capacity of 150 tons. Three machine-drills are working in the drifts, and two to four in the stopes. G. B. Pickett is manager for the company. The Vanadium mines, at the west end of Montrose county, have been shut down, the reason being that the market was overstocked.

TELLER COUNTY (CRIPPLE CREEK)

According to local statistics, the output of the mines of the Cripple Creek district for July has totaled 76,410 tons, with a gross bullion value of $1,226,224. As compared with the figures of the preceding month, an increase is shown of 2587 tons, and in value $34,593. The feature of the month has been the tonnage treated at the Battle Mountain mill of the Portland Gold Mining Co. Ore of the low value of $2.92 per ton was treated at the Argall plant on Stratton's Independence. Tailing from the old Isabella mill on Bull hill of the value of $1.20 per ton was re-treated with profit. The figures reported by the smelters and mills are as follows:

Plant.	Tonnage.	Av. val.	Gross val.
Golden Cycle	33,150	$20.00	$663,000
Portland	10,000	22.00	220,000
Smelters	3,875	65.00	251,875
Portland (C. C. D.)	14,950	3.38	50,531
Stratton's Independence	10,835	2.90	31,638
Isabella	1,800	1.20	2,160
Wild Horse	900	3.80	3,420
Jo Dandy	900	4.00	3,600
	76,410		$1,226,224

Great damage was done at Pueblo through a cloudburst on Tuesday last. Nearly an inch of rain fell in the first half hour, being the heaviest since 1889. The power-house was somewhat damaged, and fires were started at several places.

Seventy-three cars of ore, averaging $25 per ton, were shipped from the Granite company's mines on Battle mountain during July. The tenth level of the Gold Coin shaft produced 14 cars worth $30 per ton. Lessees on the ninth level of this shaft ship about seven carloads monthly, assaying up to $50 per ton. On account of heavy rains, the water in the shaft has risen 10 ft. in 14 days. The C. K. & N. mine, on Beacon hill, shipped 20 cars of ore which returned from $20 to $30 per ton. The flow of water from the Roosevelt tunnel is now 10,000 gal. per minute, against 9600 gal. a fortnight ago. This increase is probably due to heavy seepage into the mines.

The W. P. H. mine, on Ironclad hill, produced 10 cars of milling ore from one of the shoots opened some time ago, and the Union Leasing Co. shipped 13 carloads from the Husted shaft of the Mable M. and 14 cars from the Gold Sovereign on Bull hill. The ore assayed from $8 to $50 per ton.

About 60 cars of ore were shipped by the Vindicator mine, and 35 cars from lessees during July. Development of the south vein system on the 1500-ft. level has opened six separate veins in that part of the mine. The Mary McKinney produced 37 cars averaging $35 per ton. The shaft is down 905 ft. From the Duncan and Camduff lease 19 cars realized over $50 per ton.

MICHIGAN

For the six months ended July 1, the Ahmeek company crushed 315,003 tons of rock yielding 7,779,023 lb. of copper, equal to 24.7 lb. per ton. The cost per ton was $1.38, and per pound of copper produced, 7.44c. Net earnings amounted to $690,000. The Tamarack company produced 4,130,022 lb. of copper for the first half of the year. The yield was equal to 19.8 lb. per ton of rock crushed, and cost per pound of copper, 12.41c. The Isle Royale company produced 4,129,678 lb. of copper from 259,410 tons of rock for the half-year, the yield being 15.9 lb. per ton crushed, and costs 11.01c. per pound of copper. The Quincy produced 10,500,000 lb. of copper for the same period, the net profits being $367,500.

During July the Champion mine yielded 2,490,000 lb. of copper; Tri-mountain, 846,000 lb.; and the Baltic, 1,852,000 pounds.

MONTANA

Silverbow County

The Federal Court has issued an order restraining the directors of the Alice G. & S. M. Co. from transferring the property to the Anaconda Copper Co., as was voted against by the minority stockholders of the Alice company. These stockholders say that fraud was practised, and the claims were sold to the Anaconda company for less than their actual value. The directors claim that at the time of the sale the Alice was of small value. It had paid $1,500,000 in dividends up to the time of closing down in 1905. The Butte Coalition M. Co. bought a controlling interest in 1906; and in May 1910, a large majority of stockholders voted to sell to the Anaconda at the ratio of 15 shares of the Alice for one of the Anaconda.

NEVADA

Churchill County

The June return from the Nevada Hills company, at Fairview, was $104,561 from 3450 tons of ore treated. Costs

NEVADA HILLS MILL.

totaled $33,460, leaving $71,101 profit. The net costs for June were $9.70 per ton, and $1.36 below those of May.

Clark County

Rich ore has been found at the Fortuna mine, in Eldorado canyon, and shipments are being sent to the International smelter at Tooele, in Utah. Six men are employed and over three tons per day of silver chloride ore is being mined. Further work has been started about 300 ft. east of the shaft, in a small gulch where there was an outcrop of ore. A report has been made on the Empire mine, and it is expected that work will open plenty of pay-ore.

Mineral County

The Grey Horse shaft is down 30 ft., and copper has been cut 18 in. wide, assaying 19 oz. silver per ton, and 15.5 and 12.75% copper. A shipment will be made to the Thompson smelter. At the Luning Dude, good copper ore has been found 52 ft. from the Dillabough shaft. The Shipper company's shaft is down 56 ft., and five cars of copper ore were dispatched to the Thompson smelter, with a satisfactory return.

Nye County

At Manhattan it is reported that rich ore has been found in the Mustang, Mineral Hill, in the new shaft of the Crescent, the Dexter-Union, on the 150-ft. level of the Kendall-Douglass lease, ore has been proved for 200-ft. length by over 3-ft. width, and of a high value, on the 250-ft. level at the Mushett-Wittenberg lease, and Bath brothers have cut high-grade ore in their shaft. The adit at the Columbia claim is in 110 ft., and the Morning Glory shaft is down 75 ft. At the Big Four the drift on the 500-ft. level is out 150 ft. and the lode is reported to be 30 ft. wide.

During the past week the output from the Tonopah mines totaled 1080 tons, with an estimated value of $270,025, the contributors to the total being the Tonopah Mining Co., with 4100 tons; Belmont, 3755 tons; Montana-Tonopah, 981 tons; Tonopah Extension, 1055 tons; West End, 850 tons; Midway, 40 tons; and North Star, 50 tons.

Storey County

Summaries of the past week's reports for the Comstock mines state that the Ophir shipped 332 tons of second-class ore to the Kinkead mill. On the 2500-ft. level, the west cross-cut from the southwest drift is in 78 ft., the face being in porphyry; while the cross-cut on the 2100-ft. level is in 79 ft., also in porphyry. Stoping on the 2400-ft. level of the Con. Virginia, 375 ft. from the mouth of the southwest drift, 30 tons, assaying $19.62 per ton, was broken out. The west cross-cut on the 2300-ft. level is now in 203 ft., in quartz and porphyry of low grade. The Mexican mill crushed 510 tons of ore averaging $26.26 per ton, with 93% extraction. One hundred and sixty-nine tons was stoped on the 2500-ft. level, north drift, which averaged $26.08 per ton; and 37 tons from the main vein assaying $131.81 per ton. From the north drift, No. 3, at the 2400-ft. level, 125 tons assayed $18.27; and No. 2 gave 206 tons, worth $20.76 per ton. At the Union Con. timbering is being done on the 2500-ft. level; also jointly with the Sierra Nevada and Mexican companies, timbering and ladders have been put in the air connection to the 2000-ft. level from the west vein stope of the latter mine. The joint winze of the Best & Belcher and Gould & Curry is down 155 ft. below the 1700-ft. level in porphyry, with clay and veins of quartz. Diamond-drilling is under way on the 2000-ft. level on the Julia Con. The water in the Yellow Jacket shaft is now 40 ft. 9 in. below the 1400-ft. station. The shaft is still being repaired. At the C. & C. pumping shaft, the water is 297 ft. below the 2200-ft. station, the Reidler pumps working 158.75, 168, and 166.75 hr., respectively, and No. 1 elevator 162.25 hr. In the Ward shaft the west cross-cut on the 1600-ft. level is cut 200 ft., while that on the 2000-ft. level was extended 15 ft. The Starrett pump was repaired. A miner fell a distance of 115 ft. below the 2000-ft. level in the Ward shaft and was killed. He was working in the shaft at the time. The verdict at the inquest was one of accidental death.

OREGON

Baker County

At present no underground work is being done at the Ben Harrison mine. Surface work consists of road-making, erection of power transmission line, and grading for the reduction plant. The mill will be of 200-ton capacity, and is to contain 20 stamps, tube-mill, and filter-presses. Motors will be used throughout the plant.

TEXAS

Llano County

(Special Correspondence.)—The asbestos deposit at Llano, which has been acquired by the National Asbestos Refining Co. of Chicago, is stated by the vice-president of that company, F. S. Ingram, to be of great extent. He is at present examining the deposit with mining men, and has had 15 men prospecting for some weeks. Test holes have been put down from 40 to 52 ft. deep, and at no point has the bottom been reached. The deposit is about 500 ft. wide and over 1700 ft. long, and outcrops over 60 acres. The mineral near the surface is somewhat weathered, but has long fibres at depth. A plant is to be erected to deal with a large tonnage of the product.

Austin, August 1.

UTAH

Juab County

The half-yearly report of the Chief Consolidated company shows that 7968 tons of ore was shipped, averaging 0.24 oz. gold per ton, 46.22 oz. silver, and lead 3.73%, equal to a gross value of $34.25 per ton. Sampling, freight, and smelting cost $8.88 per ton. Sales of ore realized $202,182, and net profit after paying all charges was $1486.04. The balance on hand is $152,108. Development totaled 1264 ft. The mine shows promise at many points, and a still further increase of tonnage may be expected.

SALT LAKE COUNTY

Work has been resumed on the transport and drainage tunnel under the Oquirrh mountain range at Bingham. The Bingham Copper Tunnel Co. has absorbed the Bingham West Dip Tunnel Co., and will continue the work. The tunnel will be 20,000 ft. long, and will open at the mouth of Pine canyon in Tooele valley. Its course will then be southeasterly. Under the top of the range a lateral tunnel will be driven out to Markham gulch, in lower Bingham, above the Denver & Rio Grande railroad station. This tunnel will be 7000 ft. long and used mostly for transportation purposes. The main tunnel will pass under Bingham canyon and mines on the other side. A powerful tunneling machine is to be procured to push the work. At present the face is in 2000 ft. Cost of transporting ore should be greatly reduced. The tunnel will connect with the Utah Copper Co.'s mine at a great depth, and also the Boston Consolidated, Phoenix, and many other mines.

A fire at Bingham destroyed $50,000 worth of the business area of the town. Eighteen rolls are working in the Ohio company's mill.

SUMMIT COUNTY

During the quarter ended June 30, the Daly-Judge mine produced 16,017 tons of concentrating and 652 tons of shipping ore, the latter averaging $26.43 per ton. There were 2785 tons of lead, and 2250 tons of zinc concentrate sold, averaging $36.72 and $25.60 per ton, respectively. The earnings were $77,202 and $45,000 paid in dividends, while the cash balance totals $501,980. Mine conditions are satisfactory, and deeper development is now easier done, on account of the agreement entered into with the Daly West and Ontario companies in connection with the water difficulties. During July the Chief Consolidated company shipped 52 cars of ore. The Silver King Coalition Mines Co. has filed a suit against the Keystone Mining Co., in which the former seeks to quiet title to rights in the Red Fox, the U. J. Wenner, and the Bruser lode claims, all patented and located in the Park City district, to which the defendant is stated to claim title. The Silver King company owns the Pinyon, Pinyon Extension, Boss, Brave Columbia, Constitution, Cumberland, Monroe Doctrine, and Zephyr claims, and the lode on these claims on its course, and at its apex, crosses the east end of the Boss claim for 484 ft., and it also crosses the south side line of the Pinyon and Extension claims, on through others mentioned, into the claims in dispute. The report on the Park City district by the Geological Survey is at last issued.

WASHINGTON

SNOHOMISH COUNTY

(Special Correspondence.)—Mining operations are somewhat active after about two years' depression. The Hidden Treasure claim, in the Sultan river district, has been opened, and a lode 20 ft. wide has been found, assays running from $4 to $57 per ton. The vein is in slate. The divide between Olney creek and the Sultan river has been prospected of late, but the heavy undergrowth of brush is a handicap. A large outcrop has been found south of the Hidden Treasure. Twenty men are at work on the Florence-Rae copper mine. Ten feet of chalcopyrite has been opened on the Marguerite vein, and an analysis from a large sample gave 18.5% copper, 12 oz. silver, 35.8% sulphur, and 29.6% iron. Higher up on the mountain is another big outcrop. The country is composed of andesite, serpentine, and granite. Several other copper claims are being prospected in the vicinity. The Arnold Engineering Co., of Chicago, has completed preliminary work, in the Sultan district, on a hydro-electric project. By a series of six reservoirs, 106,000 hp. can be developed. The estimated cost of power-plant, water-supply, and railroad is $5,630,000. It is probable that Seattle may take an interest in this project. An air-compressor and drills have been erected at the Eclipse mine, near Silverton. Work is under way from 200-ft. depth. The ore carries silver and copper. The Sunrise group of copper claims on Vesper creek has been examined by an engineer said to be working for the Guggenheims.

Everett, August 1.

WYOMING

ALBANY COUNTY

A shipment of ore from the Rambler mine has been sent to the testing plant of H. E. Wood, at Denver. A new process of centrifugal concentration is being tried on the recommendation of Leo von Rosenberg.

AUSTRALASIA

BENDIGO (VICTORIA)

During the week ended June 24, 23 mines yielded 3944 oz. bullion, and for the fortnight ended this date, 24 other mines produced 824 oz., including returns from tributers. Dividends paid totaled $27,500. Among the principal producers were the Catherine Reef, with 164 oz. from 524 tons; Central Red, White & Blue, 355 oz. from 625 tons; Golden Pike, 85 oz. from 179 tons; Johnstons Reef, 242 oz. from 395 tons; New Shenandoah, 200 oz. from 50 tons; private mines and pyrite treatment companies, 650 oz.; United Hustlers & Redan, 337 oz. from 287 tons; New Chum Goldfields, 35 oz. from 222 tons; Garden Gully, 8 oz. from 68 tons; Koch's Pioneer tributers, 204 oz. from 70 tons; and South New Moon, 138 oz. from 410 tons. Bendigo bullion is worth about $19.50 per ounce. The north stopes on the 2300-ft. level of the Catherine Reef are producing the bulk of the output. Ore at the Central Blue is being won principally from the 318 and 400-ft., north, levels. In the Golden Pike the east leg of the reef on 447, 543, and 643 ft. is rather erratic in gold content. At the New Shenandoah, the west leg is 24 in. wide at 565 ft. United Hustlers shows a reduction in output on previous weeks. The raise above the 500-ft. level is improving. The Garden Gully has a good deal of ore at 790-ft. depth. Generally, the returns are satisfactory, and shares have been freely dealt with.

CANADA

BRITISH COLUMBIA

According to a description of the Nickel Plate mine and works at Nelson, published in the Hedley *Gazette*, the ore is drawn from the lower tramway bin, direct to a 10 by 20-in Farrel crusher, from which it passes over a grizzly, the coarse portion passing a 6 by 20-in. Farrel crusher. All the broken ore goes by belt-conveyor to the storage bins. Challenge feeders deliver to the 40 stamps, which weigh 1050 lb. each, and drop 7½ in. 101 times per minute. No amalgamation is attempted on plates. The screen on the mortars is 12 by 12, and the stamps crush 5 tons each per day. The pulp passes through four spitzkasten, one portion of the underflow going to 8 corrugated-belt Frue vanners, and the other to 16 smooth-belt vanners and 12 Deister tables. The tailing from the first vanners is ground in a tube-mill. All the pulp flows to cone-classifiers, from which the slime and sand go to their treatment plants. About 240 tons of concentrate is produced per month. This contains 70 to 80% of the gold content, and is shipped to the Tacoma smelter. The slime is agitated 12 hours with cyanide, settled, and then treated in Oliver presses. The sand is leached in a double treatment plant of 12 vats, 6 by 32 ft., for 20 days. Gold is precipitated with zinc-dust in Merrill presses. About 95% extraction is obtained. The monthly capacity of the mill is now 6000 tons. Electric power is generated by water or steam plants.

The Granby company smelted 739,519 tons of ore during the year ended June 30, and of this quantity 17,800 tons came from other properties. A comparison between the term just ended, and the previous one shows the following:

	Copper, lb.	Silver, oz.	Gold, oz.
1911	17,858,860	343,178	41,707
1912	13,266,360	255,723	33,946

The reduction in output was caused by the strike of coal miners in western Canada, resulting in the smelter being shut down for 122 days in 1911. The present rate of production is about 1,900,000 lb. of copper per month.

The Canadian Government has completed soundings of the waterways near Hidden Creek, and the channel into Granby is being marked. The ore docks, smelter, and power-plant of the Granby Con. M. & S. Co. are there. Three steamship companies will have a regular service between Granby bay and Seattle, Vancouver, and Victoria. Two hundred men are working in the Hidden Creek mines, which are looking well. Between four and five million tons of ore is in sight, and diamond-drilling is proving more. The power-plant, smelter, and other equipment should be working within a year.

Ontario

The first clean-up from the Hollinger mine is reported to have been valued at $41,000, and is considered satisfactory. The winze being sunk from the 200-ft. level is finished, and a station is being cut on the 300-ft. level. That section of the mill containing the concentrators and pans is being partitioned off from the rest of the plant.

The members of the Porcupine miners' union notified nearly all the mine managers in the district that they were applying to the Department of Labor for an appointment with the conciliation board, to settle matters in dispute between the men and managers. The question is the adoption, by the mines, of a new scale of wages to come into effect on August 1, whereby the men at the small mines are to be paid the same rate as those at the Dome and Hollinger. This new scale, adopted by the managers, gives all men 25 cents higher per day than the rate paid at Cobalt.

The quarterly report of the Wettlaufer mines, at South Lorrain, shows that 621½ ft. of development was done. No new lodes were found, but the Silver Eagle continued to open in a satisfactory way. A winze is being sunk 100 ft. below the 400-ft. level. During the period ended June 30, 4166 tons of ore was treated at the mill. From the mill and shipments 198,711 oz. of silver was produced, which returned $120,787, and the profit was $71,737.

MEXICO

The seventh annual report of the Mexican Light & Power Co. states that the gross earnings for the year ended December 31, 1911, totaled ₱7,581,027. Operating expenses and maintenance amounted to ₱2,195,028, which left net earnings at ₱5,385,999. Dividends of 7% were paid on the preferred shares, and 4% on ordinary shares. The reserve fund totals ₱855,766, and balance to credit of profit and loss is ₱1,968,254. The directors report that, beyond the breaking of a few arc lamps by unruly crowds, none of the company's property was interfered with, and the business has progressed in spite of the disturbed condition of the country. The increase in the sale of power has been satisfactory, a large part of the increased demand coming from the Pachuca district. Good progress is being made in the construction of reservoirs, dams, and tunnels.

Chihuahua

(Special Correspondence.)—During the quarter ended June 30 the La Republica mine crushed 2107 tons with a yield worth ₱158,366. Operating costs totaled ₱125,343, and construction ₱11,278. The management reports that labor conditions continue to be unfavorable, owing to the revolution having drawn away most of the workers from this section; consequently the mill cannot get a full supply of ore.

Chihuahua, July 26.

Jalisco

The United States Smelting, Refining & Mining Co. has taken an option for purchase on the San Pedro Analco silver mines, situated in the Hostotipaquillo district of Jalisco. The price is stated to be ₱750,000, and the term is for one year, during which time the company must spend ₱75,000 on development. The company controls the Real Del Monte y Pachuca property, in the Pachuca district of Hidalgo. The San Pedro mines were examined by Ezequiel Ordoñez, the company's geologist. A small mill is already at the mines. The building of a branch transmission line from the main Hostotipaquillo line of the Chapala Hydro-electric & Irrigation Co. to the Cinco mines is being pushed ahead. A 50-ton capacity smelter has been sent to the Mexicana mine, and it is to be in operation toward the end of the year. The concentrating plant will be re-started at an early date.

PHILIPPINE ISLANDS

Manila

According to the *Far Eastern Review*, a dredge has been ordered from Melbourne for the Squires gold mining property, situated on the Umarai river. The hull will be of steel and of a new design, and the buckets will be attached to a large wheel, instead of the usual ladder. The machine complete will cost $100,000. Australians have invested about $250,000 in this property. The O. K. company has been formed, with an office at Baguio, to work its claims in the Benguet mountains. Operations have been resumed at the Headwaters mines district, northwest of Baguio. The Luzon Gold Co. has started sluicing some bench claims. Water is carried a distance of 1500 ft., and 2000 ft. of hose was ordered from the United States. This company has large areas of placer holdings which can be dredged and sluiced. A 50-ton sample of coal from East Batan was recently sent to the U. S. Government Bureau of Mines testing plant at Pittsburg. The report says that, when received at Pittsburg, the coal contained 60% of slack, 15% of lump, and 25% of small lump, which reduced its steaming value. The average run-of-mine coal contains 60% of lump, large and small. The Batan coal evaporates 20% less water than the best Japanese, and 30% less than the best Australian coals, but it equals the Labuan (Borneo) coal, which is shipped in large quantities. The Batan mine can produce 5000 tons monthly at a cost of ₱7.20 landed at Manila.

THE PHILIPPINE ISLANDS.

Personal

Professional men are invited to send news of their engagements and travels. Such news is interesting to friends.

THOMAS T. READ is at Butte.

M. L. REQUA is back from Alaska.

D. M. RIORDAN is in San Francisco.

ARTHUR L. SWEETSER is in Honduras.

G. H. CLEVENGER has gone to Denver.

W. C. OREM has been in San Francisco.

C. C. BROADWATER is at Porcupine, Ontario.

J. B. KEATING has returned from New York.

H. B. KAEDING is visiting friends in Chicago.

EDMUND JUESSEN has returned from Oregon.

B. L. MILLER was in San Francisco Thursday.

FRED T. WILLIAMS left for Alaska August 9.

C. W. MERRILL has returned from Lake Tahoe.

J. NELSON NEVIUS was in San Francisco this week.

W. H. STORMS has gone to High Grade, California.

R. A. F. PENROSE, JR., was in San Francisco this week.

ALBERT BURCH has returned from Carson City, Nevada.

WHITMAN SYMMES is expected in San Francisco this week.

C. F. TOLMAN, JR., has been appointed associate professor of geology at Stanford University.

F. L. SIZER has gone to Arizona and will visit Globe before his return.

PHILIP WISEMAN was in San Francisco Monday, returning from a trip around the world.

FREDERICK G. CLAPP has returned from the Canadian oilfields and gone to West Virginia.

JOHN G. WORTH is on a professional trip in New Mexico, Arizona, Nevada, Montana, and Colorado.

GEORGE H. BOOTH is now at Miami, Arizona, as chief draughtsman for the Inspiration Con. C. Company.

J. W. MERRITT, assistant in mineralogy at Northwestern University, has been appointed instructor in geology at Dartmouth College.

H. F. WIDDICOMBE, general superintendent for the Day-Bristol Con. M. Co., at Pioche, Nevada, was married at Salt Lake City, July 29.

L. E. IVES has resigned as associate editor of the *Engineering & Mining Journal* to become mining and assistant engineering editor of the *Iron Trade Review*.

GEORGE H. ASHLEY, who recently returned to the Government service after organizing the Tennessee Geological Survey, has been appointed administrative geologist of the United States Geological Survey.

THOMAS H. LEGGETT has become consulting engineer for the A. S. & R. Co., and his address will hereafter be 165 Broadway, New York. The firm of Leggett & Hellmann being dissolved, FRED HELLMANN will continue the business in his own name at 60 Broadway.

ALEXANDER N. WINCHELL has resigned from the U. S. Geological Survey in order to resume work as a consulting mining geologist. He has recently returned to his office in Madison, Wisconsin, after spending several weeks in Nevada in connection with litigation regarding the National mine.

Copper Producers' Association Report

The Copper Producers' Association reported copper stocks on August 1 as 50,280,421 lb., against 44,335,004 lb. on July 1. Production: July, 137,161,129 lb., and in June, 122,315,240 lb. The July foreign delivery was 60,121,331 lb; June, 61,449,650 lb. Domestic deliveries: July, 71,094,-381 lb; June, 66,146,229 lb. Total delivery: July, 131,215,-712 lb; June, 127,595,879 pounds.

Market Reports

LOCAL METAL PRICES

San Francisco August 8.

Antimony	11—11½c	Quicksilver (flask)	42.50
Electrolytic Copper	18—18½c	Tin	.50—51½c
Pig Lead	4.75—5.70c	Spelter	.8—8½c

Zinc dust, 1400 lb. casks, per 100 lb., small lots $9.50—9.75; large $7.50—8.50

METAL PRICES

(By wire from New York.)

NEW YORK, August 8.—Copper is now quiet, and consumers are still holding back. European buyers are expected to come in the market shortly. Lead is in good demand, but at lower prices. Spelter is quiet and weaker.

Average daily prices for the past week, in cents per pound, based on wholesale transactions, standard brands, are given below.

Date.	Electrolytic Copper.	Lead.	Spelter.	Silver, per oz.
Aug. 1	17.48	4.70	7.05	59½
" 2	17.48	4.69	7.05	60
" 3	17.48	4.69	7.05	59½
" 4	Sunday.	No market.		
" 5	17.48	4.50	6.98	59½
" 6	17.48	4.50	6.95	60
" 7	17.48	4.50	6.95	60½

LONDON QUOTATIONS

(By cable, through the courtesy of C. S. Burton & Co., New York.)

	August 8.
Camp Bird Ltd	$ 9½
El Oro	3½
Esperanza	7⅛
Oroville Dredging	1½
Santa Gertrudis	7⅛
Tomboy	6⅛

COPPER SHARES—BOSTON

(By courtesy of J. C. Wilson, Mills Building.)

	Closing prices, August 8.		Closing Prices August 8.
Adventure	$ 6	Mohawk	$ 68
Allouez	46	North Butte	29⅞
Calumet & Arizona	75¾	Old Dominion	57½
Calumet & Hecla	525	Osceola	116
Centennial	22	Quincy	91
Copper Range	57¾	Shannon	17½
Daly West	5	Superior & Boston	1⅛
Franklin	11	Tamarack	43½
Granby	63	Trinity	6½
Greene Cananea, ctf.	10	Utah Con	11½
Isle-Royale	35	Victoria	3
La Salle	6½	Winona	5⅜
Mass Copper	6⅜	Wolverine	105½

NEVADA STOCKS

(By courtesy of San Francisco Stock Exchange.)

San Francisco, August 8.

Atlanta	$ .28	Mexican	$2.80
Belcher	.36	Midway	.59
Belmont	9.32	Montana-Tonopah	2.12
B. & B.	.09	Nevada Hills	2.05
Booth	.08	Ophir	1.02
Chollar	.11	Pittsburg Silver Peak	1.00
Combination Fraction	.17	Round Mountain	.38
Con. Virginia	.41	Savage	.12
Florence	.90	Tonopah Extension	3.00
Goldfield Con.	3.80	Tonopah Merger	1.07
Gould & Curry	.05	Tonopah of Nevada	7.00
Jim Butler	.66	Union	.67
Jumbo Extension	.42	Vernal	.13
MacNamara	.22	West End	1.75

MINING STOCK QUOTATIONS—NEW YORK

(By wire from C. S. Burton & Co., New York.)

	Closing Prices. August 8.		Closing Prices. August 8.
Amalgamated Copper	$ 83½	Miami Copper	$ 29⅞
A. S. & R. Co.	84⅜	Mines Co. of America	3¼
Braden Copper	6⅞	Nevada Con	21¼
B. C. Copper Co.	5⅜	Nipissing	7⅞
Chino	34⅛	Ohio Copper	⅛
First National	2⅛	Ray Con	21
Giroux	5¼	Tenn. Copper	42¼
Goldfield Con.	3⅛	Tonopah Belmont	9⅛
Greene-Cananea	10¼	Tonopah Ex.	2⅜
Hollinger	12½	Tonopah Mining	7
Inspiration	19⅜	Trinity	6½
Kerr Lake	2⅜	Tuolumne Copper	2¼
La Rose	3½	Utah Copper	62⅜
Mason Valley	13½	West End	1⅜
McKinley-Darragh.	1⅜	Yukon Gold	3⅜

James Lewis & Son's Copper Report

From June 17 to 20 the price of standard copper advanced from £79 2s. 6d. to £80 for cash. Owing to reports of the existence of hidden stocks in the United States, and profit taking by speculators, prices fell on June 24 to £76 10s.; but as the above reports were generally discredited, a recovery was made to £78 8s. 9d. on June 27. Closing prices on July 1 were £77 8s. 9d. cash, and £78 6s. 3d. for three months. Sales during the month of June totaled nearly 70,000 tons. Electrolytic copper has been sold up to £81 5s. per ton c.i.f.

European stocks have decreased 3227 tons, and the visible supply by 4452 tons, during the month. Imports into Europe from the United States in June total 26,457 tons, while the imports are 4452, and deliveries 2797 tons less than during the same period last year. Deliveries for shipment to Europe are much in arrears, and consumers have, as a result, drawn upon European stocks to some extent for immediate requirements. Large quantities of American refined copper have been sold for September delivery.

Imports into England and France for the month of June were 18,856, and deliveries 20,626 tons fine copper. Chilean copper arrived in England to the extent of 1986, and deliveries 1515 tons; while from other countries 9850 and 12,267 tons respectively. Liverpool and Swansea received from the United States 1812 tons of bars, 500 of plates, and 20 of matte, equal to some 2305 tons fine. In London 365 tons was received, and in France 6155 tons.

The Chilean charters for the month were advised at 4400 tons, including 2575 tons for the United States. The exports from the former country for the first half of the current year totaled 17,125 tons, against 15,370 tons for the similar period of 1911.

STOCKS OF COPPER (TONS FINE)

	1912			
Chilean in—	Jan. 1.	Apr. 1.	June 1.	July 1.
Liverpool and Swansea..	4,225	4,807	4,943	5,414
France	714	633	784	926
American in—				
Liverpool and Swansea..	12,939	9,825	5,890	4,289
France	4,033	5,248	3,933	3,958
Sundries in—				
Liverpool and Swansea..	786	741	503	574
London and Newcastle...	6,462	5,377	4,565	4,292
Birmingham	346	767	516	329
France	507	537	542	601
English in—				
Liverpool and S. Wales..	17,346	14,215	14,212	13,725
Total in England and France	47,358	42,150	35,888	34,118
Sundries in—				
Germany and Holland...	13,400	10,900	8,002	6,545
Total European stocks.	60,758	53,050	43,890	40,663
Afloat—				
From Chile	1,575	2,325	1,800	1,475
From Australia	8,350	5,700	6,900	6,000
Total visible supply...	70,683	61,075	52,590	48,138

IN ILLINOIS the value of the mine production of silver, lead, and zinc in 1911 was $569,335, an increase of more than $150,000 compared with the 1910 yield. The lead concentrates from the southern Illinois fluorspar district increased 84 tons in quantity, and the silver content recovered in treating the concentrates increased from 2022 fine ounces in 1910 to 3036 oz. in 1911. The Galena district, in northwestern Illinois, showed an increased output of both lead and zinc concentrates. The lead concentrates in northern Illinois amounted to 787 tons, worth $41,220, or estimating the metal content at New York prices, 625 tons, worth $56,250. The zinc concentrates totaled 11,011 tons, worth $320,806; equal to 4219 tons of spelter, worth $480,966. Including southern Illinois the lead concentrates amounted to 1269 tons, worth $62,425, and equal to 964 tons of metal, worth $86,760. No zinc was reported from southern Illinois, but silver equivalent to 6.25 oz. per ton was contained in the lead concentrates. The average lead content of concentrates from southern Illinois was 70% and the value $44 per ton. In northern Illinois the total amount of crude ore was 153,313 tons. The percentage of lead was 0.4 and of zinc 3.2. Concentrates averaging 79.4% were made from the lead ore, while the zinc ore yielded concentrates averaging 45.3% zinc.

Goldfield Consolidated Report

During the month of June the total production of the Goldfield Consolidated Mines Co. was 23,365 tons, containing $573,658.31, or an average of $17.72 per ton. The mill treated 29,040 tons with an average extraction of 92.63%, and 3325 tons, of an average value of $23.91 per ton, was shipped. The total net recovery from all ore was $16.60 per ton, and the total net realization to the company was $325,475.52, or $10.06 per ton. Development for the month amounted to 3034 ft. In the Combination mine, the stope in the Reilly vein southeast of the shaft produced 1341 tons of ore that averaged $22 per ton. The 402-G stope, 300 ft. north of the shaft, between the fifth and sixth levels produced 353 tons of ore averaging $18 per ton. This is the deepest point in this mine at which ore has been found. A new stope which is expected to yield a large tonnage is being opened on the second level 200 ft. east of the 136 stope, under the old January workings. The 102-X and 103-X drifts driven through the quartz produced 117 tons of ore averaging $15 per ton. In the Mohawk mine, the work north of the 3 stope on the 150-ft. level through the old Sheets-Ish ground has proved a large tonnage of good-grade ore. The 3-J sill, 50 ft. north of 3-E stope, produced 43 tons of ore that averaged $37.60 per ton. The 29 drift was advanced north in the foot-wall of the Sheets-Ish stope and produced 38 tons of ore averaging $31 per ton. The 170-L stope on the 250-ft. level stripped the lower end of the Sheets-Ish stope and produced 105 tons of ore which averaged $28 per ton. The 111-N stope on the 250-ft. level under the Hayes-Monnette stope produced 354 tons of ore averaging $40 per ton, and the 354-Q stope in the foot-wall section of the big 354 stope produced 1389 tons of ore that carried $43.20 per ton. In the Clermont mine the 426 intermediate between the 750 and the 600-ft. levels, and close to the old 401 stope produced 108 tons of $28 ore. The development on the 1300-ft. level of the Grizzly Bear was very satisfactory. The 802 drift in the orebody was shipped unsorted, and the last round of broken rock averaged $64 per ton. The third compartment of the shaft from the 1300 to the 1000-ft. level had pipes, ladders, and electrical equipment moved over. Guides were put down the former runway from the surface to the 1300-ft. level, and a double-drum electric hoist placed on the surface. Sinking on the next 140 ft. was started.

The total cost of mining, development, transportation, milling, office, and general expense was $6.82, distributed as follows:

Mining:		
Development	$0.79	
Stoping	2.51	
		$3.30
Transportation		0.08
Milling		2.03
Marketing		0.06
General expense		0.47
Bullion tax		0.12
Marketing ore shipped		0.70
Construction		0.06
Total cost of operation		$6.82
Miscellaneous earnings		0.06
Total cost per ton		$6.76

Concentrates

Most of these are in reply to questions received by mail. Our readers are invited to ask questions and give information dealing with the practice of mining, milling, and smelting.

SUFFICIENT agitation at some mills is achieved in the Brown agitator without the usual inch pipe hanging down the centre of the central air-lift to the bottom, or one fitted into the bottom from the outside.

HYDRAULIC filling was first employed in an unsystematic manner, as far back as 1883 in the Upper Silesia, and 1887 in Pennsylvania according to O. Puetz in the *Zeitschrift des Verbandes der Bergbau-Betriebsleiter Oesterreichs*, but in its present scientifically and technically perfected and systematized form it was first worked out and introduced in 1901 by Hr. Williger, director-general of the Kattowitz Mining Co., at the Myslowitz mine, in Upper Silesia.

EUCALYPTUS oil is being manufactured at Corang, N. S. W. A plant which had been in operation at Tarago has been removed to Corang. In place of the iron tanks which have been used hitherto for the purpose, it consists of an engine and boiler for heating the water in which the leaves are boiled. About 25 men are being employed in leaf-cutting. At Monka, 32 men are employed, at Fitzpatrick & Co.'s works, making about 60 altogether, with the firemen. As many more are probably engaged in the smaller plants in the district.

LIFE of steel elevator-buckets at Waihi, lifting 10-mesh pulp, was 50% less than when finer pulp was raised. Increasing the plate from ⅛ to 3/16 in. gave a life of about eight months. A wood bucket was tried with splendid results, then more buckets of different kinds of timber were tried and four months' work shows little wear. Two wheels of 35-ft. diameter were equipped with wooden buckets, at a cost of one-third of that of the steel buckets. The reason for the superiority of wood over steel in this case is somewhat hard to understand.

ISOLATED mines of any size should each have its own foundry and machine-shop. In Australasia, the mines at Kalgoorlie are nearly all so equipped, as is also true of Mt. Morgan, Mt. Lyell, and Waihi. A large quantity of iron, steel, and brass scrap accumulates, especially from mills, and this can be more profitably melted at the mine and cast as required, than sold as scrap. This has often been proved. Besides, a break-down can be quickly repaired, the shops being on the spot. Although the jobs may not be always so good as when done elsewhere, the cheapness of such repairs pays for an extra number of spare parts.

SUMMING up the difficulties of cyaniding antimonial tailing, the following are the chief points to be watched. (a) The strength of the working solutions so that the selective action of the gold will be at a maximum while the solution of the sulphide of antimony is at a minimum, also the consumption of cyanide; (*b*) the amount of protective alkalinity present; this must be such that the consumption of cyanide is kept down; yet it must not be too pronounced, as in that case the solution may dissolve the sulphide of antimony and refuse to take up the gold present; (*c*) treating the precipitate, which always contains more or less antimony in metallic form; (*d*) the final production of clean gold.

ARSENIC salts and oxides in large number are used medicinally, among them the bromide, iodide, trisulphide, trioxide, sodium arsenate, and potassium arsenate. Disulphide of arsenic, both natural and artificial, is used as a paint pigment; in calico printing and dyeing; in tanning; and, as it burns with an intense white light, in fireworks. Orpiment, the trisulphide, called also king's yellow, is used as a paint pigment and as a reducing agent in chemical work. The trioxide is used in paints; for preserving hides, both for taxidermists and in the leather industry; as an antiseptic; and in killing animal pests. Sodium arsenate is used in dyeing with turkey-red oil and in printing fabrics; the arsenite in making soaps for use on skins and hides. Potassium arsenite is used as a reducer for silver in the manufacture of mirrors.

FUEL briquetting in the fields of non-coking coal in the Middle West has to meet the low price of the raw fuel with which the briquette has to compete. The average price for fuel in the northern Middle states in 1911 ranged from about $1.10 to $1.75. The cost of manufacturing briquettes, exclusive of the cost of the raw material, is about $1 per ton, and although briquettes possess undoubted advantage for domestic use over raw coal, householders have to be educated to the fact that the higher cost of the briquettes is more than offset by their desirability. In Germany the briquetting industry has made extraordinary progress, the production in 1910 being 16,668,605 short tons, and in 1911, 18,554,020 tons. Some probability of more substantial development of briquetting in the Eastern states is indicated by the recent advance of 25c. per ton on the domestic sizes of anthracite and the fact that there is little possibility of any future reduction in the prices of this fuel. In fact, further advances are more to be expected, in view of the rumored increase in royalty to be demanded by the owners of coal lands in the anthracite region.

DEPOSITION of metals of any character upon any insoluble surface by electrical energy has been perfected by two Italian chemists. The results so far achieved promise to revolutionize the whole art of electroplating as well as many other branches of industry. China, wood, glass, celluloid, paper, and other substances which have hitherto been regarded as beyond the electroplater's craft are coated as easily as the metals generally associated with this process. The plating enters into the fabric treated so that it becomes an integral part of the article. Thus, for instance, if an attempt is made to chip the plating from a glass vase the glass will come away with its metal coating. The outer sheathing is not a thin film, but a solid sheet of metal which can be made of any thickness and capable of being worked by the engraver. The authorities have expressed their willingness to apply the hall mark to articles so mounted. The process is likely to supersede the present process of silver-mounting cut glass and other articles. Instead of the metallic adornment being attached by means of plaster of paris, which is simply a make-shift, the metal deposited upon the glass becomes part and parcel of the article. Any metal and its alloys can be electrically deposited upon some other metal as a base. Zinc, tin, and lead can be deposited as easily as silver or nickel. This fact is of vital interest to a host of industries, as is borne out by the action of one of the largest builders of naval vessels, who has adopted the process for the zinc and tin plating or galvanizing of the steel parts of the boats. The deposit is not so thin, as in ordinary galvanizing, that a pin scratch will penetrate the protective skin, but is a solid sheathing of metal associated with the other metal beneath. Wooden articles are as efficiently plated by the Marino process as if copper were being plated. So far as china plating is concerned, the article must be in the unglazed or biscuit condition, and is first coated with a chemical agent. In the same manner glass which is to be treated must first be roughened by sand-blasting to remove the polish and to enable the metal to secure a grip. Another point is that the deposit, no matter what the character of the base, may subsequently be oxidized or lacquered in just the same way as ordinary electrowork. The possibility of being able to deposit a protective coating upon aluminum, and thus save it from oxidation, will popularize the use of this metal in industries where, although it is urgently required by reason of its lightness, it is viewed with disfavor owing to its rapid corroding.

Book Reviews

Any of the books noticed in this column are for sale by, or can be procured from, the MINING AND SCIENTIFIC PRESS.

METHODS OF AIR ANALYSIS. By J. S. Haldane. 128 pp. Ill., Index. Charles Griffin & Co., Ltd., London, 1912. For sale by the *Mining and Scientific Press.* Price $1.75.

The author of this volume is well-known in the mining world through his investigations and his papers on hygiene, mine gases, and mine explosions. The work under review is a collection of useful methods for sampling air and gas and includes descriptions of apparatus for analysis, of processes of analysis, and of calculations of results. At the present time, when so many investigations are being conducted in coal and ore mines, relative to coal-dust explosions and miners' phthisis, the work is especially timely. Air and gases are peculiar compounds to deal with, and from sampling to testing, great care must be taken to ensure accuracy. At the same time, these analyses are no easy work, considerable skill being necessary. In the recent inquiry into gases from explosives in Western Australian mines, special care was shown. The iodine pentoxide method for determination of CO was used, and Haldane's apparatus for estimations of CO_2 and oxygen. 'Methods of Air Analysis' will be found to contain many notes from papers on the subject published in several journals, and not previously brought together.

INTRODUCTION TO THE STUDY OF MINERALS. By A. F. Rogers. 512 pp. Index. The McGraw-Hill Book Co., New York, 1912. For sale by the *Mining and Scientific Press.* Price $3.50.

This handy little work is intended to serve as a text-book for a one-year course in mineralogy, and also for use in the field. The volume covers the subject in a concentrated form, so much so that it obviates the necessity for a student or mining man having several books on the subject. The work is essentially one for the student, as however important the form, physical, optical, and chemical properties of minerals are, and to these large space is given, these phases of the question would not be sought by the man in the field. He is mainly interested in description, occurrence, association, and uses of minerals. These are dealt with in a useful and interesting manner, but in less detail. There are a large number of figures for study, more especially of the crystalline forms of minerals, while useful chapters are given on hardness, specific gravity, and blow-pipe tests. Six tables are included in which minerals are arranged according to crystal system and habit; structure and cleavage; color; specific gravity; optical properties; blow-pipe; and chemical tests. The general form of these tables is good. The prospector will find the 131 pages devoted to a description of important minerals of much value, giving in a condensed form the essentials as to form, hardness, specific gravity, color, chemical composition, blow-pipe tests, uses, and occurrence. Twenty-three pages are taken up with a glossary of mineralogical terms.

OIL FINDING. By E. H. Cunningham Craig. 195 pp. Ill., index. Edward Arnold, London, 1912. For sale by the *Mining and Scientific Press.* Price $3.40.

The author of this book states that it has been written for the younger geologists, but there are many who are old in the profession who might learn much from its reading. In successive chapters he discusses, The Origin of Petroleum; Processes of Formation; The Migration, Filtration, and Subterranean Storage of Petroleum; Lateral Variation; Geological Structure; Indications of Petroleum; Stratigraphy; Location of Wells; Field Work; Indoor Work. The author was formerly a member of the Geological Survey of Great Britain and has had experience in a number of foreign fields. He has produced a very readable book, full of suggestions based upon sound common sense. His views on disputed points are pronounced, but are always clearly and frankly stated with an excellent array of evidence to back them. The book will be especially helpful to those making preliminary examinations of a field. It does not cover such work as is regularly done by many geologists in America who direct development in fields after they have been found. The making of structural contours and the use of a convergence sheet are, it is true, rarely possible in an untested field, though they made possible the finding of the Carlyle, Illinois, field and are in constant service in locating extensions in the Appalachian and other regions. Mr. Craig's book, none the less, is full of useful material and covers a field not otherwise served.

Recent Publications

REPORT OF THE SLUDGE ABATEMENT BOARD FOR THE YEAR 1911. 38 pp. Plates, ill. Victoria, Melbourne, 1912.

ANNUAL REPORT ON DREDGE MINING AND HYDRAULIC SLUICING FOR THE YEAR 1911. 17 pp. Tables. Victoria, Melbourne, 1912.

THE RUBY PLACER DISTRICT, ALASKA. By A. G. Maddren. Advance chapter from Bull. 520, 'Mineral Resources of Alaska, 1911.' U. S. Geol. Surv. Bull. 520-J. 14 pp. Map. Washington, 1912.

THE ALATNA-NOATAK REGION, ALASKA. By Philip S. Smith. Advance chapter from Bull. 520, 'Mineral Resources of Alaska, 1911.' U. S. Geol. Surv., Bull. 520-L. 25 pp. Map. Washington, 1912.

THE PRODUCTION OF TIN IN 1911. By Frank L. Hess. Advance Chapter from Mineral Resources of the United States, Calendar Year 1911. 12 pp. Tables. U. S. Geol. Surv. Washington, 1912.

THE RAMPART AND HOT SPRINGS REGION, ALASKA. By H. M. Eakin. Advance chapter from Bull. 520, 'Mineral Resources of Alaska, 1911.' U. S. Geol. Surv. Bull. 520-I. 20 pp. Map. Washington, 1912.

GOLD PLACERS OF THE YENTNA DISTRICT, ALASKA. By Stephen R. Capps. Advance chapter from Bull. 520, 'Mineral Resources of Alaska, 1911.' U. S. Geol. Surv. Bull. 520-F. 31 pp. Maps. Washington, 1912.

THE CEMENT INDUSTRY IN THE UNITED STATES IN 1911. By Ernest F. Burchard. Advance Chapter from Mineral Resources of the United States, Calendar Year 1911. 37 pp. Index, tables. U. S. Geol. Surv., Washington, 1912.

GOLD DEPOSITS OF THE SEWARD-SUNRISE REGION, KENAI PENINSULA, ALASKA. By Bertrand L. Johnson. Advance chapter from Bull. 520, 'Mineral Resources of Alaska, 1911.' U. S. Geol. Surv. Bull.-520-E. 47 pp. Map. Washington, 1912.

VANADIUM DEPOSITS IN COLORADO, UTAH, AND NEW MEXICO. By Frank L. Hess. Advance chapter from Bull. 530, 'Contributions to Economic Geology, 1911. Part I.' U. S. Geol. Surv. Bull. 530-K. 25 pp. Ill., map. Washington, 1912.

SULPHUR IN UTAH, WYOMING, AND COLORADO. By F. L. Hess, D. F. Hewett, E. S. Larsen, and J. F. Hunter. Advance chapter from Bull. 530, 'Contributions to Economic Geology, 1911, Part I.' 25 pp. Index, map, ill. U. S. Geol. Surv. Bull. 530-O. Washington, 1912.

GOLD PLACERS BETWEEN WOODCHOPPER AND FOURTH OF JULY CREEKS, UPPER YUKON RIVER, ALASKA. By L. M. Prindle and J. B. Mertie, Jr. Advance chapter from Bulletin 520, 'Mineral Resources of Alaska, 1911.' 12 pp.; map. U. S. Geol. Surv. Bull. 520-G. Washington, 1912.

MINING AND WATER SUPPLY OF FORTYMILE, SEVENTYMILE, CIRCLE, AND FAIRBANKS DISTRICTS, ALASKA, IN 1911. By E. A. Porter and C. E. Ellsworth. Advance chapter from Bull. 520, 'Mineral Resources of Alaska, 1911.' U. S. Geol. Surv. Bull. 520-H. 63 pp. Charts, tables. Washington, 1912.

Coal Production in 1911

Final figures for the coal output of the United States in 1911 are given below, being those compiled by E. W. Parker, of the United States Geological Survey.

State or territory.	1911 Quantity.	1911 Value.
Alabama	15,021,421	$19,079,949
Arkansas	2,106,789	3,396,849
California and Alaska	11,647	13,297
Colorado	10,157,383	14,747,764
Georgia	165,330	246,448
Idaho	1,821	4,872
Illinois	53,679,118	59,503,278
Indiana	14,201,355	15,326,808
Iowa	7,331,648	12,663,507
Kansas	6,254,228	9,645,572
Kentucky	13,706,839	13,617,217
Maryland	4,685,795	5,197,066
Michigan	1,476,074	2,633,803
Missouri	3,760,607	6,431,066
Montana	2,976,358	5,342,168
New Mexico	3,148,158	4,525,925
North Dakota	502,628	720,489
Ohio	30,759,986	31,810,123
Oklahoma	3,074,242	6,291,494
Oregon	46,661	108,033
Pennsylvania bituminous	144,721,303	146,311,930
Tennessee	6,433,156	7,209,734
Texas	1,974,593	3,273,288
Utah	2,513,175	4,248,666
Virginia	6,864,667	6,254,804
Washington	3,572,815	8,174,170
West Virginia	59,831,580	53,670,515
Wyoming	6,744,864	10,508,863
Total bituminous	405,724,241	$450,957,698
Pennsylvania anthracite	90,464,067	174,952,415
Grand total	496,188,308	$625,910,113

Commercial Paragraphs

The American Boston Mining Co., Diorite, Michigan, will install in its power plant a 500-kw. 2300-volt Curtis turbo-generator. The order for this unit has been placed with the General Electric Company.

Reuben Bowen, who has been connected with the International Steam Pump Co., for over fifteen years in the capacity of district and department sales manager, and also general sales manager of the Fred M. Prescott Steam Pump Co. at Milwaukee, Wisconsin, and the Jeanesville Iron Works Co. of Hazleton, Pennsylvania, has resigned to accept the position of general sales manager of the Epping-Carpenter Co. of Pittsburg, Pennsylvania, manufacturers of pumping machinery.

The Dodge Manufacturing Co., Mishawaka, Ind., reports that it has just closed a contract with the Alaska Treadwell Gold Mining Co., Treadwell, Alaska, for two 250-hp. Dodge rope-drives. One of these will connect a motor with a jackshaft, and the other will connect the air-compressor with the jackshaft. Also all the equipment, including rope sheaves and jackshaft material. The Dodge company has also received an order from the Consolidated Arizona Smelting Co., Humboldt, Arizona, for jig-drives, trommels complete with screen, clutches, bearings, pulleys, shafting, and structural steel trommel supports and housings.

Among the recent sales made by the Dorr Cyanide Machinery Co., Denver, are the following: 1 Dorr continuous thickener to El Tigre Mining Co., Yzabal, Mexico; 2 Dorr classifiers and 1 Dorr thickener to the Homestake Mining Co., Lead, South Dakota; 1 classifier to the Emana M'Cubwa Copper Co., Rhodesia, South Africa; 1 classifier to the Motherlode Mining Co., Sheep Creek, B. C.; 2 classifiers to the Gold Road Mining Co., Kingman, Arizona; 1 classifier to W. B. A. Dingwall, Matehuala, San Luis Potosi, Mexico; 1 thickener to the Vulture Mines Co., Wickenburg, Arizona; 1 classifier and 1 thickener to the Cia. Minera Las Vaca, San Diego, Chile; 2 classifiers to the Tom Reed Gold Mines Co., Kingman, Arizona; 1 classifier to Charles Butters & Co., Ltd., Virginia City, Nevada; 1 classifier and 5 thickeners to the Ophir Gold Mines, Milling & Power Co., Ophir, Colorado; 3 thickeners to the Beck Mining Co., Atlantic City, Wyoming; 4 thickeners to the U. S. Treasury Mining Co., Engle, New Mexico; 4 thickeners to the Blue Flag Mining Co., Victor, Colorado. The last four named companies are installing continuous decantation process of cyaniding.

Catalogues Received

Hayward Co., 50 Church street, New York. Pamphlet No. 590, 'Hayward Buckets and Digging Machinery.' 8 pages. Illustrated. 6 by 9 inches.

Gardner Crusher Co., 566 West 34th street, New York. Catalogue No. 3, 'Gardner Crusher, Disintegrator and Pulverizer.' 24 pages. Illustrated. 4½ by 7½ inches.

Sullivan Machinery Co., Peoples Gas building, Chicago. 'Mine and Quarry,' June issue. Also Bulletin No. 58-L, covering air-compressor accessories, and Bulletin No. 63-H, on Sullivan iron-clad coal cutters.

Fort Wayne Electric Works, Fort Wayne, Indiana. Bulletin No. 1139, 'Motor Drives.' 48 pages. Illustrated. 8 by 10½ in. Also Bulletins No. 1136, 1137, 1139, 1140, 3053, and 4515, describing electrical machinery.

Ingersoll-Rand Co., 11 Broadway, New York. Form No. 8007, 'Little David Pneumatic Drill.' 16 pages. Illustrated. 6 by 9 inches. Also Form No. 5003, 'Radialaxe Air-Driven Coal Cutters.' 20 pages. Illustrated. 6 by 9 inches.

Allis-Chalmers Co., Milwaukee, Wisconsin. Bulletin No. 1630, 'Hydraulic Turbines,' Types FH, FV, and OH. 24 pages. Illustrated. 8 by 10 in. Also Bulletin No. 1802, 'Sampling Machinery and Equipment.' 48 pages. Illustrated. 8 by 10 inches.

Colorado Iron Works Co., Denver, Colorado. Catalogue No. 10-C, 'Advanced Cyanide Practice and Equipment.' 70 pages. Illustrated. Size 6 by 9 inches. The catalogues issued nowadays by many engineering firms are quite as useful as some text-books published; in fact, more so, as they are written as the result of practical experience. The above book, issued by the Colorado Iron Works, may be said to come under this head. The cyanide process is explained in its various applications in the treatment of gold and silver ores, in a concise manner. Two features in the bulletin are the drawings and explanations of the principle of counter-currents, and washing by continuous dilution in cyaniding ores. In the first system, the solution is supposed to take up gold or silver from the pulp of lowest value, while the ore is losing value as it passes down through successive tanks toward the discharge. This is done by agitators and thickeners being alternately placed. In washing by continuous dilution it may be found difficult to keep the percentages of solids and solution to the nicety shown at each successive step in treatment. Useful information is given on tube-mills, pans, filters, and accessories. A few tables are given on tank capacity, rates of flow of water, and slime density relations.

Alunite occurs in Colorado, according to a report by E. S. Larsen, of the U. S. Geological Survey (Bull. 530-F.). The mineral is found in San Cristobal quadrangle. The rocks of this region have been greatly altered by volcanic action. The occurrence of the alunite was noted by Mr. Larsen only incidentally to the geologic mapping of the San Cristobal quadrangle, and the few analyses made do not show potash to be present in probable commercial quantities.

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EDITORIAL

BUTTE and Park City reports have been finally issued by the United States Geological Survey. It remains now but to complete the Leadville monograph.

THE Senate resolution regarding foreign concessions for American harbors is but the statement in form of what every European country holds in substance. Germany would probably object as strenuously to Denmark ceding England a coaling station on its mainland, as the United States would to the same country ceding Germany a coaling station in the West Indies.

SEPARATION of surface from mineral rights in oil lands in Utah is proposed in Senate bill 3045, favorably reported to the House of Representatives at Washington. The proposed act permits entry and patenting of the reserved oil lands in Utah under the homestead and various other laws permitting the taking of agricultural land, but reserves to the United States the oil and gas in the lands. Disposition of these materials is to be subject to future legislation, but anyone acquiring rights under this act will be required to compensate the holder of the surface of the land for all damage due to prospecting or removal of the gas and oil. As at first drawn the bill proposed the same treatment for all reserved oil and gas lands, but as reported to the House its operation is restricted to Utah, in which a special emergency is held to exist.

MINE-RESCUE crews are gradually being organized and trained at the metal as well as coal mines in this country. While there is not the danger of gas explosions that exists in coal mines, fires, powder explosions, and bad air all cause conditions under which rescue crews as well as trained first-aid men may be needed. The Goldfield Consolidated, we believe, led the way among Western metal mines in training and equipping a rescue corps. The Portland Gold Mining Company was a close second, and the good examples have now led a number of companies operating on Beacon Hill in the Cripple Creek district, including the El Paso Consolidated, the Gold Dollar, and others to join in a neighborhood station. Equipment has been purchased and men are to be trained so as to be prepared for every emergency. Such movements to increase safety in mining are well worth while and deserve the hearty cooperation of all mine managers, and no part of the work of the Bureau of Mines has deserved more support than that done in focusing attention on the need of this preparation.

RUMOR travels fast on a stock exchange, and an announcement is quoted and re-quoted without, at times, any too close effort at verification. In the case of the United Verde Extension Mining Company, discussed by our Boston correspondent July 13, there was apparently a temporary feeling of distrust because it was thought that a deliberate effort had been made to confuse the public and to lead it to assume that participation in the reorganization by Mr. James S. Douglas, involved Phelps, Dodge & Company becoming sponsors for the property. The

original circular letter distributed from the office of the company, contains no such intimation, and the whole mistake was due to the similarity in name and the relationship of Mr. James S. Douglas to Dr. James Douglas. It is hard for the son of a famous man to get out from the shadow of a great name, but in a case such as this it is a penalty Mr. James S. Douglas may well pay gladly. That the plan of organization when thoroughly understood commended itself to the stockholders was shown by the fact that only one minor holder of shares voted against it. We hope that Mr. Douglas' venture in mining may turn out as well as have those of his eminent father.

LABOR conditions are particularly unsatisfactory in New Zealand just at present, and matters may easily get worse. At Waihi, the engine drivers and miners are at loggerheads, and the Waihi and Grand Junction mines and mills have been shut down some ten weeks; nearly 2000 men being out of work. A large district is fast being depopulated. The Federation of Labor, which controls most of the unions in New Zealand, tried to force the enginemen to join the central union. They would not do so, and consequently the miners stopped work abruptly. The companies concerned met the men in conference, but without result. Apparently about 80 per cent of the men are against the strike, yet none are willing to agitate against it. The mines are filling with water, though at such a slow rate as surprises everybody, especially the miners, and it will be at least twelve weeks before the water reaches the top of No. 10 level in the Waihi mine, and no damage is expected in the stopes. No machinery of any kind is at work, save a dynamo at night. Waihi is a fine little mining district, and the aspect of affairs is disheartening. At Waikino, where the big mill is, and a picturesque little town has sprung up, there is hardly a soul about the place. It may be remarked here that the whole of the Ohinemuri mining district is a prohibited one, as far as the selling of drink is concerned, and has been for about four years now. The strikers are receiving small strike benefits. At Reefton, on the west coast of the South Island, the miners objected to working 'baby' drills, singlehanded, as is done at Waihi and many mines in Australia. They are out on strike, and the Progress, Blackwater, and other small mines are shut down. At the time of writing, the matter was being investigated by a commission, and both sides were determined. There also seems to be great unrest among the coal miners in the South Island, and judging by the stocks of coal stored in Wellington and Auckland, and reports of big storage at other centres of population, a strike is expected. Such a general unrest of labor is not good for a small country, and a strike in one industry is all too apt to spread to others.

Foreign Trade and Canal Tolls

Panama canal tolls are being much discussed at present as a result of the action of Congress in providing for free passage of American ships, and the protest thereat filed by Great Britain. We print elsewhere a short note on the matter written by Mr. Courtenay De Kalb. The opinion he expresses is one widely held, and it is not too much to say that those who dissent from it, do so regretfully. There is much of sentiment that harks back to the days when the American merchant marine was supreme, and which looks forward hopefully to a return of American ships to the seven seas. There are also, as Mr. De Kalb suggests, substantial advantages from a business point of view in having the aid of our own ships in developing a foreign market for surplus manufactures. Nevertheless, we do not believe that the bill as passed by Congress is a wise measure or that it is a proper cause for jubilation. We hold in this case with Mr. Roosevelt that the intent of the Hay-Pauncefote treaty was clearly to provide equal treatment to the ships of all nations, including our own, in foreign trade. Any other construction of the treaty impresses us as forced; as a mere shifty quibble over terms. This is the opinion of the man who, probably better than anyone else in the United States Senate, is prepared to judge the matter fairly and without prejudice—Mr. Elihu Root. That distinguished lawyer and ex-Secretary of State knows if anyone does, how the treaty should be interpreted, and in this case at least no cry of 'corporation leaning' can be raised against his judgment. Believing, as we do, that in this matter the good faith of our Government has been solemnly pledged to the world, we cannot express other than profound regret that it should be proposed to violate that pledge. Entirely aside, however, from the moral aspect of the case, which should clearly be sufficient to determine the matter, it is not, we think, good policy to discriminate in this way against foreign shipping. A recent writer in the *Statist* has brought out strongly the fact that England's great growth as a sea power and colonizing nation, while based upon the necessities of her people, was none the less profoundly promoted by the freedom of trade that characterized her march of conquest. Wherever the English flag was raised all men traded on equal terms. It was therefore to the advantage of other nations as well as of Great Britain, that India should become English, and opposition of other nations was stilled. Our own country has embarked upon the opposite policy. When we took Hawaii and the Philippines we erected a tariff wall and extended the coastwise shipping laws to cover the territory. What, therefore, of advantage has it been to neutral nations to have us extend our rule? What, for example, has Germany gained by our conquest of Porto Rico? And if each nation sees in every added conquest by another, only one more bar to her own trade, is it not natural that each should in turn seek to extend her own rule? It is difficult to see any basis in equity for our maintaining a closed door to Japan in the Philippines and Hawaii, and insisting on an open door in Manchuria. The activities of other nations, our own among them, have compelled Germany to take her present disturbing position in international affairs; namely, that every gain of another country can only be permitted on the basis of compensation to her. We are accentuating the tendency toward walled-in rival spheres of trade; the greatest present danger to the world's peace.

Trade should be a mutual affair. We cannot expect to sell to the Orient unless we buy from the Orient. We must 'exchange' goods rather than 'sell' them, taking in return either goods or services. Only if we enter international trade on this broad basis can we expect it to prosper. The handling of our goods may well be payment in service for part of our exports, and whether the bargain be good or bad cannot be determined by general rule. In international commerce it is particularly true that stooping for the nickels of the present, we may lose the dollars of the future. The sharp antagonism of the world, conviction at the bar of judgment of previously friendly nations of having violated treaty obligations, is too heavy a price to pay for an advantage of $1.25 per ton in carrying charges on a limited part of our foreign trade.

Ship subsidies have been repeatedly proposed and as regularly defeated at Washington. The long record of graft and injustice that has marked government aid to other lines of industry has apparently aroused unconquerable opposition to any such measure. Indirectly the remission of tolls on American shipping passing through the canal is a subsidy; but it is a most unequal one. Under

the proposed conditions a steamer carrying nitrate from Chile to New York, and presumably American products south, would be favored; the same steamer traveling to San Francisco, would be at a disadvantage. On the other hand, trade between San Francisco and the River Platte would be favored at the expense of New York and other Eastern ports. The net effect would be to favor the longer water-haul, and that is understandable if it mean cheaper service. The latter, however, could only come from steamers traveling more miles for less money, rather than receiving more money for the same or less miles, the ordinary result of a ship subsidy. It would seem that if aid is to be given to American ships in foreign trade it would be better frankly to pay a tonnage bonus that would be non-discriminating.

It is a grave question whether subsidies are necessary to the development of American shipping. In that connection it is worth nothing that much of the American trade is carried in foreign vessels that receive no government aid. Further, it is a fact, not generally recognized, that many of these vessels are in reality owned in America. The International Mercantile Marine, while almost entirely under foreign flags, is largely owned in America. The Standard Oil Company, the United States Steel Corporation, and several other American companies have large fleets, run usually under the British flag, but owned by Americans and as devoted to building up American trade as though they flew the stars and stripes. Among independent steamship companies may be mentioned the Robert Dollar Company, with a line of excellent steamers regularly handling freight between Pacific coast ports and the Orient. These boats are not subsidized by England, nor does Norway pay anything toward the running expenses of the boats that bring coal from British Columbia to San Francisco for the Western Fuel Company. In the face of such facts we are far from being convinced that subsidies are as important as are first cost and shipping regulations. On the open seas the world comes into competition and the American shipowner if permitted to buy his steamers on the same terms as his competitor and to run them under the same rules and regulations, seems abundantly able to care for himself. Running into San Francisco from Japan are two lines of steamships, the Toyo Kisen Kaisha and the Pacific Mail Steamship Company. Both run excellent modern boats, manned mainly with English or Scotch officers. The crews of the Japanese boats are, naturally, mainly Japanese; those of the Pacific Mail are largely Chinese. Close and competent observers estimate that the cost of handling freight and passengers on the two lines is practically equal. The Japanese company receives aid from its Government, though the bulk of its business consists of handling American freight to and from China. The American company receives only the ordinary payment for carrying mail. Last year the Toyo Kisen Kaisha paid a 4 per cent dividend. The Pacific Mail Steamship Company showed a profit of a few thousand dollars, but earned no dividend. The reason lies not in the difference in shipping laws or the matter of subsidy, but in the fact that the Japanese company needs only to earn a profit on the cost of its boats in terms of ordinary interest. The American company must do better. It must pay, and does pay, a profit on the cost of the boats, but also it pays tribute to 'the dead hand.' In other words, the Pacific Mail Steamship Company does not own its principal boats, but leases them upon terms that involve payment materially above interest on the investment. When the new boats were built, instead of the company borrowing the necessary money at ruling rates, one of the officers of the concern built the boats and leased them to the company upon terms favorable to himself. It was a typical bit of American high finance, and failure of this company to pay dividends cannot be used as an argument for financial aid to American shipping. Unfortunately, there is reason to believe that similar conditions underlie other widely advertised 'failures' of American lines.

In the discussion above we have spoken only of the proposed measure as it affects foreign shipping. There are two other phases of the bill which, we believe, are also objectionable, but concerning which there is abundant room for difference of opinion, but for the proposed free tolls for American ships in foreign trade, we can see no justification, and we reiterate our disbelief in the necessity of subsidies and our obligation to the systematic campaign of misrepresentation urged in their behalf which has deceived many honest and patriotic Americans.

Iron and Steel in Australia

It is announced that the Broken Hill Proprietary Company, Ltd., has bought 200 acres of land near Newcastle, New South Wales, for the purpose of erecting large iron and steel works. The operations of this great concern include its mine, a 2000-ton capacity concentrating mill, acid-making and flotation plants at Broken Hill, and the slime-sintering works a few miles out from there; lime quarries and iron mines; a large blast-furnace plant, a refinery for lead, and a spelter plant costing about $500,000, at Port Pirie, in South Australia; and coke ovens at Bellambi in New South Wales. The Proprietary is a wealthy company, its reserve and insurance fund totaling some $1,300,000, which will help to pay for the new works. The time seems propitious for building iron and steel plants in Australia. Great development in railroads and tramways is contemplated and must be pushed, since this country, which is as large as the United States, is deficient in internal communications. Each state is constructing new lines every year, while the Commonwealth Government has just begun a line from Kalgoorlie, in Western Australia, to Port Agusta in South Australia, a distance of 1060 miles. The rails for this line will be imported. Before long this government must also construct the road from Oodnadatta, in South Australia, to Port Darwin and the Northern Territory. Besides the railway requirements, a great deal of iron and steel is and will be used for mining, agriculture, and shipbuilding. At present the importation of iron and steel manufactures of all kinds into Australia is valued at about $30,000,000 annually. Hence, the entry of the Broken Hill Proprietary Company into this field would seem to be well-timed. For some years past a blast-furnace and rolling mills have been producing pig iron and steel shapes at Lithgow, in New South Wales, the production of the former of good quality has reached over 40,000 tons in one year. Labor troubles have hindered work, but up to June 30, 1914, there is a bonus of $2.88 per ton payable on all iron produced from Australian ores, which probably will be extended.

In iron ore resources, the Commonwealth is rich. On the Blythe river in Tasmania there is a deposit of 17,000,000 tons; large quantities have been recently found at Yampi Sound, in the northwest of Western Australia at Carcoar, in New South Wales, there are 3,000,000 tons of mixed hematite and limonite averaging 50 to 60% iron; and Cadia, in the same state, about 4,000,000 tons of 50 to 65% iron; while at Iron Knob, in South Australia, there are 20,000,000 tons of 60% ore. This latter deposit is owned by the Broken Hill Proprietary, but up to the present, has only furnished iron for fluxing the lead ore and concentrate in the blast-furnaces at Port Pirie. With the active railroad and shipbuilding era now opening in Australia the new enterprise should do well.

Metallurgy at Bendigo

By M. W. von Bernewitz

Bendigo, the famous old mining district of Victoria, Australia, has had a bad name in the past for its metallurgical methods, yet any careful student is forced to admit that although plants have been and are out of date, and costs of milling are high, the results are astonishing. I recently spent three strenuous days inspecting mills and discussing treatment with local engineers. I was rewarded. About $360,000,000 of gold has been produced from the Bendigo field, and it has not been found payable to treat the tailing dumps. It is quite safe to say that the ore from the Bendigo mines will never require any different process from that at present in vogue, yet the plants at work need much alteration to effect cheaper results. The field may be said to be in a transition stage from the old to the modern type of mill; and it is pleasing to note such a movement, especially now that the field has shown good returns on recent exploratory work in the upper levels and sidelines of reef. However much the Bendigo mills are obsolete, they are well kept and clean. The total cost of treatment in the old mills is about 80c. per ton.

It is probably the simplest ore in the world to treat; and is practically similar from each line of lode down to 4000-ft. depth. It mainly consists of a clean white quartz in which the gold occurs in a somewhat coarse form, while it also contains about 2% of arsenical pyrite, which produces some 5% of the total gold output. Nothing but simple treatment is necessary, since amalgamation in boxes and on plates, with a table of some kind, will extract practically everything. As an example of this, one mill may be cited which is crushing ore worth $12 per ton, and the residue after this treatment is only worth 50c. The residue from other plants runs from 16 to 50c. per ton. In the past, the saving of the pyrite was not as good as it is now, and a characteristic feature of each surface plant is a shed containing canvas tables worked by Chinamen. These metallurgists did fairly well for a time; but not so well now. Their methods will be described later.

About two years ago a syndicate sent engineers to Bendigo with the object of sampling the old tailing heaps, which are as prominent on the landscape as they are at Kalgoorlie. If worth enough, it was proposed to erect a large central plant, transport the tailing by some cheap method, and cyanide it. The quantity was there, but not the quality. Cost of transport would have been fairly high, and the business was dropped. A cyanide plant was erected some time ago, but could not be made to pay. One trouble was the acidity of the sand, due to decomposition of pyrite, and the consequent necessity of using much lime.

From the mines to the mills, the ore is carried by ropeways, carts, and trucks. The use of rock-crushers is extending, and many mills are provided with a gyratory of about the No. 3 Gates size. At the majority of mills feeding is still done by hand, one man to 10 or 15 stamps. This is one of the costly features of a Bendigo mill. I have heard it stated that a good hand feeder is equal to an automatic machine. To some extent, on certain ores, this may be so; but only under very exceptional conditions. Challenge feeders are used at Bendigo, and several local machines, one of which seems to me to be fearfully clumsy. Save two, every mill visited was of the iron-frame type. In them a row of cast-iron columns or posts carries the cam-shafts and guides, and a row behind carries the driving shaft, which is on a level with the former. The driving shafts are mostly direct-connected with the engine crank and drive the cam-shaft by gear and clutches. Gear of all sizes is used, and there must be a deal of friction from this source.

The mortars of a very old design, being deep for good amalgamation and having a discharge up to 5 inches. They are built to receive 4, 5, or 6 stamps in each. Cam-shafts carry 10, 12, 15, or 24 cams; in the last case, two being coupled together. Breakage of cam-shafts is rare, as is also breakage of stems. If anybody wishes to see a variety of cams at work, let him go to Bendigo. There are the long-arm type, the separate boss and arms fitted together on the bedpost principle, half cams bolted around shaft, the Spier's dovetailed, and the modern Blanton. All cams of the old style are keyed and show much ingenuity in design, the effort being to secure ease of removal. Dovetailed cams seldom work loose.

The stamps on the field would average 850 lb. weight, with 80 drops of 8 in. per minute. They crush from 2 to 4 tons each per day. The tappets are raised or lowered on a large thread on the stem, and have renewable wearing faces. Each stamp has a separate iron guide. A regular order of drops is attempted, but in a 6-stamp mortar I noticed the two centre ones dropping together, then the outside ones, and last the second pair. Heads, shoes, and dies are made locally, and last up to six months. The speed varies at times. Punched and wire screens from 14 to 40 mesh are used.

It would seem that power on an old-type battery would be high, but one old millman and engineer assured me that his 60 stamps took only 40 hp., or ⅔ hp. each. Talking about old batteries reminds me of a fairly recent comparison at Kalgoorlie, where a worn-out battery cost $1200 in power, against $500 in a modern mill on the same tonnage, which is rather a difference.

Careful attention is paid to amalgamation. A high percentage is caught in the boxes. For instance, in a lot returning 127 oz., 104 oz. was found in the box. Several short plates, in all up to 12 ft. long, with riffles between, are used. These are invariably kept locked. Berdans and retort furnaces are found in each clean-up plant, some mills having as many as five furnaces to deal with small lots from tributers or individual mines. The general amalgam retorts as high as 66%, and the average value of the gold is $19.50 per ounce.

The pyrite averages 2% of the ore, and carries 5% of its value. In the past it has been caught on the Halley percussion table, which mainly consists of a table about 5 by 3 ft., knocked forward by a three-arm cam and back by a flat spring. Its work is fair—one table for 4, 5, or 6 stamps. Most of the batteries now have installed the Phoenix-Weir table, after trials against the Wilfley, Card, and others. Its driving gear and deck are somewhat similar to the Wilfley. One table to 10 stamps is the rule. A small copper plate is fixed to the pyrite discharge of some tables, and collects a little amalgam. In some cases the overflow from the tables flows over blankets, which catch a little more mineral. All concentrate is sold to public works. Another feature of Bendigo mills which crush for the public, are the separate bins of pyrite from each lot, along with the coarse pannings from the boxes. Concentrate averages $40 per ton.

Two well known works (Leggo's and Edwards') buy concentrate from the various batteries, and I was able to see a section of each plant. The pyrite contains an average of 12% arsenic, and the method in each is to roast, following by cyanidation at Leggo's, and chlorination at the Edwards' plant. In the former works roasting is done in Leggo's patent furnace. This consists of four superimposed hearths, each in itself being a complete furnace with fire-box, feeder, and discharge to push-conveyor. The floors have an area of 60 ft. by 6 ft. 9 in. For rabbling the pyrite there are 16 spindles, worm-driven at 1 r.p.m., with 4 rabbles, one on each floor; 64 in all.

The rabbles are water-cooled. The furnace capacity on concentrate is 30 tons per day, and 100 tons on an ordinary sulphide ore with, say, 4% sulphur. At the Edwards' there is a simplex, and one duplex Edwards' furnace, the latter 79 by 11¾ ft., traveling at about 1½ r.p.m. The hearth has a ⅝-in. fall per foot. There are about 600 ft. of chambers to catch the arsenic. The roasted pyrite is damped down, screened into vats of 4-ton capacity, fitted with tight lids and a gravel filter. Chlorine is made in an Edwards' semi-rotary generator. The vats are worked in series.

At most of the Bendigo mills the pulp is lifted to ponds by pumps. A few air-lifts are in operation. The elevating of pulp at Bendigo has reached a high stage of development. The pumps are of the Cornish plunger type, with poles up to 16-in. diameter. They are packed with hemp and old rubber, and have three clean water-jets to keep the sand from cutting. Self-priming apparatus is used which is simplicity itself. I was shown plungers that had been in use for years. The batteries only crush a few hundred tons per week, and the plungers last a long time, though they still require some attention.

As regards the elevation of pulp, it is interesting to note that Cornish pumps are used at Bendigo; 3-throw pumps, a few wheels, and bucket-elevators at Kalgoorlie; bucket-elevators at Broken Hill; wheels and bucket-elevators in the Waihi-Paeroa district; and wheels and centrifugal pumps on the Rand.

I should say that the Bendigo ore would yield 75% sand. At Bendigo the Chinaman has had the right, on a royalty basis, of saving what he can out of the pulp from the batteries. His skill in metallurgy is well known. I have

CHARING CROSS AND PALL MALL, BENDIGO.

TYPICAL SCENE IN THE BENDIGO GOLDFIELD.

seen it in Borneo and Bendigo, and in the former northwest district of Sambas, among other works, I saw a girl wash off *dulongs* full of gravel with great skill. In the sheds erected near the sand dumps are several tables with blankets or canvas. These catch the fine pyrite, and are disposed of to the pyrite works. Not much is made out of the treatment now. The Chinaman keeps the ponds in order.

When discussing why modern plants are not erected at Bendigo, the usual reply is that they would not do on this ore, where amalgamation is so important, not denying that they would be cheaper to work. A fast-running battery would throw out the gold from the mortars, and the plates would not catch it all. It is argued that one battery had to slow its stamp for this reason, yet, on the other hand, an up-to-date mill is being erected on the Catherine Reef; and a very good mill is at work on the Central Red, White & Blue mine. The residue from the latter is worth only 50c. The argument does not seem to hold, yet there are many opponents of the fast battery. It is largely, perhaps, a matter of experience in amalgamation.

The visitor to Bendigo sees three or four long, unbroken lines of brick stacks and head-gear, and scores of acres of dumps. The head-gear is generally of good design, the legs being made out of pipe, wood, or lattice. At Kalgoorlie, the head wheels are fixed toward the front of the top, and the shaft in the centre of the four legs; while at Bendigo the wheels are fixed in the centre, and the shaft is toward the centre of the two back legs; another example of each district following its own practice. All machinery in use is made in Victoria, either at Bendigo, Castelmaine, or Melbourne. There are Cornish, Lancashire, and water-tube boilers, consuming wood and coal. A great deal of slack coal is bought from the Government mine at Powlett. This costs $4.08 per ton delivered, as against $2.04 for wood. Forced draft is necessary at times. Newcastle coal is also burnt.

Hoists are of general good design, being mostly first motion, and some being fitted with Corliss gear. The battery engines are hardly of a highly economical type, although condensers are attached. The suction gas-engine is being introduced slowly, and two 120-hp. Crossleys are at work on the Central Blue, while others are on the Prince of Wales and Nell Gwynne, reducing costs. Engineers are paid $2.16; feeders, $1.60; and mill hands $1.92 per day.

In the table below are summarized the main features of the leading Bendigo mills.

In the Reserve, in the Mall of Bendigo, a bronze statue of the late George Lansell has been erected, and it stands there with a lump of white quartz in its hand, he having been called the 'Quartz King.' The mines controlled by the family produce some $30,000 per month. Lansell's Bendigo battery of 105 stamps is the largest in the field, and is a custom mill. It is also an old-timer, having been built in 1888. A remarkable feature of the plant is the huge main shaft, level with the cam-shafts, and driving the latter by gear and clutches. It is tapered slightly from the engine end to the far stamps. The New Moon has a 200-hp. Bellis & Morcom set, driving 150-kw. Westinghouse generator. This is for the mine hoists and crushers. There is also a belt-driven generator for two 10-hp. motors, driving pumps, etc. In this mill, after long tests, the Phoenix-Weir table was judged to be the most suitable. The Catherine Reef is about to start a fine new plant, which may be compared to the old one in the table given. As good a saving with the high-speed battery is expected as is now made in the old slow one.

Clarke's public mill, a clean and tidy plant, was quite interesting, and the owner courtesy itself to me, as in fact was everybody I met on my rounds. At this mill were found hand-feeding; mortars with 4 and 6 stamps; 12 cams on a cam-shaft, and one with 24, it being made up of two 12-cam shafts coupled; about five styles of cams; 4-in. discharge; 2¼-ton capacity per stamp; yet the huge dump of tailing worth only 40 to 48 cents per ton. I was deeply interested.

The Central Blue has as good a battery as I have seen, the only faults being that the mill is a little cramped about the crusher, the roof over the stamps is rather low, and the cam-shafts seemed to be too long between the bearings and first stamp. It is a Victorian-built mill, and a joy to watch at work. An aerial tram brings the 800-lb. capacity skips to a No. 3 gyratory crusher, and the broken ore is distributed to the bins by belt. The 20 stamps were crushing 100 tons daily through 180-screen at the time of my visit. About 8 tons of pyrite is collected weekly, and the residue is only worth about 50c. on $12 ore. The plant is driven by a 120-hp. Crossley suction gas-engine, belt driving the main drive shaft, the power used being from 60 to 80 hp. The cost per ton for power was 10c. A 120-hp. Crossley engine also drives by belt a 10-drill Ingersoll-Rand compressor. Good amalgamation is effected in this fast mill, and the total costs are 40c. per ton, which may be compared to advantage with 80c. in an old-timer.

Name.	Transport	Feeders	Battery frame	Cam-shaft drive.	No. of stamps	Weight, lb.	No. of boxes	Stamps in box	Speed	Drop, in.	Tables
Virginia	trucks	self	iron	gear and clutch.	50	800	10	5	80	8	5 P-W*
South New Moon	trucks	Challenge	iron	gear and clutch.	40	800	10	5	80	8	P-W
New Moon	ropeway, trucks, and carts	Challenge and hand	iron	gear and clutch.	71	750 to 850	7	5			
							9	4	80	8	9 P-W 4 H†
							4	6			
(1) Catherine Reef.	trucks and carts.	hand	iron	gear and clutch.	64	800	8	5	80	8	6 P-W
(2) Catherine Reef.	trucks and belt	Challenge	wood.	belt	30	1250	6	5	105	7	6 P-W
							9	4			
Clarke's Public Mill	carts	hand	iron	gear and clutch.	60	800	4	6	80	9	13 H
Johnston's Reef	carts	hand	iron	gear and clutch.	40	900	8	5	80	8	8 H
Johnston's No. 3	carts	hand	iron	gear and clutch.	20	900	4	5	90	8	3 P-W
Central Blue	aerial tram	Challenge	wood.	belt	20	1250	4	5	104	6	4 P-W
							6	5			
Lansell's Fortuna	carts	hand	iron	gear and clutch.	48	800	3	6	80	9	
											5 H
Lansell's Bendigo	carts and trucks.	hand	iron	gear and clutch.	105	1000	11	5	80	8	8 P-W

*P-W, for Phoenix-Weir table. †H, for Halley table.

Copper and Sulphur in Cyanide Solution

By Will H. Coghill

In contradistinction to a process* in which the ready solubility of copper in cyanide solution is an advantage in the extraction of zinc sulphide from the ore, I wish to show a case in which the ready solubility of copper in cyanide makes the commercial extraction of silver from the ore a difficult problem. The results relate to two similar samples which were tested simultaneously. They will be designated as samples *A* and *B*, assaying 36.27 and 26.75 oz. silver, respectively. There was less than 1% sulphide minerals and the gangue was a silicate rock. Galena, sphalerite, pyrite, and rhodocrosite were identified. The sulphides contained nearly all the silver; in fact, it was estimated that if it were possible to make a concentrate consisting wholly of sulphides it would assay more than 2000 oz. per ton.

After a number of tests which showed that something in these samples was possessed with an inordinate desire to consume cyanide it was decided to make a long-period air-agitation test, changing the solution frequently, thus preventing fouling and to test the pregnant solution for base metals. The quantities of reagents consumed and silver dissolved are shown in the appended Table I.

Note that the consumption of KCN per ton of ore during 90 hours agitation ranged from 7.2 to 11.6 lb. Note also that the greatest cyanide consumption was during the first six hours and a greater percentage of the silver was dissolved during this period than any subsequent. The large discrepancy between 'total percentage Ag recovered' and percentage extracted as determined by assay of tailing is to be accounted for by the unavoidable losses during transfer of solutions. The assay of tailing is correct and indicates the percentage extracted; however, the figures under 'percentage silver recovered' give a good idea of the rate of dissolution.

In 31, for instance, it is noted that only 5.2% of the silver was dissolved and this is easily explained by the fact that most of the silver having been previously extracted, there was little left to dissolve. Cannot the decreased consumption of cyanide be explained along the same lines, that is, the cyanicide is in very small quantities and is practically all consumed during the first 90 hours?

Table II throws some light on this question. It is the result of the determination of the amount of copper in the samples and in the solutions.

Table II

No.	Amount taken in A.T. Ore.	Solution. 2 lb.	Solution. 4 lb.	Copper in ore, %	Copper in sample, mg.	Copper dissolved, mg.	Copper dissolved, %	Total copper dissolved, %	Total silver dissolved, %
22-26...2	40			0.29	168	17.6	0.03	10.0	76.3
27-31...2			40	0.29	169	25.0	0.04	14.8	91.2
32-36...2	40			0.21	122	15.0	0.03	12.3	81.4
37-41...2			40	0.21	122	29.1	0.05	23.9	87.7

Table I

AIR AGITATION.

No.	Amount taken in A. T. Ore.	Sol.	Length of period in hours	Total time, hours	Strength of solution. Before. KCN	Before. CaO	After. KCN	After. CaO	Consumpt'n KCN per ton ore, lb.	Total con. KCN per ton ore, lb.	Silver recovered, %	Total silver recovered, %	
							Sample A—Slime						
22	2	8	6	6	2.1	2.4	1.1	0.2	4.0	4.0	24.2	24.2	
23		8	12	18	1.9	2.2	1.5	0.7	1.6	5.6	8.1	32.3	
24		8	24	42	1.9	2.2	1.3	1.0	2.4	8.0	16.3	48.6	Added 6 lb. lime per ton ore.
25		8	24	66	1.9	2.2	1.5	0.3	1.6	9.6	10.1	58.7	
26		8	24	90	1.9	2.2	1.6	0.4	1.2	10.8	7.0	65.7	Tailing assay, 8.60 oz. per ton, 76.3% extraction.
27	2	8	6	6	4.1	2.4	2.5	0.4	6.4	6.4	33.4	33.4	
28		8	12	18	3.7	2.2	3.4	0.6	1.2	7.6	14.6	48.0	
29		8	24	42	3.7	2.2	3.2	1.1	2.0	9.6	17.4	65.4	Added 6 lb. lime per ton ore.
30		8	24	66	3.7	2.2	3.3	0.3	1.6	11.2	7.8	73.2	
31		8	24	90	3.7	2.2	3.6	0.3	0.4	11.6	5.2	78.4	Tailing assay, 3.24 oz. per ton, 91.2% extraction.
							Sample B—Slime						
32	2	8	6	6	2.1	2.4	1.4	0.4	2.8	2.8	22.8	22.8	
33		8	12	18	1.9	2.2	1.6	0.7	1.2	4.0	8.8	31.6	
34		8	24	42	1.9	2.2	1.6	1.1	1.2	5.2	16.2	47.8	Added 6 lb. lime per ton ore.
35		8	24	66	1.9	2.2	1.6	0.5	1.2	6.4	11.8	59.6	
36		8	24	90	1.9	2.2	1.7	0.5	0.8	7.2	6.5	66.1	Tailing assay, 5.00 oz. per ton, 81.4% extraction.
37	2	8	6	6	4.1	2.4	3.3	0.4	3.2	3.2	29.2	29.2	
38		8	12	18	3.7	2.2	3.3	0.8	1.6	4.8	13.1	42.3	
39		8	24	42	3.7	2.2	3.1	1.4	2.4	7.2	15.2	57.5	Added 6 lb. lime per ton ore.
40		8	24	66	3.7	2.2	3.2	0.3	2.0	9.2	9.5	67.0	
41		8	24	90	3.7	2.2	3.2	0.3	2.0	11.2	7.9	74.9	Tailing assay, 3.32 oz. per ton, 87.7% extraction.

The analysis of the samples shows a quantity of copper (0.29 and 0.21%) that would be considered negligible in most cases, but not so in this; for in 37-41 23.9% of this copper was dissolved. It seems, then, that the suspicion that the cyanicide was in small quantities and finally spent itself was correct, though the percentage of total copper dissolved is barely comparable with that of the total silver dissolved.

In order to secure more pregnant solution for further tests, a grinding in cyanide test was made, lasting 48 hr. The tests were each aerated twice. Table III shows the status regarding dissolved copper and silver. The results are nearly identical with those shown in Table II and

*McGregor. *Eng. & Min. Jour.*, Dec. 2, 1911, p. 1080.

are here recorded to show that the amount of copper dissolved is independent of quantity of solution and method of treatment—that is, whether by air-agitation or grinding in cyanide.

TABLE III

GRINDING IN 4-LB. CYANIDE SOLUTION.

Name.	Amount taken in A. T. Ore.	Sol.	Copper in ore, %	Copper in sample, mg.	Copper dissolved, mg.	Copper dissolved, %	Total copper dissolved, %	Total silver dissolved, %
Sample *A*	2	8	0.29	169	23.7	0.04	14.0	76.3
Sample *B*	2	8	0.21	122	31.6	0.05	26.0	83.3

Table IV, which follows, portrays, I think fairly accurately, the conduct of the cyanicide in the test shown in Table III.

TABLE IV

KCN as:	Sample *A*. Lb. per ton solution.	Per cent.	Sample *B*. Lb. per ton solution.	Per cent.
Free cyanide	1.30	32.9	1.60	40.6
KCNS	1.17	29.6	0.91	23.0
$KAgCN_2$	0.57	14.4	0.46	11.6
$4KCN.Cu_2CN_2$	0.73	18.5	0.97	24.6
Error	0.18	4.6	0.01	0.2
Total	3.95	100.0	3.95	100.0

The amount of free cyanide remaining was determined in the usual way, with silver nitrate and potassium iodide indicator. The table shows that only 32.9% and 40.6%, respectively, of the cyanide added remained as free cyanide. The KCN as KCNS was determined by the permanganate method for estimation of thiocyanates as outlined by Clennell in 'Chemistry of Cyanide Solutions.' The KCN as $KAgCN_2$ is an estimation based on the amount of silver dissolved. The copper salt was calculated in the same way. Inspection of the 'error' column shows that all but a very small amount of the KCN is accounted for; but after all, one cannot be sure. And here I wish to point to a paucity of published information. During each of the 52 weeks of the year there are several articles published in our mining magazines alleging to describe cyanide processes. They always begin by stating that the ore is run onto grizzlies, and near the end state the strength of cyanide solution, seldom referring to cyanide losses. If cyanide loss is mentioned, it may possibly be subdivided into physical and chemical, but the reader will have to search a long while to find what constitutes the chemical losses. If the cyanide chemist does not investigate and find the cause of chemical losses, he is either overworked or negligent. If he investigates and does not publish his results, he is not doing his duty to fellow-workers.

In the case of the samples under discussion, it would certainly be unscientific to dope the solution with this and that before finding what salts are present. Clennell has indeed given us two excellent books to aid in such determinations. However, there are yet some uncertainties. I refer to the copper compound. I will quote here from Clennell's 'Cyanide Handbook,' page 80:

"The compound $4KCN.Cu_2CN_2$ is the form in which copper, according to Virgoe, normally exists in cyanide solutions, though Sulman considers that it is more frequently present as sulphocyanide, $Cu_2(SCN)_2$, dissolved in KCN. * * * The reaction (in the presence of an excess of alkali) which, according to the writer's experiments, seems most in accordance with the facts, is as follows:

$$2Cu(OH)_2 + 7KCN = 4KCN.Cu_2CN_2 + 2KOH + KCNO + H_2O$$

This indicates a consumption of 3.6 parts KCN for every part of Cu dissolved."

The calculations in Table IV were based on the above statement. Referring to page 112 in the same book, I take the liberty to multiply (a) and (c) by 2 and (d) by 3 for reasons that will be obvious later.

"The natural sulphides of copper are much less readily acted on by cyanide than are the carbonates, or than artificially prepared sulphides, but they gradually dissolve, probably with formation finally of cupric thiocyanate, by some such series of reactions as follows:

(a) $4Cu_2S + 8KCN + 4H_2O + 2O_2 = 2Cu_2(CNS)_2 + 2Cu_2CN_2 + 8KOH$

The insoluble cuprous thiocyanate and cyanide readily dissolve in excess KCN.

(b) $2Cu_2(CNS)_2 + 8KCN + H_2O + O = 2Cu(CNS)_2 + Cu_2CN_2.6KCN + 2KOH$

(c) $2Cu_2CN_2 + 12KCN = 2(Cu_2CN_2.6KCN)$

Since the solutions almost invariably contain an excess of alkaline thiocyanate, the further reaction is probably as follows:

(d) $3(Cu_2CN_2.6KCN) + 12KCNS + 3H_2O + 3O = 6Cu(CNS)_2 + 24KCN + 6KOH.$"

Upon adding these equations, the following equation results:

$$4Cu_2S + 12KCNS + 4KCN + 8H_2O + 8O = 8Cu(CNS)_2 + 16KOH$$

Here it is seen that 8 times 64 parts of copper consumes 16 times 65 parts of KCN, or one part of copper consumes two parts of KCN, which is a much more favorable ratio than the one previously cited, and has further in its favor the decomposition of some of the KCNS that naturally forms in the presence of sulphides.

Using the data which I have derived from Clennell's four equations, Table IV may be recalculated as below:

TABLE V

KCN as:	Sample *A*. Lb. per ton solution.	Per cent.	Sample *B*. Lb. per ton solution.	Per cent.
Free cyanide	1.30	32.9	1.60	40.6
KCNS	0.76	19.2	0.37	9.4
$KAgCN_2$	0.57	14.4	0.46	11.6
$Cu(CNS)_2$	0.41	10.4	0.54	13.7
Unaccounted for	0.91	23.1	0.98	24.7
Total	3.95	100.0	3.95	100.0

Here two thiocyanates have to be reckoned with instead of one. Taking into account the amount of copper in solution, the KCN as cupric thiocyanate is first calculated and all thiocyanate left over is reckoned as KCNS. The amounts of KCN as $Cu(CNS)_2$ is 0.41 and 0.54, respectively. An inspection of the formulæ of these two thiocyanates shows that the results of titration are the same whether the sulphur is in KCNS or $Cu(CNS)_2$; therefore, to find the amount of KCN as KCNS (left over after satisfying the copper), it is necessary only to take the results from the KCNS column in Table IV, which are 1.17 and 0.91, and subtract from them 0.41 and 0.54, respectively. This gives 0.76 and 0.37. In other words, the quantities under $4KCN.Cu_2CN_2$ vanish, and there are two thiocyanates which are not distinguishable by titration with permanganate. The 'error' is thus increased by the amount of KCN as $4KCN.Cu_2CN_2$ which has been eliminated, and it seems best to call it 'unaccounted for.'

It is worthy of note that there is less difference in the percentages 'unaccounted for' than there is in the 'error'; these being 4.6% and 0.2% in Table IV and 23.1% and 24.7% in Table V. I cannot explain away such a large percentage under 'unaccounted for'; for, as I have shown, our authority has not stated positively how the copper occurs. The grinding was done in an Abbé sample jar, and since the protective alkalinity did not get below 0.3, certainly no HCN was formed.

A reference to alkalinity suggests another phase of the

investigation that may be of interest. It relates to the acidity of these samples. Naturally the first test made was a half-hour agitation in lime water, to determine acidity. This was found to be sufficient to neutralize 3.6 lb. CaO in each case. It soon developed that this test had failed to reveal the true conditions; that the indicated acidity depended upon the time of treatment and state of comminution. This is shown in Table VI.

TABLE VI

ACIDITY TEST.

Sample A—Agitation

	Amount in A.T.		Strength of solution.			Lime consumed per ton of ore.	
	Ore	Solution	Before	After 2 hr....	After 24 hr...	After 2 hr....	After 24 hr...
Dry crushed.....	1	6	2.0	1.2	1.1	4.8	5.4
Slime	1	6	2.0	0.9	0.6	6.6	8.4

The 'dry crushed' was crushed dry in an Abbé jar mill, and was so fine that 85% passed 150-mesh; while the 'slime' was ground wet in the same apparatus until all passed 150-mesh. An attempt was made to find the cause of this accumulating acidity, but lack of time has prevented a thorough investigation. I will say, however, that suspicion rested upon the copper. Much has been written lately about the ready oxidizability of copper; for instance, Durant[2] says: "There are few published records showing that unoxidized copper ores are actually leached in place on a working scale, but such is actually the case, and the fact is that it has been carried on, day in and day out, for over 60 years at a mine barely 300 miles from London."

Then again Bushnell[3] says, regarding the precipitation of copper from mine waters at Butte: "Some of the operators are so fortunate in the situation of their plants that they can cause the water to flow through the tailing heaps of abandoned plants, thereby materially increasing the copper contents of the water."

The air-agitator was therefore put to work and ran five days on a pulp consisting of slime and water. The solution, at the end of this period, instead of revealing copper sulphate and acid, showed that acidity was absolutely *nil* —another theory exploded. Since the copper mineral in this slimed material resists oxidation, while chalcocite, Cu_2S, is known to oxidize easily, it seems probable that the copper does not occur as Cu_2S but in some mineral such as argentiferous tetrahedrite, for instance.

CONCLUSIONS

1. Copper, though in very small quantities in the ore, may be a detriment to cyanidation.

2. Sulphur, though but a small amount of sulphide be present, may form an appreciable amount of thiocyanates.

3. In order to find how much cyanide has been consumed by copper, it does not suffice to make analysis for copper, but the composition of the copper salt must be known. This ratio may be anything between 3.6 to 1 and 2 to 1.

4. For a given amount of copper entering the solution, it is more desirable, from the standpoint of cyanide consumption, for it to occur as a sulphide than as an oxide.

5. The 30-minute agitation test in lime water does not accurately indicate the acidity of an ore, since the indicated acidity depends upon length of period of treatment and state of comminution of the sample.

6. More data should be collected on the subject of chemical losses. This must largely emanate from the ore-testing laboratory for the simple reason that a chemical loss of much magnitude prohibits treatment on a commercial scale. If interest should be aroused in this subject, it would be but a short time until there would be enough published data to be of aid in devising schemes to overcome chemical losses, thus making many ores available to cyanidation which cannot be so treated at present. The average client is generally reluctant to pay for purely scientific investigation, but the cyanide chemist who will not make a few tests purely for the fun of it, has failed to see the best that is in his profession.

[2] *Eng. & Min. Jour.*, Nov. 11, 1911, p. 928.

[3] *Mining and Scientific Press*, Nov. 18, 1911, p. 649.

Lead Prices and Production

Under date of August 3, L. Vogelstein & Co. report conditions as below: Except once a year when Government statistics are issued, it is impossible to get a line on the position of this metal, and unless the market itself gives evidence of what is going on, it can only be surmised. There are available, however, statistics of the consumption of other metals (all for six months to June 30, except tin, which is for seven months to July 31):

	1912 (tons).	1911 (tons).	Increase. Tons.	%
Pig iron	14,072,274	11,666,996	2,405,278	17
Spelter	159,046	134,902	24,144	18
Copper	197,000	168,500	28,500	17
Tin	29,400	26,000	3,400	16

From previous experience it is safe to assume that the uniformly increased consumption shown by these figures may be taken for granted also in the case of lead. Previous experience, however, does not warrant the belief that there is or can be so large an increase in production, the entire increase, five years 1907 to 1911 inclusive, amounting to exactly 10%, or 2% per year. On this hypothesis that the consumption of lead is increasing faster than the production, we are constrained to hold a favorable opinion of the metal, especially in view of the large advances which have taken place in other metals while lead is still selling at relatively low prices.

Foreign lead has advanced to £19, equivalent to 4⅛c. in American currency. The duty on lead in ore is 1½c. per pound. The domestic market must therefore rise to at least 5⅝c. to be on a parity with the foreign market. European correspondents state that the situation there is entirely sound, and they expect a maintenance of present prices and possibly higher. Hence if a reduction of the tariff here were imminent (which it is not), it would be no menace to present prices of pig lead in this country.

Business in lead has been adversely affected the last year or two by high prices for linseed oil. This difficulty will shortly be remedied if present favorable prospects of the flax crop are realized—in fact, is now being remedied. Lumber which a few years ago cost $10 per M now costs $30 per M, and the importance of protecting it has increased accordingly. The prosperity of the farming regions should not be underestimated in this connection. Work hitherto deferred, together with new work, will mean little short of a boom for the lead industry. Advance indications that this period is approaching are already in evidence. Corroding plants are crowded with orders, and other lines, large consumers of lead, such as the electrical industry and the building trades, are fully occupied. It is our opinion that were figures available, they would show a larger increase in the consumption of lead than of any of the other metals referred to above.

THE price of antimony was so low in 1911 that there was little encouragement for American miners to produce the ore unless it contained other valuable metals. The production of secondary antimony as antimony in the United States was 10 short tons; and 2359 tons was recovered in alloys. The output was valued at $359,040. In 1910 the recovery was 9 and 2770 tons, respectively, valued at $444,600.

The Nevada-Douglas Mines

By Thomas T. Read

The plural number is here used with intention, since the Nevada-Douglas Copper Co., at its properties on the west side of Singatse range, Lyon county, Nevada, is carrying on mining operations for the extraction of both copper ore and gypsum. In addition the copper ore is being mined from two sets of workings, the Ludwig and the Douglas, differing 700 ft. in elevation, which though not differing greatly genetically, yet present many features of contrast that make necessary the employment of diverse methods. As a proper preface to their description it should be said

MAP OF WESTERN NEVADA, SHOWING SITUATION OF NEVADA-DOUGLAS MINES.

that the copper deposits of the Yerington district, in which these mines occur, are replacements in limestone, of which beds of considerable thickness occur in association with masses and dikes of grano-diorite and dikes of porphyry. The orebodies clearly have been produced by igneous emanations and the characteristic garnet zones have been well developed, sometimes at considerable distances from the intrusive. F. L. Ransome has briefly described* these ore deposits, but since the period of his visit (1908) a large amount of development work had been done and it is to be regretted that no more detailed study, by an equally competent geologist, has been made of this district, which is one of great scientific as well as economic interest. My own visit to the Nevada-Douglas properties was limited to one day, and my data are therefore chiefly based upon 'information and belief'. The broader features of the deposits are, however, discernable by even a brief inspection and I shall therefore attempt to set them forth.

The Douglas orebody is exposed over a surface area of about 20 acres, crowning a hill that rises 800 ft. or more above the level of the railroad track at Ludwig. The exposures of ore on the surface extend away to the southwest, reaching the railroad at the Casting Copper workings, and also extend a considerable distance to the south. The outcrop is characteristic of the district. The limestone is profusely stained with chrysocolla and malachite and when excavations are made to shallow depths at these points stringers of chalcocite and bornite, admixed with chrysocolla and malachite are found, and sometimes are of such size that by sorting, considerable quantities of rich ore can be taken out. A cross-section of the hill would show a thin leached crust with a thin band of enrichment below it, underlain by orebodies of unknown extent in depth. Mining in this district in the period from 1870 to 1910 was largely restricted to the search for and extraction of such small bodies of rich ore, which would bear the cost of shipment to distant smelters. This zone of rich sulphides is shallow, and is quickly succeeded by a zone in which the primary sulphides have been altered but not enriched, at least to any marked extent. In other words, though chalcocite is present the copper content of the ore is not markedly higher than where chalcopyrite alone is present, the alteration consisting in removal of the iron rather than by additions of copper. The importance of this feature is at once evident. Though the grade of ore near the surface is rather low there is no reason to expect that it will rapidly decline with increase in depth. Beyond a few shallow winzes the Douglas orebody has not been explored beyond a depth of 100 ft. so that it is as yet impossible to confirm this belief by underground study, but the evidence of the winzes, while not conclusive, tends to confirm it. At the level of the railroad track an adit is being driven under the hill, following the garnet zone, and another adit is being driven 150 ft. below the present workings, so that evidence as to persistence in depth will soon be available.

The evidence disclosed in a few openings in this orebody is not conclusive because of the irregular nature of the deposit. It may be briefly and fairly accurately described by saying that the mineralized area resembles that culinary product known as 'marble cake'. The normal dip to the limestone is 50 to 60° southeast, but varies locally because of the disturbance by intrusion and by faulting. The portions of the limestone which were naturally more open textured and porous, or which have been rendered so, have been permeated by the mineralizing solutions and contain ore, while the denser portions of the limestone are remarkably fresh and unaltered. In a recent report made to the company, E. P. Jennings estimates that, in the area of about four acres which has been quite thoroughly explored to a depth of 100 ft. by adits and raises, about one-third the total volume is workable ore, averaging 4.7% copper. If the limit of profit could be reduced to 2% a much larger proportion of the ore would be minable and if profitable methods of handling so low-grade material can be devised it is quite possible that very large orebodies may be developed.

As already pointed out, the orebody shows great variation from point to point, and for a thorough study of it a large number of samples should be examined. For this I had neither time nor opportunity, but a fairly typical specimen of almost unoxidized material, taken from the main adit, proved, when studied in thin section, to be an aggregate of grains of garnet in which the sulphides, chalcopyrite, and pyrite, serve as the cementing material. The sulphides are everywhere bordered by a bluish black alteration product that could not be identified with certainty. In more altered material from the same level this change had progressed until the original sulphides only existed as a central core or as scattered islets in the black mass. Here some of the dark material was evidently chalcocite and bornite, but much of it could not be identified, and it is at least doubtful whether more than a part of it consists of

*Bull. 380, U. S. Geol. Survey.

such rich copper sulphides, as its abundance would in that case indicate a copper content much higher than is shown by analysis. This appearance might perhaps be presented by a small quantity of copper sulphides disseminated through limonite. The light-colored minerals have also decomposed, giving the sand specimen somewhat the appearance of a kaolinized syenite. C. P. Berkey, in a report made to the company, has suggested that this altered material is possibly saussurite, but with the thick sections and antiquated microscope which were the only available materials for study, I was unable to do more than perceive the more obvious characteristics. The chrysocolla and malachite that are so much in evidence in the hand specimen of surface material almost disappear in the thin section, which shows chiefly garnet, light colored silicates, probably epidote and saussurite, and a colorless mineral which appeared to be quartz. The ores evidently present such diverse characters that generalization from a few specimens is impossible, and it is to be hoped that a thorough study may be undertaken in the near future.

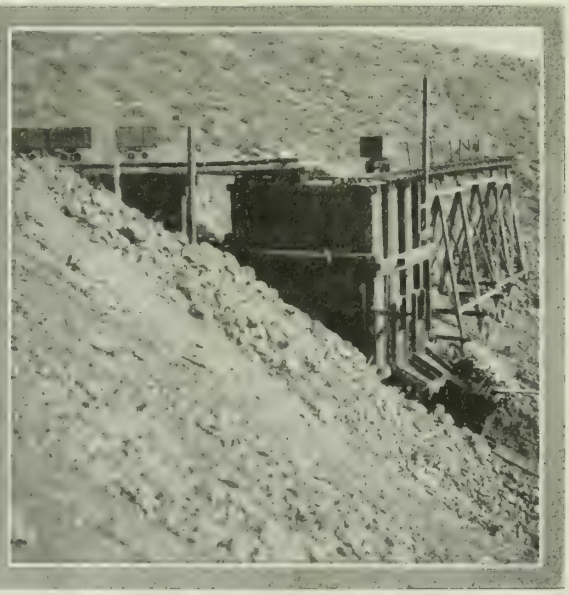
The Ludwig mine is a short distance to the northwest of the Douglas and 700 ft. below it. The orebody is of great interest, both because it represents the nearest approach to an ordinary vein to be found in the district, and because there is much difference of opinion as to its character. Mr. Ransome, in the paper already cited, says: "The Ludwig deposit differs from those on the east side of the range in the fact that it fills a fissure." Mr. Jennings, in a report to the company, describes it as a contact deposit lying between the limestone and the underlying metamorphic rocks. The impression obtained in the few hours I was able to spend underground was that the ore occurred in crush-zones within the limestone. At one place on the seventh level the orebody has been cross-cut for 90 ft. without finding any hanging wall, though at this point the grade of the ore decreases to 1 or 2% copper and shows less oxidation as the distance on the hanging wall side increases.

The former owners of this mine had developed it to the 400-ft. level and had stoped out the richer portions of the deposit. Stoping is now in progress over the entire width of the orebody in these old workings, the average grade of the ore mined being about 5%. At the south end of the sixth level, faulting has occurred and the orebody appears to be totally leached, while on the seventh level development work now in progress indicates that the top of a zone of enrichment has been reached, sulphide ores assaying as high as 7 to 12% copper being present. More water is found at this point than elsewhere in the mine, but the total amount is small, though the seventh level is below the ground-water level. The management estimates that 180,000 tons of ore, averaging 5.4% copper, is available at this point. The ore available throughout the remainder of the mine is given as 290,000 tons, containing 5.4% copper. It may be said generally that the orebodies in the Ludwig are thoroughly oxidized to the 400-ft. level, and are largely oxidized to the 600-ft. level, and even below. The depth to which oxidation here extends is doubtless due to the fact that a fair amount of water is present in the Ludwig, while the Douglas orebody is dry, the surface waters having penetrated to a depth of only a few feet.

A short distance west of the orebody a large deposit of gypsum occurs and has been quarried to a depth of about 50 ft. A cross-cut from the shaft on the 400-ft. level cuts this deposit, but on penetrating it for a short distance the gypsum changes to anhydrite. This deposit has been described in some detail by A. F. Rogers,[1] whose conclusions have been criticized by J. C. Jones.[2] According to Rogers the bed was deposited as anhydrite, and later converted to gypsum by hydration. Jones believes the gypsum to have been deposited in the form of a bed, later converted into anhydrite by the igneous intrusions, and finally again converted to gypsum by surface waters. The latter conception is perhaps the more probable one. This deposit must be counted as one of the Nevada-Douglas mines, since the gypsum is now being mined in an open-cut and shipped at the rate of 75 tons per day. Shipments are made to the Western Gypsum Co., of Reno, which prepares and markets the gypsum. Since the raw gypsum contains about 24% water of crystallization, the calcination plant will eventually be moved to the mine, no doubt, to avoid payment of freight upon the water content.

There are many mines which present geological features of great interest, but certainly few which present so great a diversity of mineral deposits, both in character and kind. The great scientific as well as undoubted economic interest of the deposits of the Nevada-Douglas mines would seem to justify more elaborate study than they have yet received.

LUDWIG SHAFT.



DOUGLAS ADIT.

COPPER production increased in Utah from 127,597,072 lb. in 1910 to 146,960,827 lb. in 1911, an increase of 19,363,755 lb., according to the U. S. Geological Survey. The Bingham district produced 129,995,865 lb. of copper in 1911, against 113,725,280 lb. in 1910, 92,560,340 in 1909, 71,155,740 lb. in 1908, and 45,431,964 lb. in 1907. The Tintic district yielded 10,922,154 lb. in 1911, against 8,993,036 lb. in 1910, an increase of 1,929,118 lb. The Park City district, in Summit and Wasatch counties, produced 1,281,190 lb. in 1911, against 1,423,629 lb. in 1910.

[1] *Economic Geology*, Vol. VII, p. 185.
[2] *Economic Geology*, Vol. VII, p. 400.

Saving Time in the Laboratory

By Harold French

Motion study is not as a rule applied to the men who labor in the laboratories. As long as their results are satisfactory and their determinations are accurately performed, they are generally left to their own resources and devices. In most laboratories work often piles up, especially during a rush season, and it is then that the man with a system wins out. All experienced technical men have increased their efficiency in many ways, but the beginner will profit most, who learns to eliminate unnecessary motions in the manipulation of his apparatus. To develop system is essential.

Many an assayer is blamed unjustly for not accomplishing more work in a given space of time, when, as a matter of fact, the fault may largely lie with the designer of his workshop. Either it was constructed in the first place on too extensive a scale, or the quarters are cramped. If the management can be induced to make necessary changes, the assayer may save himself future unpleasant occurrences by convincing his employer that there will be real economy in the long run by remodeling the plant. A pipe from a distant boiler may convey steam to heat water for washing apparatus and otherwise facilitate operations. Also, the steam may be partly condensed to supply necessary distilled water for analytical work. Simple fixtures may be installed at low cost; for example, pine or oak lockers for storing equipment and keeping it clean. The tops of such furnishings may serve a double purpose as tables. Shelves should always be placed as near as possible to the centre of operations where reagents may be kept in ready reach of the worker.

The placing of assay furnaces in an adjoining room is always desirable in order to keep the laboratory where wet work is being done as free as possible from dirt, obnoxious fumes, and heat, and prevent the ever possible contamination or unintentional salting of an assay with metallic particles. However, the room where fusions are performed may be situated at too remote a distance, and the taking of even a thousand needless steps each day may consume a quarter of an hour of valuable time. Therefore, it is a good plan to have a pane or two of glass in the door or wall adjacent, so that the operator may watch his work in two rooms at once. Wherever gas is available, it is preferable to other fuel for muffle fusions and cupellations, while crude oil is far more economical and convenient than coke in heating crucible furnaces. While gasoline is satisfactory in firing smaller furnaces, petroleum or its heavier distillates are much less expensive. In many assay-offices the heat of the furnaces may be utilized to warm water for washing purposes or distilling water for laboratory purposes whenever more extensive facilities are not available.

There is probably no line of work where parsimony in the purchase of necessary supplies is more wasteful than in laboratory practice. Cheap apparatus is often the most costly, when unsatisfactory results are the sequence of securing flimsy porcelain or glassware, inferior crucibles, or impure reagents. If a laboratory is deemed a necessary adjunct to a metallurgical plant or a mine, the assayer has a right to insist upon being supplied with essential equipment and having it purchased from a reliable dealer in technical goods. There is no more niggardly retrenchment than the restriction of an assayer or chemist to a small hand mortar and pestle for the preparation of his samples, and yet there are many men today who are compelled to putter away in this old-fashioned manner, wasting an hour or more of their time each day at about the least skilled labor they can perform. This is not an argument against necessary manual work in a laboratory, but it is based on personal observation of offices where the assayers were tediously pounding away hour after hour at a small hand mortar while their work was piling up. All the while the preparation of samples could have been performed in less than one-tenth the time by an electrically-driven crusher and pulverizer. All business-like laboratories are fully equipped with such up-to-date labor-saving devices, but there are still many places where even the purchase of a bucking-plate and muller would enable the assayer to accomplish much more work in a day. It would hardly seem necessary to emphasize the fact that an assayer should have every facility to enable him to crush a sufficiently large sample of ore and pulverize it fine enough to obtain a fair average of its metallic contents, and yet there is many a timorous technical man who fears to offend his official auditors by asking for a labor-saving device, because he believes that his employer will think he is getting lazy. As long as he is making a racket with his ear-racking mortar, he thinks his active life will be longer. Not that this is the psychology of scientific workers, but, unfortunately, in some establishments the spirit of penury affects the efficiency of operatives.

Hardly too much can be said about keeping a laboratory clean. In designing a building for this purpose it is well to place the windows so that dust may not be driven in by prevailing winds, while the fumes of smelter or other furnaces should be excluded as much as possible. Scales should always be kept in an inner room with a tight-fitting swinging door. Leather or rubber strips should be placed on the tops, sides, and bottoms of doors, so as to keep out objectionable currents of air. A tight-fitting case should cover each set of scales when not actually in use. The time necessary for removing the case just before weighing is more than compensated by the less frequent cleaning of the scales. A cement floor may be kept clean most readily, and wherever careful work is being done, slabs of slate or soapstone may be laid to good advantage. In some places silicate of soda may be spread as an acid-proof glaze over cement, if the friction upon the floor is not too heavy. Considerable economy in the use of reagents may be effected by keeping them in convenient bottles of uniform strength. Where a few drops of an acid or an alkaline solution or an indicator are required in wet work, the use of a small dropping-bottle will prove very handy. For a number of years I have had several such bottles within arm's reach. They contained from 50 to 100 cubic centimetres, and had curved spouts tapering to a tiny jet. They frequently enabled me to obtain a required reaction with what the late and beloved Professor Rising used to term "the merest fraction of a drop." These little dropping-bottles would not only pay for themselves in a short time in the economy of time alone, but they would avoid the occasional excessive use of reagents.

Nothing is more important than keeping track of samples from their receipt to their final accounting. All samples should be carefully kept in paper bags classified as far as possible according to their character or the place from which they came. Small labels may be affixed to beakers and other apparatus wherever there is any possibility of confusion. This is sometimes necessary when two or more workers are using the same apparatus and interfering with each other. Cupel trays are most useful in enforcing the habit of placing cupels in a regular and unmistakable order. It is also helpful to keep a ruled slate beside the muffle and trace the progress of scorifiers or cupels by checking the same with chalk. Occasional errors or accidents which happen in laboratory work may be greatly minimized by the adoption of such safeguards until the beginner develops a systematic procedure all his own, which in time becomes so habitual that his subconscious self can be depended upon to perform certain practices with unerring results. Under the pressure of a plethora of work, this second nature must be depended upon to keep in constant mind a large number of determinations or assays at the same time. Therefore, a memory trained by systematic methods will enable the chemist to keep track of each piece of work according to its stage of development.

Test-tubes with bottoms enabling them to stand in a vertical position are far more convenient than the old familiar form, except when it is necessary to heat them over a flame. Therefore, it is desirable to have both kinds of tubes. There is also a new style of reagent bottle which is equipped with a cover that when laid down holds the stopper tilted upward at an angle so as to prevent its coming in contact with contaminating substances. It also greatly facilitates the keeping of the laboratory work-tables more clean and less stained. Volumetric methods are usually preferred to fire assays or gravimetric determinations, whenever practicable, on account of their greater rapidity. And yet there are many who still stick to the more tedious and cumbersome processes for reasons best known to themselves and not to their employers.

I have found the microscope a useful adjunct to laboratory work in connection with a metallurgical plant. Frequently there would be brought samples of materials for assaying, regarding which it was only necessary to know whether they contained enough precious metal to warrant reduction in a furnace or treatment with acids. Placing a comminuted sample on a slide under the lens, it was possible to see at a glance whether the material contained precious metal. As a result of these preliminary examinations with the microscope the unnecessary performance of hundreds of assays was obviated each year, and the chemist was free to do more important work. Occasionally, in the assaying of bullion, it happens that small particles of ferric oxide from the iron molds become mechanically mixed with the silver-gold button. Nitric acid does not attack the oxide, and after the final washing of the residual gold it remains with the metal as an impurity. It happened that certain assay returns were suspiciously high, and in doing some umpire work I placed the finely-divided gold under a microscope and was able to show that particles of ferric oxide had been weighed with the gold. Subsequent treatment with a few drops of hydrochloric acid, after annealing the imperfectly parted residue, removed the ferric oxide, and accurate and concordant returns were obtained. Whenever in doubt about the homogeneity of such particles, it is a good plan to use the microscope. A good instrument will pay for itself many times over in the saving of labor and materials, which on certain kinds of analytical work will prove to be unnecessary.

Standard Consolidated Mine at Bodie

*The property was examined with reference to the following points: the advisability of unwatering the Standard, or the Lent shafts, and continuing development at or below the 1200-ft. level; the desirability of acquiring the mines of the Southern Consolidated M. Co.; and the present condition of the mines and property of the Standard Consolidated M. Company.

In the Bodie ground the Fortuna vein is the mother lode of that portion of the district, and this vein was developed down to the 1200-ft. level. The lower levels are now completely under water which stands at 740 ft. from the collar of the Standard shaft, equal to 251 ft. in the Lent shaft. Examination of the 700-ft. level of the Standard shaft shows that many of the veins which were present in the upper workings have pinched out, and only the Fortuna vein has been productive. Below this level former development was unproductive. When the Lent shaft was in operation some twenty-five years ago, about 800,000 gal. of water was handled per day. In order to unwater and prospect this shaft at greater depth it would be necessary to provide heavy pumping equipment, a large hoist, buildings, and to retimber the shaft, as all buildings and equipment have been removed. In the Standard shaft, maps and records show that all levels below 700 ft. were also unprofitable, and in many cases veinless.

The workings of the Southern Consolidated Mining Co. and the assay-plans made by W. H. Landers in 1908 were examined. The Red Cloud shaft is said to be 800 ft. deep. At present water stands at about 490 ft. from the collar. The Noonday shaft is in poor condition, but can be reached on the 500-ft. level by a cross-cut 2400 ft. long from the 450-ft. level of the Red Cloud. The veins of these mines show a decided falling off in the value of the contents at a depth of 400 to 500 ft. from the surface. Based on the sampling and assaying done by Mr. Landers, there is not sufficient pay-ore in sight to warrant the payment of any serious cash consideration for the property, but it would be to the interest of both companies to mine the ore and treat it in the mill and cyanide plant of the Standard Consolidated on some royalty basis.

At present the claims of the Standard company cover a territory approximately 4000 ft. square. It holds a network of veins, a few of them over 2 ft. wide, but most of them narrower, often 6 to 10 in. wide. These veins become impoverished at 400 to 500-ft. vertical depth. The wide veins were exhausted years ago. Only the narrow seams are left, and many of these are unprofitable, and the others scattered over a wide area connected by long cross-cuts which made their development and mining very costly. Former managers have reported from year to year that the orebodies were practically exhausted, and that no reserves could be maintained. By acquiring adjoining claims and by mining remnants of orebodies in the upper levels, the mine and mill have been kept in operation. The annual reports issued by the company have shown a decreasing tonnage, and an increasing cost for development, and they also show that the value of the ore treated at the present time is much lower than in former years. In the year ended February 28, 1912, an unusual amount of development resulted in a production of about one-half the tonnage produced in earlier years, and the ore was mined at an actual loss, as shown by the following figures from the annual report, based on 8798 tons of ore mined, milled, and cyanided:

	Per ton.	Total.
Mining, including development	$12.67	$111,510.50
Milling	2.02	17,780.19
Cyaniding from mine, 8798 tons, and 15,917 tons of tailing slime	2.63	65,046.35
Administration and general expense	1.16	28,608.04
Total cost	$18.48	$222,945.08

Against this cost the average value of the ore was $14.74 per ton, and from this $6.07 per ton was saved by amalgamation and $7.19 by cyanide treatment, giving a total yield from the ore of $13.26 per ton, as against a cost of $18.48. The resulting loss was offset by the yield from the 15,917 tons of tailing slime cyanide, which amounted to $7.46 per ton. The total output from the mill and cyanide plant was $235,476.81, giving a profit for the year's operation of $12,531.73. The amount of tailing remaining to be treated is estimated at 12,000 tons, and three-quarters of this amount will be exhausted by the close of the present season in November. The grade of ore treated at present is even lower than in the preceding year, and with the decreasing stock of tailing, the slight profit shown from last year's operations will soon be changed into a loss. The present ore reserves amount to only a few hundred tons, and while small orebodies may be discovered in the future, it is advisable to change the working of the mine into a leasing system as soon as possible. The company work should be reduced to a minimum. The Nevada claim on the crest of Standard hill is under option and should be purchased and explored from the 200-ft. level of the Standard shaft. The company has undeveloped water-power rights, and a timber tract of 480 acres which should prove valuable.

*Abstract of report made by Thomas H. Leggett and Fred Hellmann to the Standard Consolidated Mining Co. on July 18, 1912.

Assessment of Mining Properties

By C. E. Jarvis

*I have divided mining property into four classes, namely, mining locations, patented quartz claims undeveloped, valuable patent claims temporarily closed, and producing quartz mines.

Mining locations, with no improvement, are not assessable. Such is my opinion under the present revenue laws. If the person who has a location is willing to pay a tax on a small valuation, I accept it. The improvements on a location, I always assess. In both instances, I collect it as a personal tax, as the improvements will hold; but when I make an assessment on a mining location without improvements, and the owner or claimant thereof refuses to pay the tax, claiming that he does the lawful assessment work of $100 per year in development, there is no certain procedure. The assessor may seize the property, advertise it for sale, and sell it accordingly to the highest bidder. But the purchaser cannot be given a good, clear title, for the owner has none from the Government. To remedy this defect, I advise that legislation should be enacted that would place a small valuation upon a location, say $100. If the owner refuses to pay the tax, he will forfeit all right to his location, and some other locator will have a chance to locate and develop the claim. It is well known that the proper assessment work is not always done, especially so when some locators have many claims, which remain in their possession for many years undeveloped. Under the present law I do not think the location privileges without tax add in the least to the development of the mining industry. The man with a good claim rarely refuses to pay a just tax.

All patented quartz claims situated on the Mother Lode or main lode, I value for assessment purposes at $500, while on claims on spur lodes I place a value of $250.

In the case of valuable patent claims temporarily closed, I find it sometimes difficult to place a valuation; the conditions in each case require study. The improvements and machinery on this class of property are next to valueless; no great amount can be placed upon the equipment; the value lies in the claim. Some of the properties have a bright past, and there is no apparent reason for discontinuing operations, unless it is due to fire or juggling of the stock. On investigation I often find the owners refuse a large purchase price, and if it be so I gradually increase the assessment each year, which not only stimulates the sale of the mine, but often makes the owners commence active operations. When this has been done, I immediately reduce the assessment to that on a developing property, and thus I try to encourage making each a paying mine.

In one instance I have a claim assessed for $100,000 which is not operating and has no improvements; but it has a prosperous past, some $17,000,000 having been extracted. Deep mining in Amador county demonstrates the value of this property, and I have raised the assessment from $50,000 to $100,000 in the last five years.

With regard to producing quartz mines, after some study I have adopted the following method, which in most instances has raised valuations, although it has not always been satisfactory to the mine-owners. I ask the mine superintendent for a statement of the operating expenses and the gold output of the mine from March 1 back to March 1 of the preceding year. This statement is not always rendered, and if not, I must make an arbitrary assessment. If the statement received shows no net earnings, I assess all the improvements at 50% of their cost, while upon the claim I place a value that I think will encourage further development.

If the mine is earning a net profit, I assess all the improvements at 50% of their cost. The quartz mill on the property I assess at $500 per stamp. For example, an 80-stamp mill would be assessed $40,000. If the mine shows a net earning of $100,000, I simply multiply it by 125%, which makes a value of $125,000 upon the claim alone. Adding to this the improvements, hoists, mill, and unspecified property, I have the full value of the property for county assessment purposes. I claim this is a just way of assessing the producing property; it is only assessed on what it has produced the year before; it is not speculative, and no fictitious stock value enters into the appraisement. The only question likely to be raised is whether the factor used is correct. I shall be glad to argue that point if anyone challenges it. I think the method is fair and just to all concerned. It could also be used with success upon copper, coal, and other mining properties. For dredging, I think the factor should be much larger, for as a rule this class of mining destroys much valuable land that, if not upturned, would produce untold future revenue.

I think it will not come amiss at this time to voice my sentiments upon the franchise tax of mines, in favor of the mining counties in which the mines are situated. I believe they should pay a small annual license tax to the state only. The franchise tax on production, I am convinced, should go to the counties in which the mines are situated, for there is being exhausted a local resource year by year, and when it is exhausted the tax finally falls excessively upon the other class of taxpayers.

The mines are nearly always in a rough country. In all of these mountain counties the land values are small, the communities will never be as prosperous as in the more favored counties where land values are high, and as a consequence mining counties have a high tax rate. Many acres are in forest reserves and therefore not taxable. Under present laws a mine pays about 7½% of its gross receipts in taxes, if it meets all the requirements, such as local taxes, the federal corporation income tax, license tax, state franchise tax, accident insurance, and employers' liability insurance, besides furnishing physician and hospital privileges, for accidents are numerous. This makes a large burden for a speculative property to bear.

In conclusion, I am a strong advocate of a bullion tax on mines, and I trust some state legislation will be enacted to that end. This paper is a written expression of my own personal views, which have been formed by actual experience in the Assessor's office in the county of Amador, whose chief resource is quartz mining. The Kennedy, the deepest gold mine in the United States, with a vertical shaft of 3550 ft., is in this county. Amador county has produced since 1849 over $100,000,000 in gold. At the present time, after 60 years of continuous operations, it leads all mining counties in the state of California in the production of gold from quartz mining. The pioneer miner thus justly christened the main lode in the state the 'Mother Lode.'

*Abstract of a paper read before the County Assessors Association of California.

Mineral Production of Japan

In the report of the Department of Agriculture and Commerce of July 20 is given the quantities of the principal mineral products of Japan for the first five months of 1912. An increase of 6.8% in the gold production is shown, as compared with the same period of 1911, 11.1% in silver, 8.5% in copper, 12.9% in coal, and 8% in sulphur. There were decreases of 6.1% in iron and 6.4% in petroleum. The output for May, and the total since the beginning of the year, is given below, the figures having been recalculated and reduced to Western measures:

	May.	Year to date.
Gold, ounces	1,035	55,500
Silver, ounces	402,310	1,921,700
Copper, pounds	9,459,250	49,199,380
Iron, long tons	49,200	231,400
Coal, long tons	1,456,377	7,038,077
Petroleum, gallons	6,756,080	22,165,760
Sulphur, long tons	3,850	16,000

Shaft-Sinking Reversed

The Nowata Lead & Zinc Co., operating on the Baker estate at Duenweg in the Joplin district of Missouri, has started the raising of another shaft, a big saving in costs and time having resulted from the raising of the first shaft excavated in this manner. The work is described in the local papers as below.

H. Correll, manager for the company, undertook the work, after having received bids for the sinking of the shaft by contract. The lowest contract bid received was $15.50 per foot for a shaft 5 by 7 ft. in the clear, put down to a depth of 210 ft. This would have meant an expenditure of $3255. The raising was purely an experiment, this being the first instance of the kind in the Missouri-Kansas-Oklahoma district where a shaft has been driven from the bottom up instead of from the top down. Although many unforeseen difficulties arose which can be remedied in subsequent operations of a similar nature, the aggregate cost of the shaft was only $1237.58, or $6.06 per foot.

A 6-in. drill-hole was at the point where the company desired to sink a new shaft. Mr. Correll used the hole as a medium through which a ⅝-in. cable could be passed, to support a working platform at the lower end. At the top, near the drill-hole opening, was stationed a hoist, which was operated so little of the time that an expenditure of 50c. per day for natural gas for fuel defrayed the cost. As this was a minimum flat rate, it was in excess of what would have been charged had only the gas really used been paid for. The drill-hole extended into a drift; the distance from the surface to the roof of the drift where the drill-hole broke through being 210 ft. The cable passed over a pulley in a derrick and thence to the hoist.

At the lower end the cable was attached to a specially constructed platform, built of heavy 2 by 4-in. and 4 by 4-in. oak lumber, the size of the platform being 4 ft. 8 in. by 6 ft. 8 in., thus leaving 2 in. in the clear all around when the platform was hoisted into the shaft. The aggregate weight of the platform, operators, and equipment was 800 lb., divided as follows: stoping drill, 110 lb.; steel, 50 lb.; two operators, 300 lb.; platform, 340 pounds.

Starting the shaft in the roof of the drift was much the same as starting in solid ground at the surface. The 5 by 7-ft. space was marked out, with the drill-hole as its centre, and the work of shooting down the rock was started. A hook permitted the cable to be detached from the platform; thus when shots were fired the platform was lowered to the floor of the drift and pulled to a point of safety to be out of the way of falling rock, while the detached cable was hoisted out in order that it might not be damaged by the blast.

From the time the first round of shots was placed in the roof of the drift until the shaft was completed, cribbing included, 52 eight-hour shifts were required. This was about a third of the time usually required for sinking a shaft of similar dimensions. In raising the shaft, 14 holes were driven to a depth of 5 ft. in the rock. Six of these corresponded to the ordinary sump holes used in sinking a shaft from the top down, while 8 corresponded to the cut holes, 4 of these being driven near the corner and 4 along the edges, midway between the corner holes. Each hole was loaded with four sticks of dynamite, a total of 56 sticks for one charge. Forty per cent dynamite was used. During the work on the first 100 ft., the shots were fired from below, the electrical shot-firer being stationed in the drift. During the remainder of the work the shots were fired from the surface. A signal cord down the drill-hole enabled the operators to signal to the hoistman.

The 18 ft. of surface soil was shot down at a single blast, the drill-hole being plugged at the bottom and loaded with dynamite. The result of the blast was an opening more than large enough to accommodate an ordinary mine-tub, and in this tub workmen were lowered and the edges blasted out and trimmed. It was this final step that Mr. Correll considers his one big mistake. He believes matters could have been expedited by first sinking the shaft from the surface down to the hard limestone, then beginning the raise. As it was, an enormous mass of clay and gumbo was shot into the drifts when the surface was blasted down, and this became a sticky mass following a heavy rain. It was almost impossible to remove it, and as a result, much valuable time was lost.

This method, when available, has many advantages over the usual methods. The question of drainage is solved. Ordinarily in shaft-sinking, the necessity of removing the pumps before each blast, or the necessity of at least covering them with heavy timbers, is of the greatest importance. Repairs are constantly being made in the pumps as the result of damage from the shots. Water is invariably rising in the sump, and the workmen have an unsanitary place in which to toil. As virtually all of the larger mines of the district frequently use from one to half a dozen extra shafts, exclusive of the mill shaft, and as the underground workings usually connect in this district, the method is widely applicable.

The cost, $1273.58, includes the fuel, wages, powder, and timbering; every feature, in fact, of the work; it even includes the purchase price of the stoping drill, $135. It does not include the cost of sinking the 6-in. drill-hole, which was already down. If it had been necessary to sink such a hole, the added cost would have been 80c. per foot, including the casing, meaning a total of $168 to be added to the figures already given.

At all times the ventilation was good, as the fumes quickly lifted through the drill-hole. In this respect the method is even better than the methods of raising employed in many Western mines where cribbing is built to hold the working platforms. In such cases the air may become foul at the highest point of operation.

Power at the Alaska Treadwell Mine

The Westinghouse-Parsons steam-turbine plant is now in operation at the mine on Douglas island, Alaska. The hydro-electric power-plant is at the mouth of Sheep creek on the mainland. It consists of two 1900-hp. single overhung Pelton water wheels, direct-connected to two 1000-kw., 3-phase, 60-cycle, 2300-volt General Electric generators. This pressure is stepped up to 22,000 volts, transmitted nine miles to Treadwell, and distributed at 2300 volts. Another plant is being constructed at Nugget creek, 14 miles from Treadwell, and also on the mainland.

For the purpose of hoisting and distributing all the ore from the Alaska Treadwell, Mexican, and 700-Ft. Claim mines, it has been decided to construct a central hoisting and crushing plant. The main shaft of the 700-Ft. Claim will be enlarged and deepened, and the plant so constructed as to utilize this shaft for hoisting from the above mines. A steel head-frame and crusher house will be erected, the latter to contain two No. 12 Gates crushers. The broken ore from these will pass through two 14 by 5-ft. diameter revolving screens, the oversize going to four No. 6 Gates crushers, while the undersize and the crusher product will be delivered to concrete storage-bins by belt-conveyors. The whole crushing plant will be built on concrete foundations, separate from the head-frame. Electric locomotives will distribute the ore to the different mills. Electric power will be used everywhere except at the main hoist. This engine is capable of hoisting 5000 tons of ore in 20 hr. from a depth of 3500 ft. All the above-mentioned work is well under way.

ZINC production of Nevada was 3,548,032 lb., valued at $202,238, in 1911, against 2,707,071 lb., valued at $146,182, in 1910, according to the U. S. Geological Survey. This was almost equally divided between a lead-zinc ore and a true zinc ore. Concentrate contained 210,257 lb. and crude ore 3,337,775 pounds.

Handling Gravel in Siberia

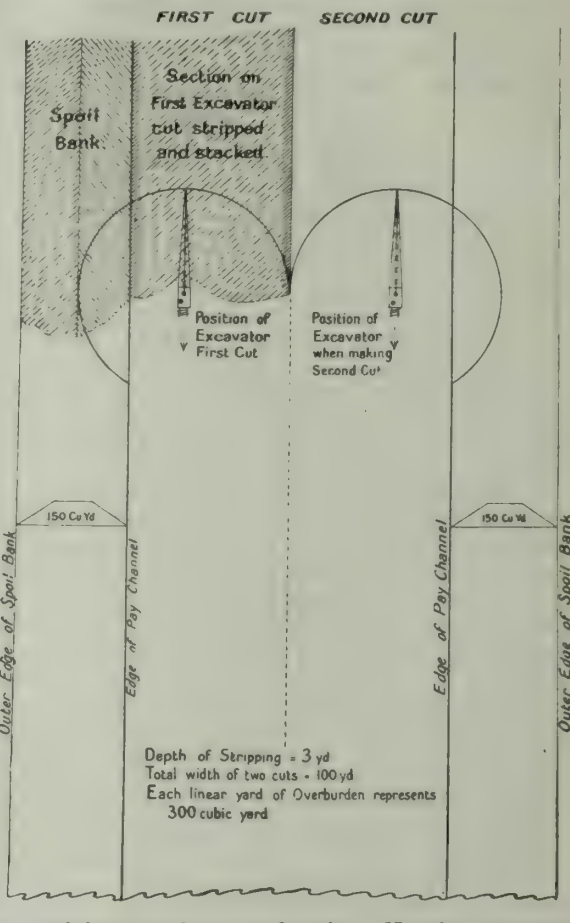
By C. W. Purington

*In discussion of Mr. Leon Perret's† recent contribution to the literature of methods of handling gold and platinum gravels, I propose to offer a few suggestions based on my own experience. Mr. Perret lays great stress on the operation of stripping overburden, and on the economy achieved by the simple methods of effecting this operation by means of horses and carts, taken in conjunction with hand shoveling. Now I had the good fortune to witness this same operation on the river Iss, some 30 miles below the scene of Mr. Perret's operations, and under conditions, I may say, practically the same, in the summer of the year 1898, some 14 years ago. I am entirely willing to accept Mr. Perret's figures as to the cost of this work; his statement that the cost of such work is from 14 to 28 kopeks per cu. yd. is believed to be correct. In order to arrive at something a little more definite, I will take the average of these figures and say it is 21 kopeks per cu. yd. Even taking the lowest figure, 14 kopeks, it will be seen later that this cost can be lowered by mechanical means. Mr. Perret states as a maximum amount of stripping which he has to deal with in one season, and presumably on one creek, a quantity of 400,000 cu. yd., bank measurement. This amount piled up on the bank would make, say, 500,000 cu. yd. measurement. From Mr. Perret's accompanying statements it is evident that this volume represents the stripping from two operations, and that a volume of from 250,000 to 300,000 cu. yd. will represent the average amount of stripping from each excavation during one season. In other words, each excavation will represent an area 1000 yd. long, by 100 yd. wide, by from 2 to 3 yd. deep, underneath which lies the pay-gravel. It is not easy to know just the dimensions of the cuts which Mr. Perret has to deal with, but I am assuming the hardest conditions for mechanical stripping. If the overburden is twice as deep and half as wide, the conditions for mechanical stripping become easier. Now assume, as I believe to be correct, that the mass of overburden is in section 1 yd. of peat, underlain by from 1 to 2 yd. of sticky clay, and that the mass is to all intents and purposes a dry one, the water having been led off by drain ditches.

From my experience in the use of the drag-line excavator in East Siberia, on the very property which Mr. Perret refers to as the Ohottsky Co. (Okhotsk Gold Mining Co.), I am prepared to maintain that an excavator of the correct description and proportions will greatly reduce Mr. Perret's cost in stripping overburden from the platinum-bearing gravel of the Shouvaloff property.

Before I proceed any further I should like to say a word concerning the indiscriminate use of the word *excavator*, as applied to machines which have been taken into Siberia for placer mining work. Those mentioned by Mr. Perret are, as I happen to know, in every case too small and of a design unfitted for the work for which they are intended. A steam-shovel of good design is fitted for a certain type of mining work, as in handling ore which has been previously broken by shooting, for example, in the porphyry copper mines of Utah, or at Rio Tinto, Spain. It is not fitted, except in very unusual cases, for placer work or any part of the operations connected with placer work. I do not know of any successful placer mine in the world today which uses one. They were formerly used at Cape Nome to a limited extent, but, so far as I know, their use has been entirely given up. The difficulty is exactly what Mr. Perret points out: the system of using tracks and cars for disposing of the material excavated is impracticable for handling material at the low cost required, and it has not sufficient mobility for placer work. The Okhotsk company had two steam-shovels, one of which I must assume is the one referred to by Mr. Perret, when I examined the property in 1907, and they were without exception the poorest steam-shovels I have ever seen. As they stood they appeared to be of no use for any conceivable purpose. They were dismantled, and one of the engines with boiler was afterward used to run an electric light plant and the other to operate a derrick. Now, if the steam-shovel is of no use on a Siberian placer mine, what form of excavator is of use?

By reference to the following description of a machine used on the Kolchan (Okhotsk) property a general idea of the drag-line type of excavator may be obtained. This one has a 60-ft. boom and is used for the purpose of mining tailing to recover the gold content, and not for stripping. For stripping in the case here assumed, the next size larger machine is recommended, with 100-ft. boom. This machine is operated by one engineer and one fireman, assisted by


FIRST CUT
SECOND CUT
Spoil Bank
Section on First Excavator cut stripped and stacked
Position of Excavator First Cut
Position of Excavator when making Second Cut
150 Cu Yd
150 Cu Yd
Outer Edge of Spoil Bank
Edge of Pay Channel
Edge of Pay Channel
Outer Edge of Spoil Bank
Depth of Stripping = 3 yd
Total width of two cuts = 100 yd
Each linear yard of Overburden represents
300 cubic yard

two track-layers and one wood-packer. No other permanent men are needed about the machine, but one or two extra men are from time to time needed in making water connections for boiler supply, for making repairs, etc. The machine digs material from a depth of from 0 to 30 ft. below the track, in a radius of 100 ft. from the centre of the rail circle, and stacks the material dug at any desired point within the same radius, and to a height of 20 ft. above the track. It will handle 2000 cu. yd. of average Siberian overburden in 24 hours, or, say, an average of 50,000 cu. yd. per month, allowing for stops to lay track, shift the position of the machine, make water connections, etc. The excavator is of the rail-circle type, the lower carrying frame being itself mounted on trucks, which run on 90-lb. rails. The hoisting cable runs over a head sheave at the outer end of the structural steel 100-ft. boom, and connects with the rigid bale of the bucket of 2 cu. yd. capacity. The pulling cable, winding on the second drum of the double-drum hoisting engine, is attached to the chain-bale of the bucket and also connected with a short compensating cable, which passes over a small sheave and is attached at the other end to the frontal hood of the bucket. By means of the ingenious arrangement the operator can suspend or balance

*Bull. Inst. Min. & Metallurgy.

†'Gold and Platinum Alluvial Deposits in Russia,' read before the Inst. Min. & Met. See *Mining and Scientific Press*, June 22, 1912.

the bucket in any position. In addition to the throttle, the operator has only two small levers to attend to, which, through the medium of a Westinghouse air control, actuate the two engines, while the brakes are operated by pedals. The bucket is dropped to the ground or into the cut, then dragged toward the machine, filling as it drags. It is generally equipped with manganese steel teeth. After filling, it is hoisted, and the excavator, by means of either rope or geared swing, actuated by the small swinging engine, is swung through an arc until the full bucket is over the desired position in the spoil-bank, when the load of 1½ or 2 cu. yd. is dumped by letting up on the drag or pulling line.

One man handles the hoisting and swinging engines and controls the entire operation. Russian operators have been trained to run these machines, and to handle as much dirt on a shift as trained imported operators. A fireman who also acts as oiler is the only other man allowed on the machine. Two track-layers are necessary, who work intermittently. The machine works backward, and when ready for a move, after working out one section of the cut, the track-layers are called on to remove the track couplings. The machine lifts a section of track in front and deposits it in position in the rear. When the track is connected the operator digs the teeth of the bucket into the ground behind and pulls the excavator 10 to 15 ft. back. The total operation of changing track and moving consumes only five to seven minutes. The machine is now ready for a new cut. It must be remembered that the bucket can be successfully dumped only in a position vertically below the head sheave, although a certain amount of leeway is allowed by giving it a swing outward. Its range of attack in the cut itself is greater, as the bucket can be swung out 15 to 20 ft. from the vertical, after the manner of casting with a fish-line. It can also dig at any point inside the vertical up to 20 ft. away from the front of the machine. The drag-line excavator is, in fact, the most mobile of all types of mechanical excavators, and the ingenious contrivance of the compensating cable on the bucket is primarily the secret of its efficiency and adaptability. It was a development of the experience of two Chicago contractors, Messrs. Page and Schnabel.

As to actual trials of the efficiency and cost of a machine of this type, I beg to call attention to my account in the *Mining and Scientific Press*, February 4 and 11, 1911, 'Sluicing at the Kolchan Mines, East Siberia.' In this paper the operation of one of the 60-ft. boom machines in mining tailing is fully described. To summarize briefly: the results obtained with this machine from August 12 to October 10, 1910, inclusive, the machine ran for 597 hours, being held up the rest of the time on account of the lack of sluicing water. Had it been engaged in stripping, there is no reason why it could not have been run 22 hours per day. The amount of gravel handled was 35,000 cu. yd., an average of 60 cu. yd. per working hour, and digging to an average depth below the track of 27 ft. and frequently running only one-half capacity, so as not to over-tax the capacity of the sluice into which the gravel was dumped. The working cost of excavating was under 20 kopeks (11c.) per cu. yd. on the small yardage implied, which cost would have been cut at least 25% had the machine not been handicapped by lack of sluicing water.

From the experience of this excavator, and from work of the same type of machine in building a levee along the Mississippi river, where costs do not ordinarily exceed 5c. per cubic yard, there can be no question that for stripping overburden from comparatively narrow pay-channels they will compete with hand labor at any price and under all but most exceptional conditions. Not only in Siberia will their use become extended, but in view of the present interest in the tin alluvials of Northern Nigeria, they should be considered as regards their application to that country.

Judging from the cost of the Kolchan installation on the property of the Orsk Goldfields, Ltd. (above referred to), and the cost of operating the plant, the following is a conservative estimate of what the cost would be for a 100-ft. boom machine used on stripping work in the Urals:

First cost at Chicago, 100-ft. boom drag-line excavator with necessary spares	£4000
Freight to Ural (100 tons)	1000
Duty	2000
Erection	1000
Total first cost	£8000

Operating Cost

	Rs.	Rs.
Day shift—		
1 foreign chief operator (first year)	20	
1 fireman at 2 rubles	2	
3 men at 2 rubles each	6	
		28
Night shift—		
1 operator at 6 rubles	6	
1 fireman at 2 rubles	2	
3 men at 2 rubles each	6	
		14
Extra labor		8
Total labor per day		50
For 200 days		10,000
Fuel, 10 cords woods per day, at 2 rubles for 200 days		4,000
Supplies: oil, wire cable, bolts, track repairs, carbide, waste, etc		1,000
Annual depreciation and repairs, and allowance for overhead charges		12,000
Total annual operating cost		27,000

On the basis of handling 300,000 cu. yd. per season, which is the duty required of it in the case assumed, the cost will be less than 10 kopeks per cubic yard. It is, of course, assumed that several years' work for the excavator are in sight, otherwise its installation would not be warranted.

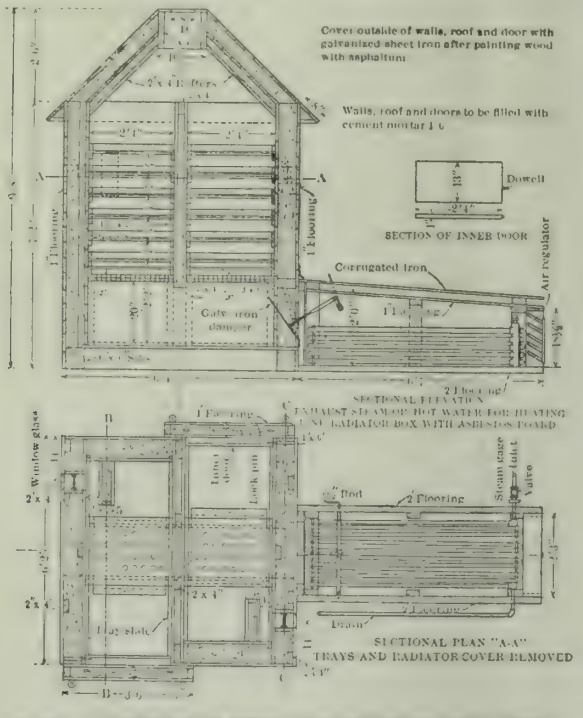
That these excavators are strongly made and good for several seasons in Siberia is proved by the case of the one at Kolchan, which is now being used for the third season. Their uses are manifold, and include road-making, a very important function in Siberia. The excavator can also be used as a derrick and a pile-driver. In the case above I have assumed that stripping on the Shouvaloff estate is advisable, the pay-gravel being handled by washing plants of the Russian type. I am not at all sure that this style of washing is advisable on Ural placers, but do not propose to take issue with Mr. Perret on the subject at this time. I would call attention, however, to the floating washing plant which is now being used on the Pokrovsky mine of the Kolchan property, in connection with which the drag-line excavator is being used. The marked success which this plant had last season, handling material which may best be described as a clay bank with a small admixture of stones, suggests that many Siberian argillaceous gravels which have hitherto been handled by the *chasha* and the well known hand methods, may be amenable to treatment by some form of floating plant equipped with log washer, screens, tables, and tailing stacker.

Lead production in Idaho in 1911 was 272,556,525 lb., valued at $12,265,044, against 228,258,839 lb., valued at $10,043,389, in 1910, an increase of over 40,000,000 lb., and was greater than the record production of 1905, according to the U. S. Geological Survey. Crude ore shipped to smelters contained 68,978,613 lb., and concentrate, largely from Shoshone county, 203,577,912 lb. The production of Blaine county decreased 579,421 lb., while Lemhi county showed an increase of 10,328,448 lb. and Shoshone county 35,078,967 lb. The Yreka district, with a yield of 118,725,981 lb., had the largest production in Shoshone county and in the state. The lead output of the Lelande district was 84,084,662 lb., and that of the Hunter district was 45,879,504 pounds.

Magazines and Thaw-Houses For Explosives.

A report upon the above subject (Technical Paper No. 18) has just been issued by the U. S. Bureau of Mines. The authors, Clarence Hall and S. P. Howell, present the advanced practice abroad and in the United States on the use of material for the construction of magazines and thaw-houses, and strongly recommend the use of a lean cement mortar consisting of 6 parts of sand and 1 part of cement as the material to be used in the walls, roof, and doors of these buildings in order that the explosives within them may be properly protected, also in order that life and adjacent property may not be jeopardized when magazines and thaw-houses are constructed the proper distances from other buildings.

In order that the explosives in magazines may be protected, they must be guarded against bullets, fire, lightning, and unlawful entry. Different fireproof materials were experimented with to determine their resistance to the



PLAN AND SECTION OF BUREAU OF MINES CEMENT-MORTAR THAW-HOUSE.

penetration of rifle bullets. Sand offered some advantages, but was rejected because it would eventually flow out on the floor of the magazine through the cracks in the walls and could not be depended upon to remain in the structure permanently; moreover, gritty materials of any kind are objectionable on the floor of a magazine. Mineral wool overcame this objection, but had little value as a medium for resisting the penetration of rifle bullets. Therefore, in order to overcome the objectionable features of sand, portland cement was mixed with it in order to form a lean cement mortar and thus cause the sand to be retained within the walls of the magazine and still be friable enough to crumble readily under a blow. Tests to determine these two features were so satisfactory that a magazine having this cement mortar as a filling was constructed by the Bureau of Mines at a cost of $400 and having a capacity of 20,000 to 30,000 pounds. A working drawing showing the dimensions and necessary sections are included in the publication. The means provided for ventilation in the magazine of the Bureau of Mines has been found to be adequate, and conditions are favorable for the storage of explosives in respect to their keeping qualities.

The cement mortar construction is effective in resisting the penetration of rifle bullets, and owing to its friable nature offers an additional advantage for the reason that, in the event of an explosion in or near the magazine, the large masses of material would not be projected over the surrounding country. The galvanized-iron covering is fire-resisting and at the same time it serves as an excellent medium for protection against lightning when the four corners of the building are properly grounded with metal rods.

The method of selecting a magazine site is emphasized and suggestions made. The permissible distance which must obtain between magazines and other structures in England, Prussia, Austria, Italy, Massachusetts, and also the proposed American table of distances, are contained in a table. The proper method of thawing explosives in either small or large quantities, and a suitable method of transporting them to the place where they are to be used is described in this paper. A temperature not exceeding 90°F. is recommended in thawing explosives. In all cases explosives must be protected against moisture and high temperatures, and for this reason thawing explosives by placing them before a fire or near a boiler or on steam-pipes or by putting them in hot water is condemned.

Panama Canal Tolls

By Courtenay De Kalb

Our Government has faced a crisis and has not flinched. The sentiment of the American people has been expressed by its representatives in Congress assembled, and Europe now perceives that we are not to be driven by diplomatic threats to abandon our natural advantage from the posession of a trans-Isthmian water-way, as we were once before cowed into servilely repealing the law which granted a rebate of 10% from the duties applying on goods imported in American bottoms. After this we may hope for a maratime policy conceived in the old-time American spirit, calculated to give us a merchant marine that shall extend our markets for manufactures throughout the world. Nothing else that we can do can so surely maintain healthy economic conditions and a high wage-scale; nothing else can so surely allay political discontent as the augmented prosperity which this will bring. It is a wholly different matter to attempt to market the products of our labor through the resident agents of foreign ship-owners and to market them through our agents in foreign parts representing home-owned ships. As our shipping is now conducted the foreigner exploits us; by a change of flag we would exploit the foreigner—wherein lies both a distinction and a difference. The refusal of the Senate to strike out the provision from the Panama Canal bill conceding free toll to ships flying the stars and stripes comes with a refreshing sound like a new declaration of independence.

Gold production in 1911 in Nevada, according to the U. S. Geological Survey, was valued at $18,193,397, a decrease of $685,467. There were increases in gold in several districts, including Manhattan, but large decreases in National and Goldfield. Of the gold output, 10,181.05 fine ounces came from placers largely in the Round Mountain and Manhattan districts, in Nye county, 847,124.81 oz. from silicious ores, 21,847.27 oz. from coper ores, 895.66 oz. from lead ores, and small amounts from zinc, copper-lead, and lead-zinc ores. Silicious ores yielded over 96% of the entire gold production. From bullion in gold and silver mills was recovered 729,252.33 fine ounces, concentrate produced 81,097.61 fine ounces, and crude ore shipped to smelters contained 59,569.92 fine ounces. The leading county in production of gold was Esmeralda, which yielded $11,198,602, mostly from the Goldfield district. Nye county produced $3,617,276, of which the Tonopah mines yielded $2,366,495. The Comstock mines of Storey county produced $977,349 in gold, against $502,843 in 1910. More than half of the total value of the state's output of precious metals is that of gold.

Granby Mines

*The Hidden Creek mines, owned and operated by the Granby Consolidated M. & S. Co., are situated in the eastern foothills of the Burniston range of mountains, which rise to an elevation of 5710 ft., and at this point separate Portland canal from Observatory inlet. The name of the bay has just been officially changed from Goose to Granby bay.

The rock formation in which the orebodies occur may be best described as an argillaceous schist; it has been subject to considerable alteration, and in some places the fissile structure of the argillaceous bands has disappeared and the rock appears to be massive. The orebodies are cut by intrusive dikes, but these have no influence on the nature of the ore, nor on its commercial value.

The ore consists for the most part of massive iron pyrite, with some pyrrhotite, chalcopyrite, and a little bornite, carrying small quantities of gold and silver. In some portions of the orebodies both iron and copper pyrite occur in a quartz gangue, while lime and a little alumina can be found associated with the ore at most points. The amount of gold and silver varies with the copper content of the ore; with 2% copper these together equal about $1 per ton, and increase in about the same proportion as the copper content advances.

Two main orebodies have been proved on the property; both appear to dip to the west, or toward the main range of mountains. Sufficient exploration has not yet been done to definitely determine the extent or nature of these deposits. At present the eastern orebody, known as No. 1, looks as if it would prove to be a large lens; it has been proved for a length of over 700 ft. in a north and south direction, and its width, with both the northern and southern ends of the workings still in ore, is not less than 180 ft. The No. 2 or western orebody appears to be in the form of a chimney, roughly 500 ft. diam., but, like No. 1, its limits have not been definitely determined.

A considerable amount of open-cut work has been done on the surface of both orebodies, at an elevation of from 600 to 900 ft. above sea-level, and several short adits have been driven. This work definitely proved the existence of large bodies of ore, but was of little value for economic mining or in determining the value of the ore; it was therefore decided to drive a working adit into the hill, at an elevation of 530 ft. above sea-level, to cut both deposits.

Diamond-drills have been extensively used in prospecting, and where the drill-holes have afterward been intersected by underground workings, the assay values have corresponded as nearly as could be expected with the results obtained from the drill-holes.

At present it is not possible to give complete and exact estimates to the ore in sight in the mine and its value, but it may be safely stated that there is available for extraction above the 530-ft. level not less than 4,500,000 tons of ore, containing 1.8% copper and a combined value of $1 in gold and silver. The management also states that it has sufficient 4 to 5% ore in sight that could be sent to customs smelter, to more than repay the expenditure on the property, in the event of a smelter not being erected. No ore has been shipped by the present company.

Sufficient water-power for all purposes is available for the greater part of the year, but an auxiliary steam-plant will be required during the winter months, for the creeks, being glacial, run low for several months in winter. Sufficient timber for mining purposes can be obtained in the neighborhood, but, being all spruce and hemlock, it makes poor fuel, and coal will be probably used for the steam-plant.

*From a report by D. G. Forbes in the Annual Report of the Minister of Mines for British Columbia, 1911.

Metal Production in New Mexico

The value of the mine output of gold, silver, copper, lead, and zinc in New Mexico in 1911, according to Charles W. Henderson, of the U. S. Geological Survey, was $2,704,843, as against $2,691,080 in 1910, an increase for 1911 of $13,763. The production of gold showed an increase of $280,384 in value, and the output of silver one of $262,153 in value. The output of copper showed a decrease of $78,897 in value, lead $56,637, and zinc $393,240 in value. Details are given in the table below.

MINE PRODUCTION OF GOLD, SILVER, COPPER, LEAD, AND ZINC IN NEW MEXICO IN 1911, BY COUNTIES

(By Charles W. Henderson, U. S. Geological Survey.)

County.	Ore treated.	Gold.[a]	Silver.[a]	Copper.	Lead.	Zinc.	Total value.
	Short tons.		*Fine ounces.*	*Pounds.*	*Pounds.*	*Pounds.*	
Colfax	2,306	$41,407	1,254	5,587	.....	.....	$42,770
Dona Ana	5	.....	111	353	1,561	.....	173
Grant	93,770	116,284	221,882	3,918,928	694,247	306,895	772,481
Lincoln	1,578	31,934	184	555	6,620	.....	32,399
Luna	229	104	1,278	1,814	98,888	.....	5,458
Otero	1,096	6,718	715	22,730	739	.....	9,971
Sandoval	10	.....	46	5,734	.....	.....	741
Santa Fe	120	3,684	2,632	16,644	11,178	.....	7,663
Sierra	5,036	27,785	16,487	5,374	28,088	.....	38,459
Socorro	128,549	534,253	1,109,945	79,321	2,124,901	9,930,281	1,794,086
Unapportioned	.....	639	6	.....	.....	.....	642
Total	232,699	762,808	1,354,540	4,057,040	2,966,222	10,237,176	2,704,843

[a] Includes placer production.

Socorro county, chiefly from the silicious ore mines at Mogollon, yielded $534,253 in gold, or 70% of the total state yield. There were also increased gold yields in Colfax, Grant, Luna, and Sierra counties, chiefly from silicious and copper ores. Placer gold amounted to $18,714, as against $26,094 in 1910. Of the silver yield, Socorro county, chiefly from the Mogollon district, produced 1,109,945 fine ounces, or 82% of the state yield. Grant county, chiefly from silicious, copper, and lead ores, furnished 221,882 oz.; these two counties combined yielded 98% of the total silver produced.

The copper output of the state came almost entirely from Grant county, chiefly from Santa Rita, Hanover, and Lordsburg, the county yield being 3,918,928 lb., or 97% of the total yield. The output from Grant county was 485,466 lb. less than in 1910. Other decreases were in Otero and Socorro counties. Copper has always been an important metal in New Mexico, the recorded output from 1845 to 1911 having been 96,380,203 lb. For 1912 and for many years to come, copper will no doubt surpass in value the present total output of New Mexico, through the operations of the Chino Copper C., at Santa Rita, which was treating 3000 tons per day of 2.24% copper ore early in 1912, and will have its 5000-ton mill completed during 1912.

Of the lead production, the Magdalena district, Socorro county, produced the greater part, with an output of 2,123,039 lb.; Grant county yielded 694,247 lb. Concentrate contained 1,562,768 lb. of lead, and crude ore sent to smelters, 1,403,454 pounds.

Special Correspondence

NEW YORK

MARKET CONTINUES LISTLESS.—CALUMET & ARIZONA ACQUIRES PROPERTY IN GLOBE.—DIVIDENDS OF COBALT MINES.

The report of the Copper Producers' Association, published this week, found a market so deadly dull as to be far beyond giving any attention to the small increase shown in accumulated stocks of metals. The tickers in New York's financial districts are ordinarily the ganglia of the stock market's nervous system; but the market is nerveless now; the whir of the ticker falls on empty space. The apathy that prevails includes all lines of business. Bond brokers report that there is 'nothing doing.' Dealers in outside securities can neither buy nor sell. In mining shares such activity as exists is the result of campaigns carried on for the purpose of distribution; that is to say, it is altogether a sellers' market. Copper metal has been at a standstill for ten days, with the price quoted at 17¾c. per lb. Copper shares have been equally without incident. Copper stocks increased in July from 44,335,004 lb. to 50,280,421 lb., an increase of practically 6,000,000 lb. Total consumption for the month was 131,215,712 lb., so that the copper surplus, as of record, may now be considered a negligible quantity, equivalent to but little more than a ten-days supply. The fortnightly reports covering copper statistics in England and on the Continent show an increase in the visible supply on July 31, as compared with June 30, of a little more than 7,500,000 lb. The bear raid made in June is said to have killed the speculative activity in London. Comparisons showing the situation month by month are hardly adequate, but when it is noted that the domestic surplus has decreased 87,500,000 lb. since one year ago, and the foreign visible supply shrunk more than 51,000,000 lb., the outward betterment of the copper metal situation is made plain. However, it is worthy of especial note that the July production of copper of 137,161,129 lb. is the largest recorded since the organization of the Producers' Association. No market movement covering a term of years ever demonstrated more plainly the contrary attitude of the outside public. Three and a half years ago, when the copper surplus was piling up, and some large undertakings, since assured of success, were being planned, the general public was enthusiastically following copper shares. Later talk was heard of a gigantic copper merger, said to have progressed so far as to have had its stock certificates all printed, and the public was expectantly watching for developments. Today the copper merger is an intangible fact; the surplus is gone, production is well in hand, the metal market as high as it can be put without curtailing consumption, and the public looks on and twirls its thumbs. Utah Copper shows a quarterly production of more than 28,000,000 lb. turned out at an average cost of 8.12c. per pound, and net earnings of $2,622,699; more than $6 per share, against its present dividend rate of $3. If one adds the earnings of the Bingham & Garfield railway, and the company's interest in the total earnings of Nevada Consolidated, the quarter shows net revenue of better than three million dollars. It is true Utah returns about 5% per annum on its present market price, but it is not disbursing half of its earnings. The point is not so much the price level of Utah Copper as the attitude of public indifference toward a property proved to be so tremendous and full of possibilities for years to come. The newer properties, such as Miami, Ray, and Chino, are ignored to a like degree, though they represent all in all better combinations of possibilities, safety, and long life than the mining industry has ever before been able to offer in this country.

The Alpha Copper Co., of New Jersey, is once more to change hands; this time by reason of foreclosure proceedings brought in New Jersey by the Bankers Trust Co. of New York. The Calumet & Arizona Mining Co. is following a movement that is general just now in buying additional properties. The purchase of the Cobre-Verde marks the advent of the Calumet & Arizona in the Globe, Arizona, field. The new purchase was made for $500,000, and at the same time it is stated that in addition to the 81 claims so purchased, options were taken on several blocks of mineral ground, and the Calumet & Arizona will probably be an important factor in the Globe district from this time on.

The Butte & Superior market has shown a considerable decline, and from its present position would appear to be on an investment basis. The entire mill is completed, and will have a capacity of 1500 tons per day. It will not be operated as a whole, however, until a new hoisting engine is placed. It is stated now that the controversy between the Clark interests and Butte & Superior is not to be considered as a serious matter. It is expected that within a short time Hayden, Stone & Co. will be making a public offering of the shares in the new organization, which has taken up some ground around the Butte & Superior property. A special meeting of the stockholders of the El Paso Consolidated G. M. Co. is called for September 10, 1912, to authorize increase of par value of the shares from $1 to $5 per share, thereby reducing the outstanding number of shares from 2,500,000 to 500,000.

Some of the Cobalt properties are continuing to make splendid showings. Kerr Lake is paying a 5% dividend and with this paid, will have returned to the shareholders nearly 140% on the capitalization of the company. The Kerr Lake property is pretty well out of high-grade ore, but will probably continue as a dividend payer for some time to come. The Timiskaming & Hudson Bay has a dividend record that stands unchallenged, in that it has returned to its stockholders 21,100% on its $7761 issued capital. This year it has paid five dividends each of 300%. The small group of local people who own the Timiskaming & Hudson Bay have been made independent by the development of this concern. The King Edward, at one time one of the favorites of the market operators in Cobalt shares, is to hold a special meeting August 1 at Portland, Maine, to act on a proposal to lease the Watts property and equipment on a royalty basis. The Watts mine is the principal property controlled by the King Edward. The latter was one of the biggest of the market disappointments in the Cobalt list.

LONDON

A NEW YUKON DREDGING COMPANY.—SIBERIAN GOLD COMPANIES.—RESTORATION OF PLANT OF TROITSK GOLDFIELDS.

The shares of the Granville Mining Co. have this week been placed on the London Stock Exchange. The company was formed in August 1911 to acquire a large number of gold gravel properties on the Indian river and its tributaries, from 15 to 25 miles southeast of Dawson, Yukon Territory. It takes its name from the settlement of Granville, situated at the junction of Dominion and Gold Run creeks. The promoters were A. N. C. Treadgold, H. C. Hoover, and A. Chester Beatty. The share capital amounts to £1,400,000 which was paid as purchase price, and there are £90,000 debentures. Of the latter, £440,000 have been recently issued, and of the funds thus raised, £300,000 is being devoted to the financing of the Canadian Klondike Co., usually known as Boyle's Concession. In return, the Granville company receives $1,500,000 debentures of the Canadian Klondike Co., together with 29% of its share capital. The Granville has the option for three years to convert the debentures into 20% of the share capital of the Canadian Klondike, and it is announced that this option will be exercised. With the money thus provided by the Granville company, the Canadian Klondike will build two more powerful dredges with

16-cu. ft. buckets. The policy pursued by the capitalists interested in Klondike during the past few years has been to consolidate the properties on a large scale and to work the gravels continuously, instead of picking the best streaks, as was the only method possible for the small man. The first consolidation was the Yukon Gold Co., which owns large tracts on Bonanza and Hunker creeks. The Canadian Klondike Co. owns the property chiefly along the Klondike valley in the near vicinity of Dawson. For some years a single dredge with 7-cu. ft. buckets was used, and at the end of 1910 a large dredge with 16-cu. ft. buckets was built. The profit during 1911 was £45,000. It is estimated that the property contains 100,000,000 cu. yd. of proved gravel averaging 10d. per yard, and that the cost should not be more than 2½d. per yard. There is also a similar amount of gravel not fully prospected, of which one-half is taken as profitable. The Granville company owns property estimated to contain 600,000,000 cu. yd., of which one-half averages 15d. per yard. The company also owns a hydro-electric power station of 10,000 hp., operated by a subsidiary company, and a highly profitable contract has been made with the

DRAG-LINE EXCAVATOR, ORSK GOLDFIELDS.

Yukon Gold Co. for the supply of power. The most interesting information recently published relates to the method that makes it possible to treat these gravels by dredges. Hitherto much of the gravel has been permanently frozen and resort had to be made to steam thawing and other similar devices. It was found, however, that if the overlying deposit of peat and moss was stripped and the earth laid bare to the summer sun, the gravel would be gradually thawed. The stripping may be done mechanically, or by drainage and burning. The gravel on the higher ground is to be hydraulicked. The Granville company is now preparing its property for treatment, and should be producing gold in 1914; in the meantime it will be receiving a substantial income from its holdings in the Canadian Klondike company.

The progress of mining operations in Siberia continues to take a fair share of the attention of London speculators. This week the ventures of the Siberian Proprietary, namely, the Orsk and Troitsk companies, have been prominently before the public. Unfortunately, neither of these has as yet arrived at prosperity, although they both promise future returns. The Orsk Goldfields was formed in 1906 to acquire gold mines in the province of Orenburg in the southern Ural region, but as these proved valueless, a gold gravel property near Nikolaievsk, on the Okhotsk sea in eastern Siberia, was acquired. A stacker-scow was first erected on the Pokrovsky claim, and subsequently a dredge was ordered from New York. The delivery of the latter was delayed by a collision outside of New York harbor, and it was not finally put into commission until the end of October 1911. Various distinguished American engineers have been in charge, namely, C. W. Purington, D'Arcy Weatherbe, and C. H. Munro. W. H. Lanagan is now the manager. The Pokrovsky plant was in operation from May 14 to October 18 last year, and extracted gold worth £24,155 from 88,654 cu. yd. of gravel. The dredge ran intermittently from October 25 to December 5, extracting gold worth £2830 from 47,089 cu. yd. of gravel. The total yield was therefore £26,985. The operating cost, administration charges, and winter up-keep amounted to £11,835, the royalty paid was £5921, depreciation £3845, expenses in London £3157; these expenses together with small items reduced the profit to £1557. The Pokrovsky plant resumed operations on May 23 of this year and the dredge on May 18. During 1911, 80,000 additional priority shares of £1 each were subscribed, in order to restore the finances of the company to a sound position after the catastrophe to the dredge and the delay in its erection.

As regards the Troitsk Goldfields, after early disasters Hooper, Speak & Co. were asked to undertake the reorganization and rehabilitation of the enterprise. A new treatment plant consisting of Chilean mills and cyanide vats was erected by H. C. Bayldon, the local partner of the firm. The new mill started in August 1909, and it was described by Mr. Bayldon in a paper read before the Institution of Mining and Metallurgy. Unfortunately, operations were suspended by a fire in the main shaft on May 12, 1911. The timbering was entirely burned to a depth of 260 ft., and seriously damaged to 500 ft.; the shaft caved for 30 ft. at the top; the shaft buildings and hoist were destroyed, and the pumps and compressors damaged. The mill was stopped on June 13, after all the available ore on the surface had been treated. The damage has now been made good. The mine has been unwatered to 500 ft. (the depth of the main shaft is 802 ft.); the shaft has been timbered from 100 ft. to 430 ft., and the top 100 ft. lined with reinforced concrete. Development is being actively pushed and it is intended to resume milling in September. During the time the mine and mill were in operation from the beginning of 1911 to the occurrence of the fire, 15,533 short tons of ore was raised, yielding 4277 oz. gold by amalgamation, 767 oz. by cyaniding sand, and 274 oz. by cyaniding concentrate. The slime is at present being impounded, 5319 tons being stored in this way during the period under review; the total amount awaiting treatment is 63,000 tons averaging 2 dwt. The slime-treatment plant is in course of erection. The ore reserve is calculated at 39,850 tons averaging 7.85 dwt. A report by Mr. Bayldon mentions that the stopes have been narrowed and that the breaking of the roof is cleaner. This has slightly raised the mining cost, but it has substantially increased the grade of the ore milled. In order to meet the cost of the fire, and to provide for further extensions, 105,488 priority shares of £1 each were issued in November last. These were subscribed by the parent company, the Siberian Proprietary.

MELBOURNE, AUSTRALIA

A Victorian Scandal. — Mt. Lyell Difficulties. — Queensland's Declining Gold Yield. — Broken Hill's Record.

The mining sensation of the past two months in Victoria has been afforded by the affairs of a mine at Daylesford known as the North Nuggety Ajax. Daylesford is a field of many and erratic veins, the value of the ore being variable and the trend of the orebodies very unreliable. The North Nuggety Ajax, however, has won distinction by the market operations which accompanied the extremely sudden decrease in the gold content of its richest lode. In March last the market value of the shares was about $21.50, and the official reports were of a roseate hue. Then a mysterious decline began, and a warfare commenced between two hostile parties. They were not mere market bulls and bears, anxious to boost the shares so as to be able to sell to advantage, or to bring down prices in order to buy cheaply, but genuine believers and disbelievers in the official assurances that all was looking

well. It was apparent that information from certain mines was diametrically opposed to that put forward by the management of the Ajax, and so many shares changed hands in the market. Obviously, some one was wrong as to the state of affairs at the mine, and ultimately the verdict of the Exchange was that the management was wrong, for the shares dropped to $5. The crash came when it was announced that no dividend would be paid, as some liabilities of the company required settlement. The directors, if they were doing their duty, must have been well aware of the state of the finances, and had authorized the payment of a 75-cent dividend during each of the two preceding months, instead of reducing each of these amounts to 50 cents. The general opinion is that certain of the directors have deluded and deceived the shareholders and the public, in order that they might get out at good prices; but, though their manipulating of the market may be difficult to prove, there is a chance that they may be brought to task on the score of having paid dividends out of capital. The *Australian Mining Standard* has pointed out in a very outspoken article that the payment of dividends out of capital is not only a breach of trust for which directors are quickly and severely liable to make good with interest the amount misappropriated, but also it may render directors liable to criminal prosecution for conspiracy to defraud. It is not altogether unlikely that some such action may be taken in this case, for matters are rapidly coming to a head. The present position is peculiar. When the date was fixed for the half-yearly meeting of shareholders, a time was selected which little suited the Melbourne shareholders. It was hoped that the Melbourne men, who were naturally dissatisfied with the actions of the management, would be unable to put in an appearance. By motoring from Ballarat on Sunday, they, however, managed to be present on Monday morning, and as they held the balance of voting power, the game seemed to be in their hands. The management, however, had a card up its sleeve. Two of the nominations for the directorate were declared informal, the name of the company not having been correctly given. The main body of shareholders would not submit to this ruling, with the result that the meeting split, and two separate lots of directors were elected. The present position is that the management refuses to acknowledge the directors somewhat informally chosen by the majority of the shareholders, and that the latter are now applying for an injunction to force the recognition of these gentlemen, and to restrain those chosen by the rival party from acting in a directorate capacity. The whole affair constitutes the greatest scandal to which Victorian mining has been subjected for many a day.

The Mount Lyell Mining & Railway Co., Tasmania, has never recovered the position it occupied before the strike of its employees in the latter part of last year. The result of smelting operations for the past 12 weeks is a total output of only 1317 tons of copper. At this rate, the production of the company, instead of being in the neighborhood of 8000 tons of copper per year, will be only about 5700 tons. The causes are many, but are not complicated, and two of them stand out with particular clearness. First of all, the grade of the ore is declining, last month's return of 402 tons of copper from 23,000 tons of ore giving a return of only 1¾%. Secondly, there is a great shortage of labor for the mines, and in consequence the output is not up to the requirements of the smelters, so that one of the few which had resumed operations since the strike has had to close down. The falling off in the grade of the ore is being met by various improvements and economies in treatment; but the shortage of labor is a much more serious affair. Of the 720 men at present employed about the mines, no very great percentage can be classed as skilled miners, and the efforts of the company to employ men from outside have not so far been very successful.

The outlook in Queensland is not bright. An attempt is being made to boom a new property, the Mt. Oxide, but there seems little reason for a boom. As for the old fields, they are almost all on the down grade. Two of the great goldfields of the past, Charters Towers and Gympie, are steadily deteriorating, the former's yield from all mines having declined last year to 133,833 fine ounces, and the latter's to 50,954 fine ounces, a drop of nearly 14,000 oz. in the one case, and over 8000 oz. in the other. The Government is seriously considering the advisability of granting substantial subsidies for the encouragement of deep sinking in these districts, so that the deep ground may be more thoroughly and systematically tested than it has been hitherto. As the state's output of gold alone up to the close of last year has amounted to nearly $370,000,000, the Government can well afford to be generous. Last year its income from the mineral industry amounted in rents, royalties, and fees to some $160,000, and its expenditure on the industry to not much over $250,000, so that the net cost of the industry was not great.

The figures just issued for the second quarter of the year constitute a record for the great Broken Hill field of New South Wales. The production for the period amounted to 72,869 tons of silver-lead concentrate, of the value of $3,500,000, 167,801 tons of zinc concentrate worth $1,500,000, and 8169 tons of silver-lead crude valued at $130,000. The net value of the mineral output in the half-year was $10,000,000; this also constitutes a record for the field for any half-year period in its history. The field is, in fact, looking wonderfully healthy at the present time, the only cloud on the horizon being furnished by the suggestion coming from a section of the workers that they should repudiate their four and a half years' agreement with the mine-owners, though not one-fourth of the time has yet run out.

TORONTO, CANADA

Production of Porcupine Mills.—New Plants to Be Ordered.—Activity in Mining in Cobalt District.

The Hollinger recently shipped two 95-lb. gold bars valued at $41,040, the product of a three days run of the refinery. The Vipond also made, about the end of July, its first shipment since the fire of last year. All the Porcupine mills are working steadily, the aggregate amount of ore treated per day being given at about 715 tons. The percentage of extraction obtained at the Dome is stated to be 96, while the Vipond and the McIntyre each obtained 75. The Hollinger milling grade is averaging over 1 oz. per ton, the Dome grade is about ½ oz. per ton, the former milling ore closely representing an average of the mine, apart from the higher-grade sections, and the Dome ore taken as it comes from the present workings. The milling capacity of the Dome is to be increased by coarser crushing. The main shaft is rapidly being put down to the 400-ft. level. The Vipond will enlarge its amalgamating plant by adding four plates for separating the gold, which will give the mill a complement of 10 plates. Its old boilers have been scrapped and new ones placed. The vein has now been tapped on three levels and widens considerably at depth. At the McEneany a vein in a drift on the 300-ft. level shows native gold and has widened from 33 in. on the surface to 6 ft. at depth. The shaft is being put down to 400 ft. The McIntyre has ordered a cyaniding plant, comprising Chilean mills, rolls, and cyaniding tanks, and will increase the capacity of the present plant to 100 tons per day. It is understood that results of development at the Dome Extension have been somewhat disappointing, as the stringers showing in the cross-cut on the 230-ft. level are so small and broken that profitable ore is hardly to be expected. In other workings the gold content is distributed over a wide area and the grade is low. John P. Heffernan, managing director of the Crown Chartered, reports that assays taken in three 5-ft. sections of the vein at the 100-ft. level give an average of $21 per ton. A promising orebody 15 ft. wide in places is being proved on the 200-ft. level. The Foley-O'Brien is to be unwatered for inspection to determine whether operations

will be resumed. The company has $130,000 in the treasury. Labor difficulties have arisen between the management of five Porcupine mines, the Vipond, McIntyre, Jupiter, Plenaurum, and McEneany, and their employees over a new schedule of wages, which was to have gone into operation August 1. The men protested against any reduction, while the companies contended that the present wages paid were fixed when the camp was new and living expenses were higher than at present, and that the proposed schedule was the same as that of the Dome and the Hollinger. The men have appealed to the Department of Labor at Ottawa, which will appoint a board of investigation, and in the meantime the operation of the new schedule has been postponed until September 1. The Lucky Cross mine in Swastika district has made another good find at the 100-ft. level, consisting of a 7-ft. vein which carries free gold and is stated to assay high.

The past few weeks have witnessed a great resumption of activity in Cobalt mining, and the list of mines and prospects supposed to be dead which are taking on a new lease of life is steadily growing. The Foster, formerly a dividend-payer, has been leased to C. B. Flynn, of New York, and Thomas Flynn has been placed in charge. The Silver Bar, lying south and west of Cross Lake, on which little development has been done, has been taken over on a working option by the Preston East Dome of Porcupine, and active operations begun. The Cochrane Cobalt is being unwatered preparatory to a thorough inspection and sampling of the veins. The Nancy Helen has been purchased by the Buffalo and the workings of the latter mine are extended to the Nancy Helen shaft. The Cyril Lake Mining Co. has been organized to operate the Airgold, and the shaft, now down 90 ft., will be put down to 150 ft. Other mines which have been reopened, or are being unwatered for tests, are the John Black, Columbus, Last Chance, Twentieth Century, Waldman, Silver Lake, and King Edward. The Bailey is preparing to ship a carload of high-grade ore to raise funds for further development. Mining is now being done at the 400-ft. level, with the shaft down to 450 ft. in the conglomerate. The Ontario Government has thrown open to prospectors, commencing August 26, 4000 acres of land in the Gillies Limit, lying south of the portion already disposed of. The area has been examined by officials of the Department of Mines, but no discoveries were made, and most of the claims on that portion of the limit which were sold by the Government are lying idle. The Imperial Privy Council has confirmed the decision of the Canadian courts that natural gas is not a mineral. The matter is one of considerable interest to many landholders in western Ontario, who purchased their property from the Canada Land Co., the latter reserving all mines and minerals, and afterward selling the mineral rights to natural gas companies.

BOSTON

AGREEMENT BETWEEN BUTTE & SUPERIOR AND CLARK INTERESTS.—RAID ON LAKE COPPER.—ELECTRIFICATION OF N. Y., N. H. & H. RAILROAD.

Butte apex disagreements have usually proved to be 'irrepressible conflicts.' Hence incipient trouble between W. A. Clark and Butte & Superior was viewed with alarm. It now appears that the two interests, realizing the cost of a legal struggle over extralateral rights, are determined to have the matter threshed out amicably, if possible, and thus avert a struggle in the courts. It is understood in Boston that a new exploratory and development campaign has been worked out carefully and has been agreed to by the parties at interest in order to keep the question from going into the courts. The orebodies in dispute lie in the western portion of the Butte & Superior property, and in no way affect the big zinc orebodies which are being worked now in the eastern part. As a matter of market policy, Butte & Superior could probably well afford to dispossess itself entirely of the mooted territory, rather than engage in one of the characteristic Montana legal controversies with W. A. Clark. Butte & Superior had considerably more than its original capitalization clipped from its market valuation because of the first hint that it would have a legal tangle over apex rights with Mr. Clark. D. C. Jackling ridicules the talk of dispute, and says that both sides have agreed to carry on development extensively and ascertain exactly where the orebodies in controversy begin and end. The Clark people have also gone on record as saying that there will be no occasion for resorting to the law. Either because the lawsuit rumor has run the regular nine-day Marathon or because traders now actually believe the two interests will not engage in a legal fight, Butte & Superior has recovered partly from its recent reaction.

An attempt to raid Lake Copper, which was started by a Stock Exchange house in Boston a few days ago, came quickly to an end. The house which took this initiative had sent one of its members to the Lake country to investigate conditions, and this representative conceived the idea, after going down in the Lake mine, that the stock was selling too high. He returned to Boston and started forthwith a short-selling campaign, giving out the information that the property had been exaggerated and overboomed and that it was not likely to prove more than a mediocre proposition. Prior to this move Lake had been more than usually inactive, selling around 37 to 38. This new selling pressure clipped off nearly five points. As a result, a banking house which is sponsoring Lake quickly formed a league with two rival Stock Exchange houses, and with their combined weight they stopped the raid. The truth about Lake seems to be that it is selling within bounds and will continue to give a fairly good account of itself. The property will scarcely realize the expectations it aroused in 1910, when it sold up to $94 per share. The famous Lake lode has proved to be a good deal of a freak and nobody has a definite idea of its trend. The property is producing about 300 tons per day, of an ore which is above the Lake average in content, and is more than meeting expenses. Lake has sold this year 10 points higher than its present price, and with strong interests behind it, looks like a difficult property to raid anywhere under $45 or $50 per share.

An interesting report has it that the coal mines of the Narragansett basin will be used largely as power stations for a considerable electrification system radiating from Boston and Providence, including the change-over to that basis of the Boston & Providence line of the N. Y., N. H. & H. railroad. The New Haven line is electrified from New York to New Haven and is working very satisfactorily at that end. It is proposed now to electrify the Boston end similarly. It has been learned that Henry M. Whitney has been negotiating with the railroad interests to supply power from the Portsmouth or old Rhode Island coal mines at Narragansett, Rhode Island. Another rumor is that English capitalists are negotiating in a similar enterprise. New England coal finds it hard to overcome native distrust. This coal has been extensively distributed throughout New England, and is said to have given satisfaction, producing great heat when under heavy drafts. But the coal is slaty and graphitic to such an extent that people are slow to believe in its merit. Hence the interests controlling the deposits seem to be turning to utilizing the coal right at the mines themselves and delivering electric power to the railroads and other customers. The project is one which is of great interest to the copper people, as it takes from 4000 to 6000 lb. of copper per mile for single track standard electrification equipment.

The Lewisohn interests seem to be taking more interest in the Lake country than any other section, ever since J. Parke Channing's trip to that district early in 1911 and his examination of the properties for the proposed Calumet & Hecla merger. The latest option taken by the Lewisohns is on the Kukana property, adjoining Elm river on the north and west. They have given orders to acquire 1200 acres in that vicinity

General Mining News

ALASKA

Cordova

The telluride of gold, which was found in a claim near Teikhell, on the Valdez-Fairbanks road, turned out to be mispickel, an arsenical pyrite. Somewhat of a slump has followed this announcement. A rush has started to the Aniak district, where a rich placer deposit is said to have been opened to some extent. This place is difficult to reach, freight being taken by way of the mouth of the Kuskokwim, the plan being to carry it up the Aniak in small gasoline launches.

The Valdez *Daily Prospector* of July 27, in reviewing the mining situation, says: "Although the season has been unusually backward, yet the situation from a mining point of view is most encouraging. We do not refer to the number of 'deals' made, as much as we do the work of actual and miner-like development going on at the present writing. There are a dozen properties in widely scattered localities, within the field immediately tributary to Valdez, where development in progress is carried on with a view to ascertaining the extent and permanence of the orebodies. . . . Our faith in their permanence is unbounded. . . . There is a limit to our financial capacity in developing the immense orebodies lying on all sides of us. . . . With the close of this season, we will be in a position to demonstrate that our orebodies carry depth. As far as work has progressed, without a single exception, properties on the glacier, on Mineral creek, on Shoup bay, Columbia basin, and Port Wells have shown that depth gives us wider and richer veins between well defined walls. . . . We hope by fall to be able to show investors a sufficiently developed country, to justify the expenditure of large sums of money in opening producing mines. . . . Within five years Valdez will be the centre of a great free-milling camp."

The Tacoma claim on Slate creek has been sold for $36,000. This property has produced over $300,000 in placer gold, and still contains a fair area of ground, which will be worked by the hydraulic plant brought to the claim during the spring by one of the late owners. The old tailing will be reworked. The ground yields from 50 to 94c. per yard.

Fairbanks

A large dredge weighing some 700 tons, is to be started on Flat creek, when brought over from Dikeman to Iditarod. A fleet of small vessels is engaged in carrying the dredge in sections to Flat city, but the river is low at present. From Iditarod the parts will be transported overland to Flat city. Miners are doing well on Otter creek this season, and Keystone drills are being used to further test the ground. A 5-stamp mill has been started at the Newsboy Extension. This mill was made at Fairbanks. The owners are driving on the 70-ft. level, which is out 50 ft. from the shaft. It is intended to resume sinking from 130-ft. depth.

Nome

(Special Correspondence.)—The New Era Mining Co. is erecting a 4-stamp Hendy mill in Snow gulch, about seven miles from Nome, to prospect a group of 11 claims. There is a series of small veins on and near a contact of schist and limestone, which averages $10 to $15 per ton. Little work has been done. The veins occur both in the schist and limestone, and their positon does not seem to affect their gold content. The strike of the vein is almost east and west, with a dip of 65° to the south. This company has been financed by business men at Nome.

Nome, July 27.

From 93 tons of placer tin, mined by the Buck Creek Dredging Co. last season, the net result from Liverpool, England, was $48,000. This quantity of tin ore was produced after 35 days' work.

Word from Seattle, Washington, states that the steamer *Victoria* reached that port on August 10, from Nome. She had on board 283 passengers and $543,000 in gold bullion. The heavy passenger list is on account of many miners, who have left the Seward Peninsula and Yukon valley, placer mining being restricted by scarcity of water, following the small snowfall of last winter.

ARIZONA

Cochise County

The Leonard Copper Co. is shipping 120 to 180 cars of ore per month to the Clifton smelter. It is somewhat low in copper content, but is a good fluxing ore. The Minneapolis company has 20 men at work, and is mining at 550 ft. Regular shipments are being sent to the Copper Queen smelter. It has been decided to build a 350-ton mill and cyanide plant at the Common-Wealth property at Pearce.

The production of copper from the Phelps-Dodge mines totaled 12,994,253 lb. in July, against 12,759,184 in June. The Copper Queen mine yielded 6,589,512 lb.; Montezuma, 3,092,016 lb.; and 1,118,635 lb. was recovered from custom ores.

Gila County

(Special Correspondence.)—The production of the Miami Copper Co. for July was a little over 3,000,000 lb. of fine copper, the highest monthly production to date. During the month there was mined 96,403 tons of ore, dry weight, and 4942 ft. of drifts and raises were driven. The third 8-ft. Hardinge pebble-mill has been added to the equipment of the fourth unit of the concentrator, giving a slight increase of capacity. It is believed that monthly production will be maintained close to 3,000,000 lb. of copper. A large proportion of the ore mined comes from square-set mining next to the capping, and from development, the rest from the shrinkage stopes and from the dump at No. 2 shaft. The new machine-shop at No. 4, or main shaft, is finished, and is being equipped. A building to contain the mine and engineering office is nearing completion. A contract has also been let for the steel work of a large new change-house, 57 by 90 ft., two stories high, and designed to accommodate 650 men. Development by diamond-drilling continues on the 570-ft. level, but considerable difficulty is experienced in obtaining a core. The northeastern territory is being prospected by two churn-drills. About 1000 men are employed, of whom 550 are underground.

The contract for railroad construction at the Inspiration Consolidated mines has been let to McArthur Brothers, and work should be started within the next two or three weeks. H. Kenyon Burch has established his office at the Inspiration camp, with a force of draughtsmen and assistant engineers. The chief draughtsman is George H. Booth, who held a similar position with Mr. Burch during the construction of the Miami concentrator. A temporary engineering office building, 30 by 120 ft., is being erected near the millsite. It will be occupied by Mr. Burch and his assistants when completed. The development of the Inspiration mine is proceeding at the rate of 4500 ft. per month. The two main working shafts are being sunk. The first haulage level is being opened at many points, the ore being hoisted through the Joe Bush shaft. Stations and ore-pockets are being cut at the first haulage level in the Scorpion and Colorado shafts, and an incline is being driven from the main tunnel to the surface. After this is finished, a hoist will be erected and the incline will be sunk to the haulage levels, and will be used exclusively for men and timbers. At the Live Oak mine, a pumping station is being cut at the 1160-ft. level in No. 2 shaft, and a steel head-frame is being erected at No. 1 shaft. After this work is finished, the sinking of the latter shaft will be resumed. The Sulphide tunnel is being widened to 7½ ft., and will be equipped with double track for electric haulage. Churn-drill hole No. 2, of the South Live Oak Development Co., has been stopped at a depth of 755 ft. in granite-porphyry, without discovering chalcocite, though silicates and carbonates of copper were found. The drill is being moved to the hill in the schist area, at the northern end of the property adjoining the Needles group, and it is expected

that hole No. 3 will be started within a week. The schist is mineralized, and engineers who have examined the property think it offers a better chance of being ore-bearing than the granite-porphyry area.

The Old Dominion produced 1106 short tons of blister copper in July. Engineers under H. Kenyon Burch are working on the plans for the concentrator. Proposals for steel work and machinery are in, but no contracts have yet been made. Construction will probably be started within two or three months. Concreting of the last section of the Kingdon shaft has been started, and should be finished in about two weeks. The section is 135 ft. deep, and the last three weeks have been spent in stripping this part of the shaft, that is, enlarging it from one to two compartments. The work is being done by Michaelson & Weideman, engineers and contractors. The Copper Hill shaft, at the Arizona Commercial, is being enlarged to three compartments above the fourth level; and there will probably be little other work done underground until the new equipment is erected, which should be within two or three months. The compressor at the Eureka shaft has been moved to the Old Dominion power-house, and a 5-in. pipeline has been laid from the power-house to the Copper Hill shaft. About 25 men are employed.

Globe, August 8.

CALIFORNIA

Los Angeles County

(Special Correspondence.)—Los Angeles members of the American Institute of Mining Engineers have been giving careful consideration to the report of the Committee of Five, appointed to study the condition of the Institute. Philip N. Moore, of St. Louis, a member of the committee on nominations, recently visited Los Angeles, and was invited by Seeley W. Mudd to meet a number of the local members of the Institute on July 15 at luncheon, at the California Club. Besides the host were present J. Morgan Clements, T. B. Comstock, C. Colcock Jones, F. A. Keith, F. J. H. Merrill, P. N. Moore, and W. F. Staunton. The general condition of the Institute was discussed at length, using as a text a preliminary copy of the report of the Committee of Five. On the following day a meeting of local members was held in the office of F. A. Keith, at which were present A. B. Carpenter, E. W. Carson, J. M. Clements, T. B. Comstock, W. M. Cummings, G. G. Damon, C. Colcock Jones, C. R. McCollum, F. J. H. Merrill, S. W. Mudd, P. N. Moore, S. Robinson, A. M. Strong, and W. L. Watts. T. B. Comstock presided. Mr. Moore addressed the meeting and requested suggestions regarding the management of the Institute and the nominations for officers at the approaching election. On motion, the chairman was empowered to appoint a committee of seven to act on the suggestions of Mr. Moore, and also to consider the matter of forming a local section of the Institute. In accordance with this motion, the following committee was appointed: F. A. Keith, chairman, A. B. Carpenter, W. M. Cummings, C. Colcock Jones. F. J. H. Merrill, S. W. Mudd, and W. F. Staunton. This committee will meet at an early date and take up actively the matters committed to its charge. This meeting was called hurriedly on account of Mr. Moore's brief sojourn in the city, and all the local members could not be notified in time.

Los Angeles, August 13.

Modoc County

(Special Correspondence.)—The High Grade Merger Co. is being formed by C. L. Fulton and associates to work three claims recently acquired. These adjoin the Big Four and Josephine estate. The Sunshine claim is reported to have been leased to a party of Nevada mining men. It has been decided to sink 300 ft., and a contract has been let to George Cassell, former superintendent of the Home Run mine at Cripple Creek. The Lucky Dutchman No. 2 Leasing Co. has taken a lease on Block 5 of the Sunshine claim. Four men are at work and rich surface ore is being sacked. The same interests are working the Lucky Dutchman lease at the Yellow Jacket. It is officially stated that work is to commence on the Sunset-Hammer claims, adjoining the Consolidated estate. James T. Wall, A. D. Armstrong, and other San Francisco people are chiefly interested. The new mine plant of the Modoc Mines Co. is nearly finished. It is said that the shaft will be deepened and extensive development undertaken. Good bodies of pay-ore are exposed. This company is composed of Chicago people, headed by William Wrigley, Jr. The Ft. Bidwell Con. Co. ordered a new boiler for its mill, and laid in over 300 cords of wood for the winter. The mill is treating ore from the Mountain View workings. A 2-ft. shoot of rich ore is reported as showing in the surface workings of the Gold Shore. The Big Four mill has been thoroughly overhauled, and is ready to commence crushing. Absence of adequate transportation facilities hampers shipment of ore from mine to mill. Prospecting is under way at a number of claims, and in several instances results are reported as encouraging. W. H. Storms, state mineralogist, visited the district this week. He appears favorably impressed with conditions, considering the present stage of development.

Ft. Bidwell, August 10.

Shasta County

(Special Correspondence.)—A new ore-shoot has been discovered in the southern portion of the Uncle Sam mine, six miles west of Kennett. Assays return about $9 per ton. The find was made in virgin country and is considered important. The 10-stamp mill is working. The Uncle Sam has a record of $1,500,000 from ore averaging $8 per ton. It is being worked by the Standard Mining Co., of which H. D. Staley is general manager and S. W. Richards superintendent. The Afterthought Copper Co. has leased the recently acquired Terry railroad from Anderson to Bella Vista to the Terry Lumber Co. for the season. It is reported that the Afterthought interests paid $200,000 for the line. Development is progressing in a small way at the mine, and experiments with the new treatment process continue. The new 5-stamp mill at the Gambrinus mine, near Stella, has commenced work. Four shoots of free-milling ore have been developed, ranging from six inches to four feet in width. Ore from all shoots averages about $10 per ton. A good reserve of ore is reported to be opened. A 500-ft. adit has been driven at the Mad Mule mine, and work has started on an intermediate level. The completion of present work will give an approximate depth of 700 ft. below the old workings. The ore assays from $3 upward. The Mad Mule recently passed under the control of F. M. Sponogle of San Francisco. W. G. Briggs is superintendent. The property is near Stella, in the Whiskeytown district. The North Star vein, in the Joe Davis group, is reported to be giving better results. A small crew is at work, and it is said that Eastern people have promised financial support.

Redding, August 13.

COLORADO

Lake County (Leadville)

The output of ore from Leadville mines during July was as follows: Western Mining Co., 10,000 tons; Iron Silver, 5000; Yak Tunnel, 11,000; Ibex, 6000; Colonel Sellers, 5000; Stars Consolidated, 5000; Castle View, 3000; Fryer Hill, 4000; South Evans, 3000; Sugar Loaf, 1500; minor companies, 4000 tons. The yield was slightly lower than that of June. About 50 tons of lead and iron ore is being hoisted from the Castle View mine. A good deal of zinc carbonate ore is also being shipped. The Sugar Loaf tunnel is in about 3600 ft., and good ore is being mined from the Dinero vein. Important work is under way in prospecting the Monarch vein, north into Prospect mountain; and will consist of extending the 500 and 600-ft. levels from the Silver Spoon north. The Monarch vein has already been followed for a distance of 3500 ft. from the north line of the Monarch, and is in ore for this distance. It is argued that the ore should continue, and the acquisition

of the Monitor and other properties will give ample country to prospect.

OURAY COUNTY

According to statistics collected by the United States Geological Survey, Ouray county produced the following in 1911: Ore treated, 133,252 tons; gold valued at $1,952,958; silver, 512,800 oz.; copper, 564,273 lb.; and lead, 3,949,822 lb., with a total value of $2,273,018. The county was fourth in Colorado in point of production. R. H. Elliott, of Berkeley, California, has been appointed mine superintendent of the Liberty Bell. W. H. Staver remains as general superintendent, and Mr. Elliott will assist him. The new mill at the Smuggler-Union is treating about 350 tons per day, 35 of which came from old dumps. The Wanakah company has made additions to its mill, resulting from the opening of a new lode in the mine some time ago. A pan to regrind the tailing from the Wilfley tables is being put in, and the pan product will pass over copper plates, and then be further concentrated on Deister and Wilfley tables. Besides the shipment of concentrate, several cars of high-grade ore have been sent to the Salida smelter.

SAN JUAN COUNTY

The new plant of the American Zinc Ore Separating Co. at Eureka, consists of an elevator, bin, Ruggles-Coles drier, trommels, and Huff electrostatic machines, the last to treat the zinc middling produced in the wet concentrating plant. About 90% of this product will pass a 150-mesh screen. The final zinc product is shipped to zinc smelters at Caney in Kansas, and the lead-iron-copper product to the Durango smelter.

During July, 132 cars of ore were sent out from the different mines, the principal producers being the Gold King with 35 cars; Silver Lake, 23; Sunnyside (lead ore), 18; Sunnyside (zinc ore), 17; Barstow, 13; and Iowa-Tiger, 11 cars.

TELLER COUNTY (CRIPPLE CREEK)

The Jerry Johnson mine, on Ironclad hill, shipped 32 cars of ore in July. This came from a new vein on the 650-ft. level. The Roxana company is suing the Doctor-Jack Pot company for $1,000,000 for alleged trespass, and for ore wrongfully extracted. This will tie up valuable property for some time. The Doctor-Jack Pot company recently had judgment in its favor for a like amount, being the alleged profits made on ore wrongfully extracted by the Work company and its lessees. During the second quarter of this year the Doctor-Jack Pot shipped 837 tons of ore valued at $21.40 per ton.

IDAHO

COEUR D'ALENE

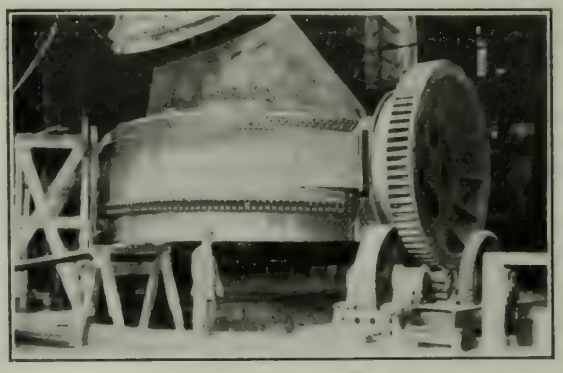
The Bunker Hill & Sullivan company has paid another dividend, amounting to $64,500, making the total to date of $13,650,150. The high metal market is attracting numbers of mining men to the district. Properties in the Nine Mile and Mullan districts are being actively worked. A miner who was injured at 1000-ft. depth in the incline skipway of the Bunker Hill has brought suit against the company for $30,000 damages. Work at the Giant Mining Co.'s claims on Sunset Peak consists of driving a cross-cut which will give a vertical depth of 450 ft. on the lode. The cross-cut is now in 670 ft., and a further 100 ft. of driving will be necessary. About 50 ft. per month is being driven. Samples taken from near the surface, in the 50-ft. drift being run from 150 ft. in the cross-cut, return gold, silver, copper, and silver and lead. The vein at this point is from 3 to 5 ft. wide. Annual assessment work is to be started on the 16 placer claims on Moose creek. The Tamarack & Custer Mining Co., incorporated under the laws of Nevada, has a capital stock amounting to $2,000,000. It is said that a 300-ton concentrator will be erected at the Callahan property in the Sunset district. A great deal of ore has been opened in this mine.

A heavy flow of water was encountered in the tunnel of the Ajax mine, near Burke. Some time ago this tunnel was started a short distance from the Hercules No. 3 tunnel, and after 150 ft., good ore was opened for about 300 ft. Later on, a tunnel was purchased in Moonlight ground, 2400 ft. lower down the mountain from the Ajax workings; and was continued for 2400 ft. The country rock is somewhat similar to the Hercules ground. During the year ended June 30, the Snowstorm mine produced 32,014 tons of ore, of which 29,964 tons was shipped, and 2050 tons milled. The total earnings were $177,939; operating expenses, $99,294; development and improvements, $62,867; leaving the net profit at $15,778. The cash balance is now $48,645. The first unit of the concentrator is at work; and the second unit should be ready by September 15, which will make the mill's capacity 200 tons per day. It is hoped that the Coeur d'Alene district will support the Spokane Interstate Fair, in October, and send in exhibits relative to the mining industry.

MONTANA

CASCADE COUNTY

(Special Correspondence.)—At the B. & M. smelter of the Anaconda Copper Co. a new upright converter of the 'Great Falls' type has just been blown in. This converter is 20 ft. diam. inside the shell and 17 ft. high. The lining is of magnesite brick, 2½ ft. thick on the tuyere side, and 2 ft. thick on the opposite side. There are 62 tuyeres 1¾



GREAT FALLS CONVERTER.

inches in diameter, and the air consumption is 25,000 cu. ft. per minute. The total weight of the converter filled with metal is nearly 300 tons. The weight of the initial charge of matte is 65 tons and about 50 tons of copper will be produced from each pour. In the first run 135 tons of copper was produced from 24 hours actual blowing time, and 100 tons per 24 hours lapsed time. The converter was built in the shops of the B. & M. plant, with the exception of the castings weighing 13 tons each, which came from the Great Falls Iron Works.

Great Falls, August 7.

SILVERBOW COUNTY

(Special Correspondence.)—Shaft-sinking at the Pilot Butte has reached a depth of 1340 ft. The new hoist has arrived from Milwaukee, and is being erected. After this is finished the shaft will be sunk to 2000 ft. The Berlin claim of the North Butte company is expected to be cut at a depth of 1800 ft. Negotiations are pending between the Barnes-King and North Moccasin people whereby the former will operate the latter's property. These two mines adjoin. The Moccasin was equipped with good machinery, and before the shaft caved in showed profits on operations. Some large orebodies were opened, and the Barnes-King should do well. The Anaconda company has decided to increase the wages of its mechanics, on the lines of the increase given to miners and smeltermen. The mechanics, including all skilled laborers, will get an increase of 25c. per day as long as copper remains above 15c. per pound. The increase applies to the men employed at Butte, Great Falls, and Anaconda. The Tuolumne company is sinking its shaft from 1800 ft. some 400 ft. deeper. Second-class ore amounting to 250 tons, and 50 tons of first-class are being sent to the Washoe smelter. With copper at 17c. per pound,

a profit is made on this second-class ore. The Anaconda company has bought the Oro Fino mine, in the Georgetown district, for $250,000. It joins the Southern Cross, which the company bought for $500,000 some time ago. It would seem that the company is to develop the district fairly well, so owners of small properties are pushing work also. The Butte, Anaconda & Pacific railroad should be finished into this district by November. A good deal of work is under way at the Tramway mine, and the Berkeley is producing 14,000 tons per month. The Butte-Alex. Scott continues to ship about 250 tons of 6% copper ore to the East Butte smelter. A new hoist is being erected, after which the shaft will be deepened. In consequence of the assertion of W. A. Clark that the Butte & Superior company was encroaching on Elm Orlu ground, well-known engineers are studying the properties. The former's mill is working well.

Butte, August 12.

NEVADA

Esmeralda County

From the 1300-ft. level of the Grizzly Bear mine, at Goldfield, regular shipments of ore are being sent to the smelters at Tooele. Until the 7 by 18-ft. shaft at the Goldfield Merger mines is down 2000 ft. it is not intended to open out. At the depth which will correspond with the 1400-ft. level of the Grizzly Bear mine of the Consolidated, a cross-cut will be driven from the Merger shaft to the west, to meet one to be started from the former for the purpose of ventilating both mines. The Goldfield-Florence shaft is down over 1185 ft. and at about 1200 ft. it is intended to open out. The Jumbo Extension has started to ship ore to the Bonnie Clare mill, 36 miles south of Goldfield.

Nye County

High-grade ore is being stoped at four places in the Kendall-Douglas lease of the Manhattan Consolidated. A raise was put up after cutting the ore to a height of 35 ft., and the ore is from three to eight feet wide. There are 90 tons in the ore-bin. The Big Four company has opened a rich vein on the 500-ft. level. Ore up to 30 ft. wide has also been proved on this level. About 20 different placer claims are busy, and some of them yielding rich gravel.

During the week ended August 10 the mines at Tonopah produced 9957 tons of ore valued at $248,925. The Belmont sent 1600 tons to the Millers plant and 2110 tons to the new mill. About 130,000 gal. of water per day is being pumped from level No. 13. A pump is being erected at the collar of the shaft to elevate the water to the water-tanks at the mill. Twelve feet of ore shows in the drift on level No. 13. The usual stoping was in progress on the 1166-ft. level. On the 1100-ft. level the intermediate west drift on the shaft vein has been stopped; but 5 ft. of good ore was exposed. The new mill is working satisfactorily, and should be up to full capacity next week. At the Tonopah M. Co.'s mill 93 stamps ran full time for the week ended August 3, and crushed 3225 tons of ore worth $18, with 90% extraction. Thirty-six bars of bullion worth $45,000 and 20 tons of concentrate worth $9000 were shipped from the mill. In the Silver Top mine a new stope has been started on the foot-wall vein at the 240-ft. level, where it is three to four feet wide. The new stope on the 200-ft. level of the Mizpah mine is also this width. The raise from the 700-ft. level in the Desert Queen is being continued in three to four feet of low-grade ore. In the Red Plume stoping and driving are in progress east on the south vein on three feet of good ore. The shaft of the Tonopah Merger is down 40 ft. below the 980-ft. level in hard formation. During July the West End Consolidated treated 3184 tons of ore producing 41 bars of bullion and 29 tons of concentrate. The eastern workings on the 500-ft. level continue to show about 18 ft. of ore assaying from $25 to $36 per ton. From 14 to 22 ft. of ore is being mined west of the shaft stope 555. This stope is 120 ft. long and is being worked up to the 400-ft. level. The Tonopah Extension produced $63,200 from 4503 tons of ore. The stopes generally are yielding good ore. During July the new shaft was sunk a further 115 ft., while a total of 787 ft. of development was done in the mine. In the Montana-Tonopah 938 ft. of work was carried out in July, and the output was 4485 tons of ore, from which 31.7 tons of concentrate was produced. It is expected that a better extraction will be made when the new Trent agitator is at work.

Storey County

During the week ended August 10 the Mexican mine yielded 195 tons of ore worth $56.08, and 23 tons worth $106.46 from the 2500-ft. level; 396 tons containing $7506 from the 2400-ft. level; and 6 tons valued at $41.46 per ton from the 2300-ft. level. The mill crushed 506 tons averaging $22.60 per ton, with 93% extraction. The Ophir shipped 272 tons to the Kinkead mill. At the cyanide plant the tube-mill foundations are finished, also those for the Dorr thickeners, three agitators, and stock tank. Framing of the building is nearly finished. From the stope in the southwest drift at the Consolidated Virginia, 27 tons of ore was mined, assaying $19.22 per ton. On the 2300-ft. level the west cross-cut is out 115 ft. in quartz and porphyry of low value. At the Union Consolidated the blower station near the Union & Sierra Nevada winze has been cut out. In the Yellow Jacket shaft water is now 38 ft. 11 in. below the 1400-ft. station. The pumps in the C. & C. shaft worked from 150 to 160½ hr. during the week, and the water was down 291 ft. below the 2200-ft. station. Timbering has been done below the 2300-ft. level. The Starret pump in the Ward shaft was under repair.

White Pine County

A man employed in the converter building of the Steptoe plant was electrocuted last week while at work on one of the overhead traveling cranes. The cause of the accident is not known.

NEW MEXICO

Socorro County

(Special Correspondence.)—The Socorro company has erected special ore-bins, and receives custom ore regularly. The 700 and 800-ft. levels of the mine were flooded, on account of a large flow of water being cut in the 500-ft. level on the Queen vein; and a concrete bulkhead is being built to stop the flow. The Ernestine battery of 20 stamps is being reconstructed. During the week ended August 9, 590 tons was treated, and the total output for the month amounted to 27,460 oz. of bullion and 14 tons of concentrate. An automatic sampler has been ordered, to deal with custom ore at the Deadwood mill. The 50-hp. gasoline engine for the mill is working. During July the output was 7050 oz. of bullion. The Pacific & Johnson produced 115 tons of high-grade ore, which goes to the Socorro mill for treatment. Both the Deep Down and Iron Group are sending their ore to the Deadwood mill.

Mogollon, August 9.

UTAH

Juab County

Additional pumping equipment is to be used to unwater the 2200-ft. level of the Centennial-Eureka mine. The present electric pump has been lifting 1100 gal. per minute from this level. The Grand Central company has cut ore at a depth of 2300 ft., but assays are rather low so far. In the tunnel of the Lehi-Tintic, which is in 1450 ft., a number of promising veins have been found, while a cross-cut is being driven to prospect for the Empire vein. After diamond-drilling to 500 ft., the Dragon Consolidated stopped work, as compressed air for the machine had to be brought a long distance. Steam will probably be used later on. The May Day mine is to ship zinc ore to the smelters in Kansas. The mine is said to contain at least 10,000 tons of high-grade ore.

The Chief Consolidated is at present shipping four carloads of ore per day, and is arranging to have a branch

built from the Rio Grande railroad, so that ore can be loaded direct into cars.

SUMMIT COUNTY

During the week ended August 10, the mines in the Park City district shipped 1250 tons of ore.

SALT LAKE COUNTY

The mining men of Utah are thoroughly aroused to the necessity of completing some organization for the promotion of the welfare of the mining industry, and a meeting is to be held for the purpose of getting the members of the mining committee closer together, and determining whether Utah metal producers should form an independent organization, or revive the state chapter of the American Mining Congress.

WYOMING

ALBANY COUNTY

The Commercial company has started to cross-cut for the old Centennial lode, 458 ft. in the main adit. It is expected that the vein found in the cross-cut will be reached within 40 ft., and then be followed toward the main shoot. The small vein assays up to $56 per ton in gold.

AUSTRALIA

CHARTERS TOWERS (QUEENSLAND)

During May nine mills crushed 15,340 tons of ore for bullion valued at $93,000; cyanide works treated 11,400 tons for $36,500; smelters treated 212 tons for $30,900 in gold, $830 in silver, $1130 in lead, and slag, $1700; alluvial gold was won worth $280; 106 tons copper ore yielded $1850; and 32 tons black tin were valued at $19,800, a total from all sources of $193,460. Mining in this centre is now down nearly 3000 ft. vertical depth. Mills Day Dawn United at 2540 ft., is prospecting the deeper ground on the Day Dawn reef; and at the same depth the Brilliant Deeps is stoping pay-ore on the Brilliant reef; the Brilliant Extended development is now close on 3000-ft. depth. The Brilliant Extended crushed 3620 tons for $18,000; Mills Day Dawn, 1566 tons for $10,000; and Golden Horn, 5632 tons for $9500. The latter is an interesting low-grade mine several miles from Charters Towers; the ore is quarried, crushed by 20 stamps, and the sand leached in vats, the residue being washed down a creek. The whole plant is driven by a suction gas-engine.

CANADA

ONTARIO

A new factory for the manufacture of dinitrolite, a new safety explosive, has been started near Clear lake, for the Dominion Explosives Co. The plant will make from 10 to 15 tons of explosives per week for a start. Two men were sentenced to two years imprisonment for stealing about $2000 of silver from the Nipissing mine. During July the Cobalt Lake mine yielded 100,000 oz. of silver, from high-grade ore shipped to the smelter, and part from ore milled at the mine. Additions to the concentrating plant are being made. It is probable that the Silver Islet Mining Co. will reopen the mine bearing that name. About $3,500,000 was extracted from the mine many years ago, but water broke in and stopped work. The new shaft at the Ophir is down 145 ft. on a lode which is 4 ft. wide.

The shipments for the week ended August 3 were as follows: La Rose, 101.12 tons of ore; Nipissing, 64.93; Townsite, 43.63; Buffalo, 28.98; McKinley, 41.37; Cobalt Lake, 34.12; Hudson Bay, 31.79; Kerr Lake, 20; and Timiskaming, 30.99 tons. Silver bullion was shipped by the following mines: Nipissing, 112,142 oz.; Kerr Lake, 7339; La Rose, 24,180; Cobalt Townsite, 2984; Drummond, 1477; and Casey-Cobalt, 940 ounces.

QUEBEC

The annual report of the mines department of Quebec states that in 1911 the various mines produced minerals valued at $8,769,786, an increase of $1,356,505 over the preceding year.

YUKON

About 1200 bbl. of fuel oil arrived for the Yukon Gold Co. on July 26, and is to be used as an experiment in generating steam for the company's thawing plants on the creeks.

JAPAN

On July 17, fifty men were injured and one killed in the Okuma coal mine, in the Fukuoka district, owing to the careless use of a safety-lamp. For the first six months of the current year, Japan has exported coal valued at 10,245,355 yen, and copper at 10,419,009 yen. Imports included phosphates valued at 4,444,922 yen; pig iron, 4,545,634 yen; wire, bar, and plate 18,334,000 yen; rails, 2,473,565 yen; tube and pipe, 2,517,760 yen; kerosene, 6,204,655 yen; and machinery, 14,555,613 yen. The exports of gold and silver coin and bullion totaled 13,001,600 yen; and the imports, 8,923,669 yen.

MEXICO

The *Boletin Fiscal* for the year 1910-11 has been issued by the Minister de Hacienda, and contains official records of the mining industry. The total value of mineral products exported for the year amounted to ₱180,005,956, against ₱156,520,075 for the preceding year. The past fiscal year has been the greatest, in point of production, in the history of the industry. Gold was exported to the value of ₱62,090,505, a gain of ₱19,454,103; while the silver totaled ₱80,867,861, an increase of ₱4,518,740. The base metal exports were as follows: Copper, ₱26,300,228; lead, ₱6,539,908; zinc, ₱900,706; antimony, ₱2,046,689; and quicksilver, ₱438,369. There were 30,837 existing titles at the close of the fiscal year, embracing 442,541 pertenencias, a decrease of 318 titles. Sonora ranks first, with 5094 properties; Chihuahua, 5046; and Durango with 4028. The exports of all minerals to the United States amounted to ₱137,853,411, which is 77% of the entire production.

CHIHUAHUA

A new 100-ton mill is to be erected at the north of the adit being driven at the Cababacilla mine, at Cababacilla, in the main range of the Sierra Madre. This mine is situated at a height of 4200 ft. and is 75 miles southeast of El Fuerte, Sinaloa, the nearest station on the Kansas City, Mexico & Orient railroad. The gold ore at Cababacilla occurs on the contact between an andesite and rhyolite, and is red and white in appearance, the gold being associated with iron oxide. The ore occurs in lenses, from 5 to 50 ft. wide and 10 to 110 ft. long, is free-milling, and is worth ₱30 per ton in gold, with practically no silver. The main incline shaft is down 800 ft., and 10 levels have been opened 1300 ft. along the lode. Over 12,000 ft. of development has been done in the mine. The adit first mentioned will cut the lodes at a vertical depth of 1000 feet.

(Special Correspondence.)—The situation in the revolution is unchanged. Dolores is still cut off from railroad communication, but the officials of the Dolores Mines Co. have gone in from El Paso. The rebels are expected to move into northern Sonora by way of the Mexican Northwestern railroad.

El Paso, August 10.

RUSSIA

(Special Correspondence.)—The platinum market at Ekaterinburg, in the Urals, shows little change, prices being somewhat under the quotations of a few months ago. There is a movement now to form companies to prospect the platinum placers of this district. Three companies have been formed: the Aktai Platinum Mines Co., with a capital of $750,000, partly subscribed by Belgians; the Sosva-Ural Gold & Platinum Co., with $200,000; and the Vagran Gold & Platinum Co., with $750,000 capital. Their object is to get hold of the remaining platinum deposits of the Urals, which will be worked out before long. The present high price of the metal probably also has something to do with the formation of new companies. There is little to report from the goldfields of the district, and production remains much as usual. Many placer miners prefer to work on platinum, as it pays much better than gold.

St. Petersburg, July 23.

Personal

Professional men are invited to send news of their engagements and travels. Such news is interesting to friends.

C. S. Thomas is in California.

E. F. Burchard is to go to Alaska.

J. G. Kirchen is in San Francisco.

Ralph Arnold is at Washington, D. C.

F. G. Cottrell has left Butte for the East.

T. T. Read has gone to Great Falls, Montana.

Claude E. Jamison is examining the Jumper mine.

H. W. Turneb is in the Urals on examination work.

Garnett A. Joslin has gone to Caracas, Venezuela.

Sumner S. Smith has left Nome for Katalla, Alaska.

E. P. Matthewson will be in San Francisco next week.

Chetwynd Inglis has arrived from Cobar, New South Wales.

E. D. McDermott is in the Caucasus examining copper mines.

Rene de Label is exploiting placers in the Trans-Baikal, Siberia.

John W. Finch is conducting exploration in northern Ontario.

C. A. Englebrock is examining dredging ground near Vladivostok.

Charles Janin has returned from Nome and is at Seattle, Washington.

F. L. Cole is in Shanghai on business. He will soon go to Vladivostok.

A. C. Perkins is in the Straits Settlements installing dredging machinery.

Harry Wood is assisting T. C. Jaggar in the study of Hawaiian volcanoes.

L. M. Drury, who was in San Francisco last month, is back at Fairbanks, Alaska.

H. W. Hardinge is back in New York from his trip to London, Sweden, and Norway.

August Hoffmann has resigned and will soon leave the Syssert Estate for Stockholm.

Percy E. Barbour is in Boston for several weeks for business and pleasure combined.

G. E. Grunsky, Jr., is now superintendent at the Standard Consolidated at Bodie, California.

Stanley C. Sears is now general manager for the Utah-Apex Mining Co., Bingham Canyon, Utah.

S. B. Christy, A. C. Lawson, and A. S. Eakle have returned to Berkeley for the winter's work.

Lloyd C. White passed through San Francisco this week on his way from Lucky Boy, Nevada, to Stewart, British Columbia.

R. E. Smith, H. G. Haan, N. C. Stines, and William Knox are examining placer ground under R. B. Hoffmann near Nikolaievsk.

R. E. Garrett, of the University of Oklahoma and the Oklahoma Geological Survey, has been appointed assistant in mineralogy at Northwestern University.

The engagement is announced of Eugene P. Kennedy, assistant superintendent of the Alaska Treadwell Mining Co., to Miss Theresa Keeney, of San Francisco.

D. M. Folsom, who has been assisting in the editorial work of the *Mining and Scientific Press* for the summer, has returned to his regular duties at Stanford University.

J. P. Hutchins and J. F. Erdlets have just finished examining mines in the Nerchinsk district for the Russian Government, and have gone to Blagovestchensk on the Amur river.

Morton Webber has terminated his association with C. L. Constant & Co., and has opened an office at 2 Rector street, New York City, where he will continue to specialize in mine valuation and development.

Otto Wartenweiler, who has been in charge of the mechanical design and construction of the new mill of the Tonopah Belmont Development Co., has gone to Pearce, Arizona, where he will act in a similar capacity for the Common Wealth M. & M. Company.

Market Reports

LOCAL METAL PRICES

San Francisco August 15.

Antimony	11—11¾c	Quicksilver (flask)	42.50
Electrolytic Copper	18—18¼c	Tin	50—51¼c
Pig Lead	4.75—5.70c	Spelter	8—8¼c

Zinc dust, 1400 lb. casks, per 100 lb., small lots $9.50—9.75; large $7.50—8.50

METAL PRICES

(By wire from New York.)

NEW YORK, August 15.—Copper prices are firm, despite the increased supplies and large production reported by the Copper Producers' Association last week. This is attributed to increased demand for domestic consumption and is considered very favorable. Lead market firm and metal is in good demand. Spelter is quiet and somewhat weaker.

Average daily prices for the past week, in cents per pound, based on wholesale transactions, standard brands, are given below.

Date.	Electrolytic Copper.	Lead.	Spelter.	Silver, per oz.
Aug. 8	17.45	4.50	6.75	60½
" 9	17.40	4.50	6.75	60⅜
" 10	17.40	4.50	6.75	60⅜
" 11	Sunday.	No market.		
" 12	17.48	4.50	6.75	60½
" 13	17.48	4.50	6.75	60⅞
" 14	17.48	4.50	6.75	61¾

LONDON QUOTATIONS

(By cable, through the courtesy of C. S. Burton & Co., New York.)

	August 15.
Camp Bird Ltd	$ 6⅞
El Oro	3⅜
Esperanza	6⅜
Oroville Dredging	1¼
Santa Gertrudis	7⅜
Tomboy	6⅜

COPPER SHARES—BOSTON

(By courtesy of J. C. Wilson, Mills Building.)

	Closing prices, August 15.		Closing Prices August 15.
Adventure	$ 9	Mohawk	$ 68¼
Allouez	45	North Butte	30½
Calumet & Arizona	76¼	Old Dominion	58
Calumet & Hecla	535	Osceola	118
Centennial	22½	Quincy	92¼
Copper Range	58½	Shannon	16¾
Daly West	4⅞	Superior & Boston	2⅛
Franklin	11¼	Tamarack	43½
Granby	55	Trinity	6¼
Greene Cananea, ctf.	10	Utah Con	12¼
Isle-Royale	35⅝	Victoria	3
La Salle	6½	Winona	5
Mass Copper	7	Wolverine	106

NEVADA STOCKS

(By courtesy of San Francisco Stock Exchange.)

San Francisco, August 15.

Atlanta	$ .27	Mexican	$2.67
Belcher	.37	Midway	.58
Belmont	9.80	Montana-Tonopah	2.02
B. & B.	.08	Nevada Hills	2.05
Booth	.08	Ophir	1.00
Chollar	.10	Pittsburg Silver Peak	1.00
Combination Fraction	.16	Round Mountain	.38
Con. Virginia	.55	Savage	.12
Florence	1.00	Tonopah Extension	2.65
Goldfield Con.	3.80	Tonopah Merger	1.98
Gould & Curry	.04	Tonopah of Nevada	7.00
Jim Butler	.65	Union	.63
Jumbo Extension	.42	Vernal	.13
MacNamara	.25	West End	1.72

MINING STOCK QUOTATIONS—NEW YORK

(By wire from C. S. Burton & Co., New York.)

	Closing Prices. August 15.		Closing Prices. August 15.
Amalgamated Copper	$ 85¾	Miami Copper	$ 29¾
A. S. & R. Co.	87	Mines Co. of America	3
Braden Copper	6⅝	Nevada Con	22½
B. C. Copper Co.	5	Nipissing	7¾
Chino	38	Ohio Copper	⅞
First National	2½	Ray Con	22½
Giroux	5½	Tenn. Copper	42½
Goldfield Con.	3⅜	Tonopah Belmont	9⅝
Greene-Cananea	10⅛	Tonopah Ex.	2¾
Hollinger	12½	Tonopah Mining	7
Inspiration	18⅞	Trinity	6¼
Kerr Lake	2⅞	Tuolumne Copper	3
La Rose	3	Utah Copper	64
Mason Valley	13	West End	1⅜
McKinley-Darragh	1⅜	Yukon Gold	3⅜

Concentrates

Most of these are in reply to questions received by mail Our readers are invited to ask questions and give information dealing with the practice of mining, milling, and smelting.

LEAD acetate used in cyanide plants does not always result in a decreased consumption of cyanide, or an increased extraction.

GAS for engine power is now derived from many sources. It is stated that an engine in New South Wales makes power from the gas issuing from a septic tank. This ought to be economical.

EXHAUST from three gas-engines at a new mill in Western Australia is conducted into the firebox of a locomotive type boiler, and about 10 hp. is developed; enough to drive a dynamo for lighting.

ANIMIKITE is a doubtful mineral species, containing silver antimonide, which is allied or perhaps identical with dyscrasite. It occurs in the Silver Islet mine, Ontario, associated with Huntilite, a silver arsenide.

SEPARATE houses are considered advisable by many metallurgists for copper plates in the interest of safety, and close supervision; likewise all tube-mills, vanners, and other departments are occasionally placed in separate buildings.

WHEN excavations are being cut, for foundations, in gravel or loose rock, a cheap method is to sluice the waste away, as has been done fairly often, notably at Seattle, and for battery foundations at mines in New Zealand.

CHROMITE has been produced outside of the United States during recent years mainly in New Caledonia, Rhodesia, Asia Minor, Russia, Greece, Canada, India, and Japan. Rhodesia and New Caledonia at present are among the most important producing countries.

ANTIMONY is used principally in antimonial lead as type metal and as babbitt and other bearing metals, in coffin trimmings, linings for acid tanks, toys, clock cases, and other articles for which a fairly hard metal to be gilded or otherwise finished is desired.

CLASSIFICATION of mill pulp has reached a fine point in some places, even to the extent of becoming very complex and being overdone. During the past year or more, the Ivanhoe company at Kalgoorlie cut out a number of small classifiers and recovery was not lowered.

TUBE-MILLS in the plant of the Waihi-Paeroa Extraction Co., of New Zealand, on being started after 24 hours' shut-down, were found to run out of balance, resulting in breakage of driving gear. It was found that this was due to the pulp and pebbles setting hard in the mills.

FILTER leaves made of corrugated iron show the same tonnage efficiency and good wash as do those made of cocoanut matting in a leaf of a vacuum plant. The matting is liable to become choked with slime if the filter-cloth leaks, and also choked with lime compounds. This is Waihi experience.

ROPES used for driving shafting always make trouble in that one rope is tighter than another and does more work. Some millmen prefer one long endless rope, usually running around a grooved tension pulley. If the splice pulls out of the ropes there is a long shut-down, whereas if one of a number of driving ropes pull out, the others will take up the extra load.

OWING to the shut-down of the plants at Waihi on account of the strike, most of the Brown agitators were left in all stages of being filled, agitated, and emptied. During the first few weeks it was the practice to give the slime a blow with air, no trouble being found in restarting. It was decided later to leave the tanks alone, as the slime seems to settle to a certain consistence, and remain so, while further agitation may destroy this.

MAGNESITE is supplied on the Pacific Coast in quantities greater than the demand. Very little dead burnt magnesite is made here, owing to the cost of fuel and labor. Most of the magnesite of this quality comes from Greece, Austria, or Norway, and commands a price of about $23 to $25 per ton, according to quality. Prices are quoted monthly in the *Mining and Scientific Press.* Precipitated magnesium carbonate is a different material.

MOLYBDENITE is the chief source of molybdenum, which is used in steel-making as a hardener, and in chemical industries in the form of ammonium molybdate and other salts. Two methods of production are in general use; the aluminothermic, and the electrical. The former yields a product free from carbon, but containing small quantities of silicon, and from 1 to 2% of iron. The electrical process consists of heating the ore in a carbon tube, employing a current of 350 amperes at 60 volts. A portion of the sulphur is thus expelled as SO_2. By increasing the current to 900 amperes the mass is fused and the sulphur completely expelled. The metal thus produced contains about 7% carbon, which may be removed by heating the metal with molybdic oxide. Buyers require concentrate to contain 90 to 95% molybdenite, and the price fluctuates between $400 and $500 per ton. The crude ore is concentrated, like any other mineral, by ore-dressing processes.

WATER from mines and other sources has a corrosive effect on iron or brass pump parts, and also on iron pipe. The use of wood pipe has helped greatly to reduce this trouble. Very bad water was met with in a mine at Carterville, near Joplin, and a pump made of wood and lead has been specially ordered. It will be a 4-in. two-stage centrifugal pump, the spindle of which is of brass, and similar to two pumps working at another property in the district. The delivery pipe will be coated with an acid-proof paint. At the Associated mine, Kalgoorlie, wood pipe of 3, 4, 5, and 6-in. size replaced iron pipe at many parts of the surface plant, with great success, one line being used for returning furnace water at 140°F. to a cooling tank. It is also used on other mines in Western Australia. The Australian Wood Pipe Co., of Sydney, has recently secured a contract to make 14 miles of 18-in. wood pipe for the new water system for Broken Hill. This contract is worth $200,000.

POTASSIUM PERMANGANATE has been used in South Africa as a preliminary wash, especially in the treatment of pyrite. It should, however, be removed by a water-wash prior to cyanide treatment, as any excess remaining in the solution reacts with and destroys cyanide. In some cases a mixture of permanganate and sulphuric acid has been used for the preliminary oxidation and removal of cyanicides. Certain oxidizers are ineffective in cyanide work, and in practice, when air is not used, permanganate, sodium dioxide, and bromine have been used to assist in solution of gold. During milling operations ferrous sulphides are formed, which attack solutions. The remedy is to supply oxygen artificially in the form of air, or an oxidizing agent. From two to eight ounces of permanganate per ton of slime have been used. The reactions of permanganate with ordinary mill solutions are somewhat complicated, many compounds being formed in alkaline solutions, and it does not appear to be known with any certainty how permanganate acts in aiding solution of gold. For the estimation of ferrocyanides and the use of permanganate, see Clennell's 'Chemistry of Cyanide Solutions.'

Company Reports

NEVADA-DOUGLAS

The annual report of the Nevada-Douglas Copper Co. for the year ended March 31, 1912, states that the mines in the Mason mining district of Nevada produced 23,937 tons of copper ore and 7299 tons of gypsum, with a return of $152,429, and after deducting $105,560 for all expenses there remained a profit of $46,869. Final settlements on ore shipments are expected to give $33,101 profit. Ore from the Ludwig mine averaged 5.62% copper, and the reserves are estimated at 289,000 tons. In this mine 2261 ft. of development work was done. The most important results were on the sixth and seventh levels. A cross-cut has been driven 120 ft. near the south face of the former level, and the hanging wall of the lode had not been reached. The cross-cut is in carbonate ores and leached material. This enlargement is in the vicinity of a porphyry dike. The Douglas Hill mine has reserves of ore totaling 350,000 tons. Its average during the period was 5.24% copper. Four hundred and sixty-three feet of development was done, showing that strata of barren limestone alternate with lodes throughout the deposit. The Copper Basin mine averaged 5.06% copper, and 106 ft. of sinking in the main shaft passed through alternating beds of ore and limestone. Reserves are given as 50,000 tons. A Gould pump was put in to lift the water from 780-ft. depth in the incline shaft. So far, returns from gypsum shipments have not been very profitable. The quarry where this mineral is mined is 50 ft. wide, with a vertical face 35 ft. high. There is a small overburden. The rock is elevated to a crusher, broken to 3-in. size, and shipped away. The gypsum carries 24% moisture and averages 96%. The erection of a smelter for the copper ores is to be considered at an early date. The company holds a half interest in the Nevada Copper Belt Railroad Co., whose earnings for the first three months of 1912 were $44,656, and expenses $39,811.

ALASKA TREADWELL G. M. COMPANY

The financial year of this company has been changed to conform with the calendar year, hence the twenty-first report covers the past 19 months to December 31. During this period 15,533 ft. of development was done on eight levels, making a total of 122,563 ft. for the past 18 years. The Treadwell company also did 931 ft. of work in the 700-Ft. Claim mine. Little development was done on the 440, 750, 900, and 1050-ft. levels, and nothing was done in the open pits. On the 1250-ft. level the No. 4 east drift was connected by a cross-cut 65 ft. long, with No. 3 east drift. This was to improve the ventilation through the raise from 1450 ft. Seven samples from the above 65 ft. averaged $2.93 per ton. Work was done from No. 4 south cross-cut, which was necessary for stoping 50,000 tons of ore left on the foot-wall between the 1250 and 1050-ft. levels. Most of the development work on the 1450-ft. level consisted of intermediates, manway drifts, and raises for chutes and stopes. The stopes on the level are about half completed, and contain 769,130 tons of broken ore ready for the mills. The main cross-cut on the 1600-ft. level was continued 603 ft. through waste, after which the lode was cut. The cross-cut was then turned west and continued 421 ft. through ore to the hanging wall. Seventy samples, taken across this 421 ft., averaged $4.14 per ton. No. 1 east drift was driven 236 ft., the first 88 ft. being ore, the balance waste. Thirteen samples assayed $6.96 per ton. Work on other cross-cuts and drifts went through ore of a fairly high average. At the 1750-ft. level the main cross-cut was driven 883 ft. through waste, and 36 ft. of ore, which assayed $3.13 per ton. The No. 3 east drift in the main cross-cut was driven 19 ft., which gave $2.22 per ton; while No. 7 west drift, opposite the former, was advanced 14 ft., assaying $2.27. During the 19 months under review, 1,349,264 tons of ore was extracted from the 750, 1050, 1250, 1450-ft. level stopes, and development on 750, 900, 1050, 1250, 1450, 1600, and 1750-ft. levels. The ore reserves totaled 7,613,087 tons, made up of 6,344,749 tons in place, and 1,268,338 tons broken in stopes. The average of 6193 samples from the mine was $3.32 per ton. The 240-stamp mill crushed 633,976 tons, with a duty of 4.64 tons per stamp, and the 300-stamp mill 715,288 tons, equal to 5.44 tons each. Both mills produced 24,952 tons of concentrate, of which 17,751 tons was treated at the mine by cyanide, full details of which appeared in the *Mining and Scientific Press* of June 29. The total yield from 1,349,264 tons milled and concentrate treated was $3,259,446. Dividends paid amounted to $800,000. The yield per ton milled was $2.41, and costs totaled $1.43 per ton. The report, which covers 74 pages, and several mine plans, is a creditable production and leaves nothing to be desired.

NIPISSING MINES COMPANY

The seventh annual report of this company, operating mines at Cobalt, Ontario, shows that it had a year of high production of silver at a low cost per ounce; a large profit was made and dividends paid; the cash surplus was much increased; the high-grade ore is now being properly treated at the mine, while a plant for the treatment of the low-grade ore is being constructed, also at the mine. During the year, 29,146 tons of ore was shipped, assaying from 273 to 2393 oz. silver per ton, yielding a total of 4,678,074 oz., worth $2,506,608. The average price received per ounce was 53.58c. For 2356 lb. of cobalt sold, $589 was realized. Freight, treatment, and smelter deductions totaled $125,484, which left a net value received of $2,381,712. The total cost of producing silver, based on an output of 5,197,042 oz., which was contained in the shipments and ore on hand, amounted to 13.95c. per ounce. There was on hand at the end of 1910 ore amounting to 185 tons, and at the end of 1911, 268 tons; so with the shipments during the latter year, the mine production totaled 2992.39 tons, containing 5,197,042 oz. silver, with a gross value of $2,820,257. The total profit on production was $2,095,241. The shipments from 1904 to the end of 1911 amounted to 24,475 tons, valued at $12,939,395. Dividends for the year were $1,838,430, making $7,850,930 in all. Twelve veins contributed to the past year's output, No. 73, 80, and 100 yielding 3,142,198 oz. A new hydraulic equipment, for surface prospecting, was fitted up. A force of 25 men completed 13.7 miles of trenches 2.7 ft. deep. In the diabase, east of the lake, No. 149 vein was found to contain high-grade ore. Of the 846 acres held, 576 are partly prospected, and 270 unprospected. A total of 8781 ft. of development, and 13,841 cu. yd. of stoping was done. The year's work on vein 73 has been most favorable, and on the 247-ft. level it has been opened for 200 ft., the average width being 4 inches. A fault disturbed veins 80 and 100, between the 70 and 189-ft. levels, but they have been picked up again. Vein 64 is the strongest on the property, and has been developed on five levels to 344 ft. deep and 900 ft. long. Vein 122 did not realize expectations; but 63, 108, and 148 produced heavily, although the high-grade ore in them is nearly exhausted. The reserves consist of 7 veins containing 3454 tons of ore with 6,126,838 oz., and 80,036 tons on the dump, with 1,756,954 oz. silver. Treatment of the high-grade ore was started in February 1911. The process, described in detail by T. A. Rickard in the June 1912 issue of *The Mining Magazine*, consists essentially of amalgamation in cyanide solution in a tube-mill, where 97% of the silver in the ore is recovered as amalgam. The tube-mill pulp is further treated in a cyanide plant. This new mill dealt with 922 tons of ore, from which 2,522,888 oz. of silver was recovered. For the treatment of the low-grade ore, assaying about 22 oz. per ton, a mill of 40 stamps, with 200 tons daily capacity, is being erected. The stamps will weigh 1500 lb. each, following which there will be four tube-mills, amalgamation if necessary, agitation with cyanide, a Butters filter, and Merrill zinc-dust precipitation.

Decisions Relating to Mining

Specially reported for the MINING AND SCIENTIFIC PRESS.

GROUP OF MILLSITES—POSTING OF NOTICE

Where two or more contiguous millsites are embraced in a single application for patent, the posting of one copy of the notice and plat within the limits of the group is sufficient, without the necessity of posting a separate copy upon each claim.

Phoenix Gold Mining Co., 40 Land Decisions, 313. December 1, 1911.

OIL LEASE—FORFEITURE FOR BREACH

Under an oil and gas lease providing that it should be void unless a well is completed before a specified date, or unless, after that date the lessee pays a specified rental, a failure to either complete the well or pay the rent is a breach of the condition working a forfeiture of the lease, and not a breach of covenant entitling the lessor to recover the rent.

Butcher *v.* Greene (Indiana), 98 Northeastern, 876. June 18, 1912.

FELLOW-SERVANT RULE ABOLISHED IN MINES

A state statute abolishing the fellow-servant rule in mine accidents, but limited in its application to employees in mines producing mineral, and exempting from the liabilities imposed prospectors and others whose mines have not reached the point of production, has been held constitutional and not class legislation. The unusual hazards incident to the duties of miners who work beneath the surface furnishes adequate support for the distinction made in the act between classes of miners engaged in duties distinctly different in character and with respect to the dangers attendant upon them.

Hawkins *v.* Smith, (Missouri) 147 Southwestern, 1042. May 20, 1912.

COAL-LAND ENTRY—REPAYMENT OF PURCHASE PRICE

Where a person makes a coal-land entry, avowedly for his sole use and benefit, but actually at the instance of a corporation, with its money and for its benefit, the entry cannot for this reason be deemed to have been fraudulently procured in contravention of the Federal statute which forbids the acquisition of such lands in excess of the quantities prescribed, where there is nothing to show any effort through this or like entries to evade the restrictions in respect of quantity. Where such person assigns his rights by quitclaim deed to the corporation for whose benefit the entry was made, and thereafter the entry is canceled by the Government, the corporation is entitled, as assignee of the entryman, to repayment of the purchase money from the United States.

United States *v.* Colorado Anthracite Co., 32 Supreme Court Reporter, 617. May 27, 1912.

DIRECTOR OF GEOLOGICAL SURVEY TO REPORT ON MINERAL CHARACTER OF LIEU LANDS.

"Hereafter in the matter of all railroad and state indemnity selections, state selections in satisfaction of quantity grants, forest lieu selections, and selections made by the railway company or individuals under the provisions of the Act of July 1, 1898, the Commissioner of the General Land Office will request the Director of the Geological Survey to report whether the land sought is valuable because of coal or other mineral deposits, and also whether the same has any value for power or reservoir purposes or is needed in connection with any existing or contemplated power or reservoir site withdrawal. When any such selection is sent to the Department for consideration, the report of the Geological Survey should accompany the papers, reference thereto being made in the letter of transmittal."

Instructions of the Secretary of the Interior dated Jan. 11, 1912. (Unpublished.)

Recent Publications

THE PRODUCTION OF SALT AND BROMINE IN 1911. By W. C. Phalen. Advance chapter from 'Mineral Resources of the United States, 1911.' 20 pp. Tables. Washington, 1912.

MONTHLY SUMMARY OF INTERNAL COMMERCE OF THE UNITED STATES. May 1912. U. S. Dept. of Commerce and Labor, Bureau of Statistics. 201 pp. Tables. Washington, 1912.

THE PRODUCTION OF ANTIMONY, ARSENIC, BISMUTH, AND SELENIUM IN 1911. By Frank L. Hess. Advance chapter from 'Mineral Resources of United States, 1911.' 11 pp. Washington, 1912.

MICA: ITS OCCURRENCE, EXPLOITATION, AND USES. (Second Edition.) By Hugh S. de Schmid. Canada Department of Mines, Mines Branch No. 118. 411 pp. Ill, maps, index. Ottawa, 1912.

GOLD DEPOSITS NEAR VALDEZ, ALASKA. By Alfred H. Brooks. Advance chapter from Bulletin 520, 'Mineral Resources of Alaska, 1911,' U. S. Geol. Surv. Bull. 520-D. 27 pp. Map. Washington, 1912.

THE PRODUCTION OF MANGANESE AND MANGANIFEROUS ORES IN 1911. By Ernest F. Burchard. Advance chapter from 'Mineral Resources of the United States, 1911.' 20 pp. Tables. Washington, 1912.

GEOLOGY AND ORE DEPOSITS OF THE PARK CITY DISTRICT, UTAH. By John Mason Boutwell, with contributions by Lester Wood Woolsey. U. S. Geol. Surv. Professional Paper 77. 231 pp. Ill., maps, index. Washington, 1912.

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SPRAGUE ELECTRIC WORKS, 527 West 34th street, New York. Bulletin No. 902, 'Sprague Electric Grab-Bucket Cranes.' 24 pages. Illustrated. 8 by 10 inches.

CARNEGIE STEEL CO., Pittsburg, Pennsylvania, 'Steel Sheet Piling.' Ninth Edition, containing tables and data on the properties and uses of sections of steel sheet piling. 88 pages. Illustrated. 5 by 7½ inches.

HYATT ROLLER BEARING CO., Newark, New Jersey. 'The Hyatt Way.' Monthly publication of this company covering the Hyatt roller bearing. 8 pages. Illustrated 6 by 9 inches.

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EDITORIAL

ACCORDING to the jury, Mr. Darrow didn't do it. Very well, Mr. Darrow, but don't let it happen again.

TRAVEL broadens a man. The journey of the Secretary of State to the Empire of Japan is to be commended.

MINING by boat is common enough in the dredging field, but mining and tramming by boat underground is distinctly unusual. Our Joplin correspondent describes this week how a scow is used in one of the sheet-ground mines of Missouri for pulling pillars without unwatering the mine.

LAKE SUPERIOR engineers are to hold their annual gathering at Houghton, Michigan, this year, and sessions will be held August 28, 29, and 30. The Lake Superior Mining Institute is one of the livest local organizations of engineers in America and its sessions are always of much more than local interest. The preliminary announcement shows that the program will be fully up to the usual standard of the Institute.

MONTANA is now in line with a request for a local mining experiment station to be conducted by the Bureau of Mines. We are glad to understand that there is small probability of any of these bills being enacted as they stand. We approve heartily of the proposed work and are well assured of the competence of the United States Bureau of Mines, but establishment of a number of fixed local stations savors too much of the pork barrel to warrant support.

MINING in Canada, it is said, is about to receive further recognition by the appointment of a Dominion Minister of Mines. At present the Geological Survey and the Mines Branch of the Department of Mines are under the charge of a Deputy Minister, Mr. A. P. Low. Owing to Mr. Low's long sickness, the effective direction of affairs has been for some time in the able hands of Mr. R. W. Brock, director of the Geological Survey. If a separate minister be appointed, it will give the mines direct representation in the cabinet, and in view of the great and growing importance of mining in Canada, this would be but deserved recognition.

CIVIL ENGINEERS in England have taken the lead in a movement to raise a fund for the purpose of placing in Westminster Abbey a memorial window in recognition of the distinguished service of Lord Kelvin as an engineer and man of science. Since the benefits of his work have been world-wide, it is especially to be hoped that the funds will come from every land. A cooperating committee consisting of Messrs. James F. Kemp, Samuel B. Christy, James Douglas, and Joseph Struthers has been appointed on behalf of the American Institute of Mining Engineers. Subscriptions of $5 to $10 are requested, and checks may be sent to Mr. Struthers, who is acting as chairman of the committee.

PEACE at any price! Such has been the watchword of the administration, and the reign of disorder, of loot, rapine, and murder, in Mexico has been suffered unmolested to pursue its riotous way. The lives and property of American citizens in Mexico have not concerned the authorities at Washington. Were not Americans warned to leave? Therefore, if they stay, they do so at their own risk. But this policy is applicable to Mexico only. The lives and property of Americans in Nicaragua are precious to the administration. The principle of 'peace at any price' does not restrain the landing of marines, accompanied with the proclamations and warnings appropriate to the case. We see the difference, but we fail to comprehend the distinction.

SAMPLING is at the base of any adequate estimate of tonnage and recovery, but, unfortunately, difficulties incident to variations in moisture and to the scale of modern operations, lead to provision of inadequate sampling devices at many mills. It is related that at one of the best known, where a certain recovery had been promised, cars were counted instead of weighed, and were assumed to contain 60 tons each. The promised recovery resulted. When, however, smelting returns became available there was an evident shortage of metal. The output was therefore recalculated on the basis of 50 tons to the car. This gave the promised recovery, but indicated such a shrinkage in the capacity of the mill as to provoke a protest from the designers. In the interest of harmony, therefore, a compromise figure of 55 tons to the car was assumed and a slightly lower percentage of recovery admitted. Knowledge of such conditions may have something to do with puzzling disinclination to soar shown by certain stocks.

IT is becoming common for railroads to prohibit employees from using liquor. The Delaware, Lackawanna & Western has gone further than others in demanding abstinence and healthy habits. Not only while on duty, but at all times, must the employee abstain, on the ground that alcohol impairs efficiency and reliability. The new regulations even require that workmen refrain from patronizing games and amusements that excite the emotions and cause loss of sleep. We recall instructions once sent by the late ex-Mayor Grace of New York to one of his mining engineers in the field: "Keep well rested; do not attempt an important piece of work when tired; and avoid all things that use up physical and nervous strength to no purpose." One of the ways to increase efficiency is unquestionably to insure nervous economy, which will soon become translated into financial economy. It is not only safety of operation that the Delaware, Lackawanna & Western, the Pennsylvania, and the Baltimore & Ohio railroads will gain by their new regulations; the result will soon be evident in a reduction of the ratio of operating cost to gross income. Mining companies may well take notice.

CHICAGO, long considered by many to be merely a railroad junction point where pork was packed, has become in recent years a city great not only in material wealth, but in civic ideals and accomplishments. No one familiar with her traction settlement, park system, public playgrounds, art school, orchestra, libraries, and University, no one who is prepared intelligently to contrast the present with the old Chicago, can doubt that the city is becoming great in the things that make for permanent good as well as wealth. Death of D. H. Burnham removed one of the men who contributed mightily to the new order, but the best thing about Chicago is that its betterment depends upon no one man or group of men. Mr. John D. Rockefeller did well when he gave millions to build up a great university at this melting pot of America; but he did better when, having assured the fair starting of the institution, he withdrew and threw responsibility for its maintenance and future growth upon the local citizens. They have responded to the appeal in a characteristic Chicago manner. But a few days ago Mr. Julius Rosenwald celebrated his fiftieth birthday by giving many thousand dollars to various local institutions devoted to social betterment. Among other gifts was one of $250,000 for new buildings at the university, and in this mining men have a special interest, since among the departments for which provision is to be made, is that of geology. With Mr. T. C. Chamberlin at the head, any department of geology would be assured of greatness, and with the men he early gathered around him, the old quarters have long been outgrown. The University of Chicago has been a powerful influence toward the development of new concepts and clear thinking in geology. We congratulate the University and the department upon the better facilities that will be afforded as a result of the gift of Mr. Rosenwald.

BOOMERS frequently defeat their own purpose, and that seems to be happening in the case of High Grade. We have already referred several times to the foolish stories published about this old district with a new name in Modoc county, California. There are good veins, and rich ore has been found. It is altogether probable that two or three good mines will be developed; an opinion in which we are glad to be in accord with Mr. W. H. Storms, state mineralogist, who has but recently returned from the district. There was no excuse, however, for the rush into the district when snow was so deep that location stakes were tied to tree tops in place of being driven in the ground, and there is no excuse for the stories now being circulated. Recently Mr. J. M. Hill, of the United States Geological Survey, while studying various small districts in Nevada, was instructed to examine High Grade. He had hardly got on the ground when news items were extensively circulated to the effect that the Geological Survey had found the district to be "a second Cripple Creek." This was so far from the truth that Survey officials naturally resented the attempt to misrepresent the Bureau, and Mr. Hill has now been ordered away from the district. It is proposed to defer completion of the examination until heated imaginations shall have cooled enough to permit an accurate survey to be made and a report published without being used to toll dollars from the pockets of the unwary.

MINING companies are becoming more liberal in issuing and publishing full reports of their operations for the benefit of the stockholders and the interested public. This is as it should be, and all such information from an authentic source can only result in the advancement of the industry. There are still some companies, however, who seem to believe that 'silence is golden,' and who steadfastly refuse to publish any information themselves, or to allow anyone to tell for them what is being accomplished at their plants. In most cases this should not be placed to the discredit of the managers and engineers in charge of operations, but rather charged against the financiers who control the property. Some men profess to believe that they can gain importance by surrounding their operations by a veil of mystery. Strict orders are accordingly issued to superintendents and foremen not to talk to outsiders, and in some instances the rule is even made to exclude all visitors. To be sure, certain justification can be found for this policy on the ground that an individual, and a corporation as well, has a right to keep business trade secrets from a too inquisitive public. Such a policy in mining, however,

is extremely selfish and short-sighted, and when it comes to research work, though common, it is exactly the policy most likely to kill invention, stifle discovery, and promote waste of funds. How many companies in the last decade have duplicated long and costly experiments already made by neighboring concerns? How much time and money has been squandered in laboratories, in mills, and in smelters by men attacking problems at the beginning and laboriously working through a mass of preliminary investigations, when as a result of a more liberal policy they might have had access to information which would have enabled them to start at the real heart of the problem? When work is being done toward the obtaining of a patent there may be some excuse for secrecy, but why should companies hesitate to publish the results of tests made with standard machines, or the results of the operation of a developed process on a certain class of ore? Some managers seem to enjoy this imposed secrecy, while others rebel and go so far as to give up occasional information to fellow engineers, but always on the assurance that it will not be published. With the changing conditions in mining and the consolidation of interests there will undoubtedly be a more liberal exchange of results among the engineers employed in the different departments of the corporations. It is to be hoped that the public and the engineers outside the circle of corporation service will at the same time receive some benefit in the form of direct information and will not always be compelled to wait on the inspired reports of stockbrokers for their news in regard to the success or failure of new methods and new plants.

Finding Mines

It is a common remark these days that the public is not in the market for mines, and this is largely true. The reason is not far to seek. The public, meaning thereby the general and uninformed public, has received but little return from past investment and has but little reason to buy again. It was long too easy both here and abroad, to 'float off on the public' the unprofitable ventures and lock in the safe certificates in those that did well. Methods in London and Denver differed, but the game, and game it was, was essentially the same. There are those among engineers, and some rank high in ability and accomplishment, who privately, if not publicly, defend the practice. They say that the risk in mining is so great that if it were not possible to pass on to the public a large percentage of the failures, there would be no profit left for the insiders. Others point out that the West has been developed by Eastern money, much of which would not have left home save in hope of the unusual gain foretold by the fanciful tales of the promoter. The individual 'investor,' who was usually at heart a gambler, lost; but real mines were found and the West was developed. Whatever be the line of argument, however, there is general agreement that the game is now slow, and a wide fear that it has been stopped for a long period, if not permanently. It is true that large promotions do now occur, and that the public has full opportunity to invest in poor as well as good ventures. There is, however, one considerable difference. In Western America it was for many years possible for men of no real financial responsibility to take an option on a property and, by advertising, by circulars, through solicitors, and through wash sales on the minor stock exchanges, to gather the money to pay for the option, for the selling campaign, the development and plant, and finally to reserve to themselves the major share of any possible profits. This is still done, but not frequently or easily. In any large and successful mine promotion nowadays, the promoter or his backer must usually put up actual cash in considerable amounts at some stage. Where this is not necessary it is because an established firm with several successes to its credit, underwrites the issue of stock or buys the bonds, and on this assurance of success in financing the property, the public buys so promptly that the underwriters do not need to advance money. This does not happen as often as the brokers would like the public to believe, and it is an open secret that in a number of successful ventures, where good mines are paying fair dividends, the campaign of distribution has been slow or unsuccessful. It is clear, none the less, that even at a possibly higher price per share, the present plan is advantageous to the public as compared with the old. Formerly the buyers of a few shares in a new property took all the risk of mining, plus the risk of 'thin ice' financing, and paid a heavy commission to the 'sure thing' men who manipulated the deal. Conditions are none too good now. The shares absorbed by underwriters and paid as commissions are large; but a real service is performed and a real risk is saved the public. The security to the latter is actually greater than it seems, since a promoting house saddled with a bad venture must often, if it is to maintain itself with its clients, sustain the market by buying back securities distributed with much pains and at some cost. So heavy is this tax that some of the most successful mining partnerships in America never go to the public for funds. The Hagen-Hearst partnership, which scored a number of the biggest successes in American mining, always preferred to spend money underground rather than on stock exchanges. Other men frankly accept the situation, and by gambling in stocks of established properties that they control, recoup losses on new ventures.

Business is founded on confidence. The average wage earner deposits his money in a savings bank because he has confidence in the management. He accepts a low rate of interest and the banker is thereby able to make a profit by buying bonds, in which he, in turn, has confidence. The banker takes his profit and lends personal funds on the more risky but more attractive ventures. Thus the accumulated funds of the many make possible the large profits of the few. From one point of view the division is inequitable; but systems that result from years of growth have usually much to justify themselves, and under this plan there is at each stage a margin of safety. When a promoter cuts across lots direct to the investor he may, though he seldom does, pay the latter a larger profit; but he wipes out the safeguards that normally stand between. We believe thoroughly that mining is a proper investment for funds, but we do not believe in the general peddling of mining stocks. A mining venture must be based upon knowledge, and that necessarily limits the number who may participate. We are glad to see that with the passing of the era of 10-cent shares sold on the installment plan, we are returning to the old system of mining partnerships. There are more men out now actively looking for mines and actually spending money on the ground, than there was at the height of the Cripple Creek or Goldfield booms. The demand now is for mines to work, not mines to boom and sell. With the greater skill, the closer personal direction, and the more earnest purpose of the present, the mines are being found. In the meantime promoters and claim owners, not yet alive to changed conditions, are wasting time and money 'presenting propositions' which will not stand analysis. They make statements that cannot be verified and ask prices only justified on the bases of an immediate re-sale to a waiting and crazy public. The public has a towel around its head, and with a firm grasp on the ice pitcher refuses to be interested—and the public is right.

Persistence of Ore in Depth—I

By T. A. Rickard

The paper on this subject presented by my friend, F. Lynwood Garrison, before the Toronto meeting of the Canadian Mining Institute, revives a useful controversy to which I made my first contribution in 1891. It is a subject of vital importance to the mining industry. The application of scientific methods of thinking is the foundation of the art of making money out of ore deposits.

Twenty years ago it was generally held, among speculators and operators in mining, that ore-bearing veins became richer in depth. Deep sinking was advocated as the most practical way of improving the chances of a mine that looked sickly in its shallow levels. The general attitude on the question is exemplified by the following quotation from a prospectus on the Phoenix mine, at Skipper's Point, New Zealand: "It has been inspected and reported upon by several eminent engineers who have declared that the quartz lodes are true fissure veins and in true fissure veins it is well known that there is no fear of giving out or not paying as depth is reached, the experience being that they get richer the farther they go down." This comes from the prospectus as published in *The Illustrated London News*, in 1892. I know the Phoenix mine, for I examined it in 1890; needless to say, I was not among "the eminent engineers" to whom reference is made. Even in those days the true-fissure idea was becoming decrepit, but the fancy lingered that 'true fissure veins' penetrated into the very heart of creation and continued rich to the unknown interior of the earth. The theory that ore was a deposit from mineral solutions welling upward from the interior had generated the notion that the nearer the mine approached the supposed source of the ore the richer it must become. Of course, "experience" had not justified the hope that veins "get richer the farther they go down," but the wish has been the father to loose thinking from time immemorial, especially in company prospectuses.

In the decade following 1883, lateral secretion, that is, enrichment of lodes by leaching of the adjacent rocks, was in the ascendant, in consequence of Sandberger's diagnosis of famous European mining regions, and the hasty exaggeration by others of the views expressed by S. F. Emmons in regard to Leadville. This checked the idea of indefinite enrichment in depth, for geologic reasoning veered the other way, but it was the work done later by Emmons himself and by W. H. Weed on secondary enrichment that gave the geologists valid grounds for controverting a popular generalization.

One of the stout defenders of the old fallacy was William P. Blake. In the *Engineering and Mining Journal* of January 7, 1893, he contributed an article on 'The Persistence of Ore in Lodes in Depth.' He confesses that "the tendency of the theories of lateral secretion seems to be to shake our faith in the full mineralization of lodes at great depths." He refers to rich ore being found in the Dolcoath mine at 2700 ft. below the surface and argues that "in this instance, as in others which may be cited, increase of depth does not show any impairment of the richness of the lode, but rather its betterment. We are not, however, justified in accepting the popular idea, or hope, that lodes grow richer in depth. We shall be satisfied if it can be shown that lodes can be expected to maintain their average value at any depths we are ever likely to reach in mining operations." He essayed to prove this in an interesting article, which ends with these words: "Whatever view we may take of the source of the mineralization of lodes, we may conclude from the evidence that it is deep-seated; and in a homogeneous country rock may be expected to extend as far as we can ever reach downward in mining operations."

The editor (Richard P. Rothwell) invited criticism on the subject. Hence in the issue of January 21, that is, two weeks later, I broke a lance with the old professor. It was easy to point to the fact that Dolcoath, if rich just then in its deepest workings, was a solitary survivor among hundreds of mines in the same district that had become too poor to be operated at shallow levels. Taking other examples quoted by the professor, I controverted his evidence and proffered testimony to the contrary. By way of conclusion I said then: "Let us not bend facts to theories, but rather bring our theories in accord with the facts. When we do so we shall, I believe, find that ores do not, as a rule, persist in depth, much less get richer, but we shall recognize that the exceptions to this general experience are fortunately numerous."

That was 20 years ago; the dear old white-haired professor has crossed the range; his theory in turn has been relegated to one side by geologists as a "popular idea, or hope"; and my youthful assertions have been confirmed by every thousand feet the miner has penetrated the earth.

Since 1893 technical opinion has undergone a great change. The logic of facts has proved irresistible. It is only in a flamboyant prospectus or in a popular article that anybody dares now to repeat the old fallacy. With the revival of interest in the genesis of ore deposits, after the Posepny paper was published, and with the acceptance of a tentative theory of secondary enrichment, especially of copper ores, consequent upon the papers of Emmons and Weed, it became impossible for any responsible geologist to make an optimistic generalization on the subject of the indefinite persistence of bonanzas in depth. The mine-owner might still hug the delusion, but science discarded it definitely and finally.

No discussion can be conducted profitably without an understanding of the meaning of the terms employed. Definitions are a requisite preliminary. 'Persistence' here means continuity, physical extension, or prolongation in depth. 'Ore' is metal-bearing rock that will yield a profit when exploited at a given time and place. Rock that cannot be profitably exploited today is waste. Years hence it may, under better economic conditions, be exploitable profitably. Thus also the ore, or moderately rich rock, in a given decade or in a given mine may be the 'bonanza,' that is, the inordinately rich ore, of another decade or another mine. Miners habitually look for rich ore, namely, material that will yield a handsome profit. It is not usual to go deep in the pursuit of ore that leaves a scanty margin for dividends unless a good reason exists for expecting a betterment in depth. I say that it is not "usual," because sagacious persons recognize the fact that beyond the ordinary expenses entailed there are extraordinary expenses and all the accidents of industry to be set against a narrow margin of profit. The risk becomes unattractive. Persistence of ore means the continuity of ore that will not only meet the cost but will yield a surplus for dividends. Next we come to 'depth,' a term variously used, for in its essence it is comparative. In a new district, 500 ft. is deep; in an old one, 1000 ft. is shallow. But we do not use the term in the sense employed by a mechanical engineer, we use it in this discussion to convey the idea of the mining geologist. To the latter the first dividing line between the shallow and the deep zone is the water-level, with its concomitant chemical change from the oxidized to the sulphide ores. However, even this is elementary and insufficient, for while in regions of average rainfall the water-level may be at 200 or 300 ft., in arid regions it comes much nearer to surface, so that it is reached at 40 or 50 ft. The level at which water hinders mining was early recognized as marking a change in the character of the ore; this change at first connoted impoverishment because it involved refractoriness and costliness of metallurgical treatment, but later it was found to be attended in many cases, as in some copper and silver lodes, with sulphide enrichment of a most

positive nature. Still later evidence, obtained by deeper sinking, went to show that for some distance below the water-level the finding of rich sulphide ore was likely. Conditions favoring secondary enrichment might in some cases, as at Butte, continue to a depth of 2500 ft. from the surface. In gold mining the rich orebodies were found to extend far below 1000 ft., bonanzas being sometimes uncovered at twice that depth. In short, 'depth' became a term the significance of which varied locally, according not only to the amount of shaft-sinking but the geologic structure ascertained thereby. Thus the term is incapable of a definition universally applicable. It is essentially comparative. The old idea of increasing richness in depth or the modified notion of a maintenance of moderate richness persistently downward alike meant that the orebody was expected not to come to an end but to continue indefinitely deeper. No limit was set to profitable mining except the mechanical obstacles incidental to the increasing distance from the surface. During the last 20 years, however, the improvement in pumping, hoisting, and boring machinery has more than sufficed to enable man to go deeper than any orebody he has yet uncovered. At one time several of us argued against the probability of indefinite persistence or increasing richness in depth. Now we deny it—as a generalization—confidently. A tragedy has supervened: a lovely theory has been killed by a number of ugly facts.

Those who made their wish the father to their thought had not the courage of conviction. Obviously, if lodes generally become richer in depth, their system of mining was all wrong. If an orebody is confidently believed to extend 5000 ft., for example, it is absurd to sink a hundred feet at a time and stope the ground overhead; this would be what a Cornishman calls "pulling out the h'ore by the 'air of the 'ead." As compared to a bolder and more comprehensive scheme, it is underhand stoping and winzing. A good miner who knew that his orebody reached to 5000 ft. would sink a main shaft to the bottom of the ore and open up the mine in a big way. Of course, the capital required would be greater and the return upon it would be delayed; but that would be no obstacle to enterprising men if it assured richer ore and a constant supply of it to a mill of heroic proportions. Moreover, the dangers and difficulties that befall every big and deep mine by reason of the caving of ground due to the ever-increasing pressure of the hanging-wall country upon the old workings would be obviated by excavating from the bottom upward. There would always be a thick arch to protect the stopes, and that arch would become weakened in proportion as its burden became less dangerous. No; the experienced miner may echo the loose optimism of the promoter or the make-believe of the speculator; but he knows better. He follows the ore from surface, never knowing when it may thin to a thread; he takes short views of geologic continuity; he proves his mine before he builds his mill.

Man has never failed to go deeper than the orebodies he has found. The Comstock, the copper lodes of Luke Superior, the saddle-reefs of Bendigo, the veins of Przibram are usually considered to typify the most profound search for the valuable metals. The Adalbert shaft at Przibram, in Bohemia, attained a depth of 3600 ft. below the surface and 1850 ft. below the sea-level. It was highly productive for a long time, but it is now idle, because it became unprofitable to continue mining operations. The Cambrian sandstone in which the rich ore was found is succeeded in the hanging wall of the deeper workings by pre-Cambrian slate, but the origin of the ore is associated with dikes of diorite. The ore in the deepest workings shows the same structure as in the upper levels; only it is less rich.

The Comstock was once synonymous with a natural treasure-vault, yet its bonanzas were found at a relatively shallow horizon. The big bonanzas of the California and Virginia mines reached from 1100 to 1860 ft. The most productive portion of the Comstock mines was above the level of the Sutro tunnel, which cuts the lode at about 1850 ft. below the outcrop. The Combination shaft was sunk to a vertical depth of 3260 ft. Later workings from the Union shaft went down to 3350 ft., but they found only patches of rich ore. Broadly speaking, mining became unprofitable in depth, not because of hot water or other physical obstacles, but just because rich ore was less plentiful and barren rock was more abundant.

The deepest metal mine in the world is the Tamarack, at Calumet, Michigan. This mine is the 'deep-level' of the Calumet & Hecla, that is, it gets the lode on its dip after it passes out of the vertical side-line of the Calumet & Hecla property. The No. 1 shaft of the Tamarack cut the Calumet conglomerate lode at 2270 ft. and the Osceola amygdaloid lode at 1000 ft. deeper. The No. 5 shaft, which is 5253 ft. deep, cut the Calumet lode at 4835 ft., and the No. 3., which is 5281 ft. deep, cut it at 4662 ft. The deepest workings in any metal mine are those of the No. 5 shaft, for they extend to 5368 ft. vertically below the surface. The Red Jacket shaft of the Calumet & Hecla cuts the same lode at 3287 ft. and was sunk at 4920 ft. In 1901 it was recognized that the wonderful run of ore had been bottomed. The yield of copper in the Calumet & Hecla declined from 5% in 1873 to 3% in 1900, and 1½% in 1910. The Tamarack venture was a disappointment, for it was based on the expectation of persistent ore. The Tamarack paid its last dividend in 1907 and was absorbed by the Calumet & Hecla in 1911. The future of the Calumet & Hecla company depends not on its own deep workings but the yield from shallower subsidiary mines.

The 180 mine at Bendigo was, for many years, the deepest gold mine in the world. After it ceased to be the deepest, other mines in the same district maintained the tradition for profitable work at a greater depth. It was more a tradition than a fact. The maximum depth attained at Bendigo is in the Victoria Reef Quartz mine, which has a shaft that has been sunk to 4614 ft. A saddle formation cut in the neighboring New Chum Railway mine at 4154 ft. induced the further exploration of the same orebody, which, on its pitch, would enter the Victoria Reef Quartz claim at 4800 ft. But the undertaking was never completed because the representatives of the Lansell estate, the chief shareholder, withdrew financial support, despite a subsidy subscribed by the Mining Department of Victoria. In the New Chum Railway the orebody averaged 6½ dwt. per ton, a yield quite insufficient to compensate for all the expenditure incurred in sinking and cross-cutting before stoping could actually begin. Now all the deep mines on the New Chum line have ceased operations and work has been diverted to prospecting the shallower ground, incompletely tested at a time when the fashion was to sink deeper in the vain hope of finding richer ore. When I was at Bendigo first, in 1890, it was held that any mine in unproductive ground needed only to be deepened to return to the dividend list. Up to a certain point deep sinking proved sagacious, but that was at a horizon far above the ultimate depth attained. I doubt whether mining at Bendigo on the whole was profitable below 2000 ft. Some mines were temporarily profitable, but allowing for the unsuccessful properties and for the expense incurred even by the successful ones in their search, I question whether money was made below 2000 ft., which is less than one-half the total depth attained in this celebrated district. I ventured to express my own doubts in regard to the deep-sinking craze in 1890, and then advocated lateral exploration on intermediate 'lines of reef,' as the anticlinal lode-channels are named locally. Now the mine managers are of the same opinion, for *The Bendigo Advertiser,** the exponent of local industry, speaks of the vindication of the "shallow ground" theory, and proceeds to say: "In almost every, if not in every, gold mining area in the world the experience is that as considerable depths are attained, the gold is scarcer. The depositions of quartz may be more or less or practically the same as in the upper levels. Opinions vary on that point, but most authorities agree that as the earth is penetrated to great depths gold is less plentiful. Bendigo investors and speculators know from

*June 10, 1912.

bitter experience the absolute truth of the latter point, as far as this field is concerned." This is interesting, especially to one who remembers the confident optimism of a bygone day. The editor of the *Advertiser* may not be a scientific man, but his frank submission to the logic of facts is deeply significant, for he expresses the opinions prevalent among the most intelligent of the mine managers at Bendigo. No local mining paper would have dared to talk in this strain twenty years ago.

The Great Cobar Copper Mine

One of the excursions of the annual meeting of the Australasian Institute of Mining Engineers was to the above mine and smelting plant on June 1 and 2; and the *Mining and Engineering Review* of July 5 gives an interesting résumé of the company's property. H. C. Bellinger, general manager for the Cobar company, is the president of the Australasian Institute of Mining Engineers, and the visiting engineers had an instructive and pleasant time at Cobar.

The Great Cobar property comprises a group of four mines, three of which have been purchased during recent years. The lodes of the Cobar district occur along a narrow belt of Silurian rocks, some 20 miles long, which is flanked both east and west by Devonian quartzites and slates. Both the Silurian and Devonian rocks have been intensely folded, and strike about 17° west. No lodes occur in the Devonian, and those in the Silurian are lens-shaped in horizontal section. At the 1200 and 1400-ft. levels of the Great Cobar mine, the orebodies keep their size. The ores consist of iron pyrite, copper pyrite, pyrrhotite, magnetite, and galena. There is an absence of outcrops of igneous rocks at Cobar. The main shaft, 15 by 8 ft., is down 1400 ft., and is equipped with a hoist having cylinders 22 by 48 in., drums 10 ft. diameter and capable of lifting a 2-ton load at 2000 ft. per minute. The steel head-gear is 67 ft. high. The ore reserves in the mines are as follows:

Mine.	Tonnage.	Copper, %.	Gold, dwt.
Great Cobar	2,000,000	2.6	1
Cobar Gold	350,000	1.5	10
Chesney	750,000	2.7	1
Peak	Development on lode to prove reserves.		

The parent mine has three great lenses of ore, which are about 70 by 450 ft. in the centre lens, 90 by 300 ft. in the north lens, and 50 by 150 ft. in the south lens. These lenses are separated from one another by fair widths of mineralized slate.

Previous to being bought by the Great Cobar, the Cobar Gold, and Chesney were worked as gold mines, and treated their ores in stamp-mills, but the ore became too refractory for such treatment. Now the output from the group is smelted. The cars of ore from the shaft cages are emptied into a storage-bin holding 450 tons, by a rotary tipple. The ore is broken by two Hadfield gyratory crushers, then passes over picking belts to the bedding pits. From these it is put into cars, a small portion from each being kept in a special car, which, when full, is sent to the sampling mill. This mill includes a Babcock & Wilcox tray conveyor having a capacity of 50 tons per hour, at 45 ft. per minute, which delivers the ore to a similar conveyor set at an angle of 20°. This feeds a No. 5 McGully breaker, and a 15% cut of the broken ore is made by a 64-in. Simplex sampler. After a No. 3 McGully breaker, a 20% cut is made by a 44-in. machine. Rolls, 24 by 14 in., further crush the sample, and a 28-in. machine takes a 15% cut. After another set of rolls, 24 by 14 in., another 15% cut is made, the final samples going to a sample grinder.

The smelter consists of four blast-furnaces, each 56 by 240 in., with a total capacity of 200 tons daily, the present average being 1250 tons. The furnace charge is approximately four parts of Great Cobar ore to one of siliceous ore from the other mines mentioned. No furnace slag is used in the charge, excepting that from the converters. There are two tiers of water-jackets, 4 by 10 ft., and there are 40 tuyeres supplied by a 34-in. bustle pipe. The furnaces are 8.5 ft. from ground to tapping-floor; 26.5 ft. from tapping to charging-floor; 50.25 ft. from charging floor to top of the auxiliary stack; and 19.5 ft. from top of superstructure to down-take. The furnace charge-cars have capacities of 34 and 44 cu. ft. There is a continuous discharge from the furnaces to the forehearths, 4.5 ft. by 9.5 ft. The slag flows into Berg and Dewhurst slag ladles of 200 and 280 cu. ft. capacity, and is taken to the dump. The converters are of the barrel type, 84 by 126 in., with 14 tuyeres, and are handled by two 40-ton Babcock & Wilcox overhead cranes. The power-plant contains 6 Babcock boilers of 3580 sq. ft. heating surface, fitted with stokers and superheaters. Three Browett-Lindley triple-expansion engines of 250 hp. each are direct-connected to Siemens generators, for general power purposes. The furnace blast is supplied by four Morley engines coupled to two Connersville blowers, 48 by 78 by 96 in., having a capacity of 36,000 cu. ft. of air at 42 oz. pressure. The converters are supplied by a Walker Bros. compressor, supplying 9000 cu. ft. at 36 to 48 oz. pressure.

Costs per ton are: Mining, $2.26; smelting, $1.78; converting, $0.42; total, $4.46.

In 1911 the Great Cobar property treated 346,303 tons of ore yielding 6548 tons of blister copper, valued at $1,830,000. The total production of copper since 1876 amounts to 89,009 tons.

Mining in Quebec in 1911

According to the returns received by the Quebec Mines Branch from the producers, the mineral production of the province during the year 1911 reached a total value of $8,679,786, an increase of $1,356,505 on the previous year. By the addition of Ungava the area of Quebec is now 708,000 square miles, offering great scope for prospecting. Railways already and will increasingly render accessible northern parts of the province. There were no changes or amendments in the mining law during the past session of the provincial legislature. Two field parties were sent out by the Mines Branch during the year, one mapping out the geology of an area in the vicinity of Kewagama lake, south of the National Transcontinental railway, while the other party began an investigation of the iron resources of the state, with special reference to the deposits of titaniferous ores. The report of the Mines Department gives details of mining of various minerals, and contains reports on the following: 'Accidents in Mines,' by J. H. Valiquette. There were 7846 men at work, the fatal rate being 0.77 per 1000 employed. 'Report on the Montreal Quarries,' by J. H. Valiquette; 'Preliminary Report on Some Iron Deposits on the North Shore of the River and Gulf of St. Lawrence,' by E. Dulieux; 'The Magnetic Sands of the North Shore of the Gulf of St. Lawrence,' by the same writer; and 'Report on the Geology and Mineral Resources of Keekeek and Kewagama Lakes Region,' by J. A. Bancroft. The papers are well illustrated with maps and half-tones. The most important mineral products from Quebec in 1911 are as under:

		Value.
Asbestos, tons	102,224	$3,026,306
Cement, bbl.	1,588,283	1,931,183
Bricks, number	176,532,000	1,129,480
Limestone	.....	1,128,402
Granite	.....	308,545
Lime, bushels	1,284,914	284,334
Copper and sulphur ores, tons	38,554	240,097
Mica, pounds	.....	76,428
Gold, ounces	590	11,800
Silver, ounces	23,000	11,500

Besides the above, there were fair quantities of many other minerals produced.

Mines of the Republic District, Washington

By Sidney Norman

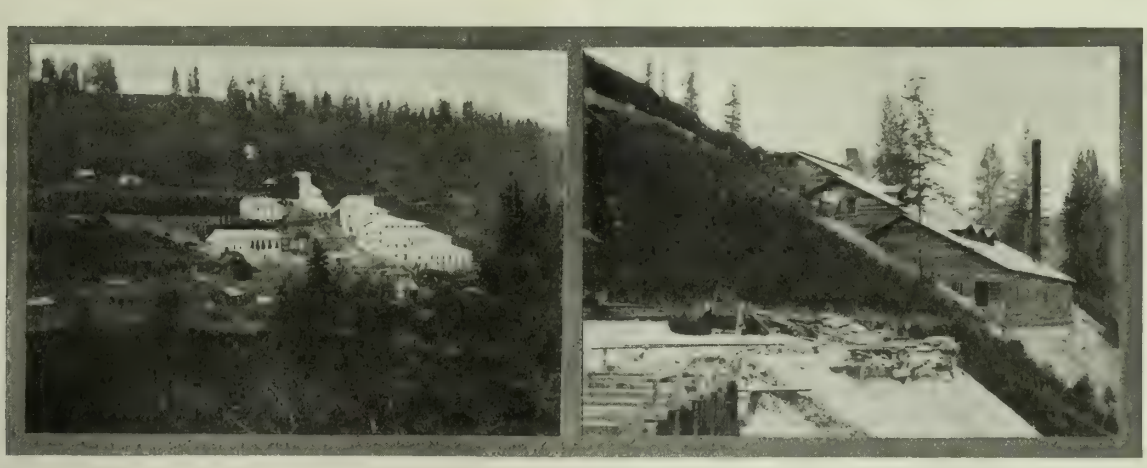
Unless all present signs fail, the gold camp of Republic, Ferry county, Washington, which passed through a 'boom' 12 years ago and subsequent abandonment of operations, will soon become as popular as it was in the earlier days. From a pessimistic community of but a few hundred souls five years ago, Republic has grown to a prosperous thriving town of perhaps 2000 population, while new arrivals are in evidence daily, and the residential facilities of the town are taxed to their utmost.

The resurrection of the camp dates from about four years ago, when J. L. Harper, who had been operating at Belcher, secured control of the old Republic group from the county, to which it had reverted for unpaid taxes. Just previous to the transfer the property had been leased by the county to a partnership of miners which included James Casey, formerly superintendent under the Patrick Clark regime, and several high-grade shoots had been found and ore shipped from the old workings. Within a short time after Mr. Harper assumed control, a different aspect had been placed upon the property, and dividends amounting to $35,000 were subsequently paid. From that time forward public interest in the district revived, though the residents of Spokane, who had financed a large majority of operations in the early days, still looked with skepticism upon the movement. Money supplied by the farmers of the Palouse country has been largely responsible for the revival, and particular credit is due to T. A. White, of Colfax, who helped to finance the early operations of Mr. Harper.

REPUBLIC, WASHINGTON, FROM THE NORTH.

A little more than two years ago dissension arose in the ranks of the stockholders of the New Republic Mining Co., which had been organized by Mr. Harper, the net result being his retirement and the subsequent haphazard development of the ground. Later it passed to the Rathfone Reduction Co., which erected a cyanide plant for the treatment of the old tailing pile, and met with some success. The property is not now being worked, but it is understood that engineers have just concluded an exhaustive examination of the old workings with the idea of consolidating the New Republic, Rathfone Reduction, and Princes Republic companies. Should such plan be consummated, the Rathfone plant will be brought up to greater capacity by the addition of adequate crushing machinery, thus giving to the camp three plants fully equipped for the reduction of its ores.

After severing his connection with the New Republic, Mr. Harper turned his attention to the Lone Pine, the Surprise, and adjacent ground on the east side of Eureka gulch. Working bonds were secured, and the development of the ground undertaken. Since that time 46,734 tons has been sent forward to the Granby and Trail smelters, of an average value approximating $22, and the total value has been $1,067,603 gross. During last March 1841 tons was shipped averaging $21.26 per ton, while in April the output was 2475 tons, averaging $17.63. The first 862 tons shipped in May gave smelter returns of $17,364, or an average of $20.13 per ton. These are the latest figures available, but the probabilities are that the shipments since then have been of higher value, owing to the discovery of a large high-grade orebody near the point where the 670-ft. incline shaft passed through the vein. A winze is being sunk on this shoot and was down 75 ft. on June 10. At that time it showed a full bottom of quartz, and daily mine samples from June 7 to 11 gave a general gross average of $59 per ton. No returns from the smelter are yet available on this particular shoot, but mine assays or carload shipments have run around $35 per ton.



MILL OF NORTH WASHINGTON P. & R. CO. BELOW REPUBLIC. MILL OF THE SANS POIL CON. CO., FROM No. 2 DUMP.

The extraction of this large tonnage of high-grade ore necessarily exposed larger bodies of ore that could only be economically treated by modern milling methods. Consequently Mr. Harper organized the North Washington Power & Reduction Co., with the eventual purpose of constructing a 1000-ton cyanide plant to treat ores of the Republic Corporation and custom ores. The first building was constructed to house machinery for two units of 125 tons capacity each, and the first of these units was placed in operation in May, under the management of Harry W. Newton, formerly connected with the Gold Road mine, Mohave county, Arizona. No close estimate of sav-

ing has yet been made, but it is the general opinion of mining engineers who have visited the plant that the problem of economical extraction has been solved.

The new plant occupies a site on the west side of Granite creek, within a quarter mile of the abandoned plant of the old Republic Gold Mining Co., erected in 1900 by D. C. Jackling. It is served by the Great Northern railroad from a spur running above the ore-bin level, and from this point the ore is trammed to crusher-bins, from which it is fed by a shaking-grizzly, with bars spaced at 1½ in., to a 20 by 10 Blake crusher. The product then goes to an 8 by 12 Dodge crusher and through 30 by 14 rolls to a belt-conveyor which carries it above the mill-bins to a Vezin sampler. From the mill-bins the product goes to a 6-ft. Trent Chilean mill, where it is ground to 16-mesh in cyanide solution. All material of 200-mesh overflows to the Trent agitator, the oversize going to a 22 by 5-ft. tube-mill. The tube-mill product is returned to an Akin classifier, where any not passing 200-mesh is again returned, the finished product flowing to the Trent agitator. In the first Trent agitator the pulp is thickened to the proper consistence for agitation and passed on to agitator No. 2. The overflow solution from No. 1 is returned continuously to the Chilean mill by a 2-in. centrifugal pump. The agitators, four in number, are connected in series for continuous agitation, the pulp passing from one to another by displacement. Thence the product flows to a 16-ft. Oliver continuous filter and the solution is pumped to clarifying tanks. The clear solution flows to the gold-tank and from there is fed to Trent precipitation tanks automatically fed with zinc-dust. The treated solution is pumped by a 6 by 8 Goulds triplex pump to the refinery above the mill.

Another reduction plant of 'resurrected' Republic is that of the Sans Poil Consolidated Mining Co., which acquired the Sans Poil and adjacent ground from Finch & Campbell about two years ago. Development carried on since that time has exposed large bodies of milling ore, while shipments aggregating 3300 tons, of a value of $18 per ton and a total value of $59,511, have meanwhile been sent forward. To treat this milling ore, and part of the product of the Knob Hill mine to the northeast, a 125-ton plant has been erected on the Sans Poil claim on the west side of Eureka gulch and about one mile to the north of the plant of the North Washington Power & Reduction Co. The machinery was turned over for the first time on June 8 and everything is now ready for the initial run as soon as track facilities at the ore-bin level have been provided by the Great Northern railroad. To prevent any delay in delivery of ore, the company has also undertaken the construction of a cable tramway that will haul mine-cars to the ore-bin level. The entire plant was designed by the Hammond Manufacturing Co. and has been erected under the superintendence of E. J. Morris. The main building is 90 by 100 ft., and rests on concrete foundations, as do as well all tanks and crushing machinery.

The mill design closely follows the Grass Valley type of continuous cyanide treatment, though novel crushing machinery has been introduced in the shape of a Williams hammer trommel mill, closely resembling the Quenner mill, used with such success in the Altar dry-placer fields of Sonora, Mexico, some years ago. An exact duplicate of the mill has been in use for the past year at the United States Government work on the Celilo canal near The Dalles, Oregon. There it is said to have been eminently satisfactory with a record of 20 tons crushed in one hour from coarse feed to ¼-mesh. A practical test, in my presence, on mine-run ore from the Sans Poil, resulted in the crushing of 1000 lb. to 3/16 inch in exactly two minutes, or at the rate of 15 tons an hour, or 120 tons in a shift of 8 hours. Feeding was done by hand, and the engine was not speeded up to capacity until the last few seconds of the run. If the mill can hold up to this test in daily work, it will provide sufficient feed for a 24-hr. run in one shift of 8 hours. Such a result would completely solve the problem of economical coarse-crushing; particularly when it is remembered that a large portion of the product is converted to a fine powder in the process. The product of the Williams mill is delivered by worm-conveyor to an elevator boot that raises it to a storage bin, an automatic sample being taken on the way. Thence the product goes to a set of fine-crushing rolls, and from there it is passed on to a 5 by 12 Gates tube-mill, where it is ground to slime in cyanide solution. The discharge from the tube-mill is elevated by a tailing wheel to a duplex Dorr classifier, where a separation is made of coarse and fine material. The fine material passes to a 24-ft. diameter by 10-ft. deep Dorr thickener, and the coarse is returned to the tube-mill.

The thickened material from the bottom of the Dorr thickener passes by gravity through 10 cone-bottom air-lift agitators, connected in series and allowing sufficient contact with the cyanide to dissolve all soluble gold. The clear solution is returned to two battery-tanks for classifying purposes, the discharge from the agitation tanks flowing to a 16-ft. Oliver continuous filter of 125-ton daily capacity. The tailing is sluiced to the flat below the mill, and the solution delivered to four clarifying tanks for precipitation in twenty-four 18 by 24-in. iron zinc-boxes. Water supply is obtained from a well in the gulch and elevated to the mill by an electrically-driven power pump. Power is supplied by two boilers of 110 hp. each and a 200-hp. Erie automatic centre-crank engine. Agitation is maintained by a 10 by 16 by 10 steam-power compressor.

The Knob Hill company, largely financed by farmers of the Palouse country, is another concern that has met with success since the revival began. Its property consists of the Knob Hill and Mud Lake claims at the head of Eureka gulch, just northeast of the Sans Poil, and acquired from Jonathan Bourne of Portland, Oregon, on a bond of $125,000, with a 25% royalty applying on the bond. From this source the sum of $46,373 has already been credited on the bond, and further payments of $35,000 have also been made. Dividends to the extent of $45,000 have been declared, and sufficient is now on hand to warrant the assumption that distributions to stockholders will be maintained. Within about twenty months the company has shipped 8594 tons to smelters with a gross value of $277,687, or an average of $32.31 per ton. The highest consignment in that period was 47 tons, sent forward in May of last year, which yielded $6058 gross, or an average of $129 per ton. In extraction of this higher-grade ore large bodies of good milling ore have been uncovered, and for the present 50 tons will be sent forth daily to be treated in the Sans Poil mill. If the latter demonstrates its efficiency, the company will then undertake the erection of its own plant.

Several other properties well known in the earlier history of the camp, including the Morning Glory, Blacktail, Insurgent, Butte & Boston, Quilp, and others, are being worked in some degree, the payroll for May showing a total of 364 miners and surface men employed in the district. The Mountain Lion, Tom Thumb, and Rebate, all lying to the north of the main zone of activity, are at present idle, but in each case are rumors of impending sales that may result in resumption of operation before the summer is over.

The prime necessity of the district at this time is cheap power, and it is said that such arrangements are in a fair way to be perfected by Mr. Harper, of the Republic Mines Corporation and North Washington Power & Reduction Co. If plans mature, a high-power line will be constructed to Danville, 28 miles east, where connection will be made with the lines of the West Kootenay Power Co., owning a hydro-electric plant of great capacity at Bonnington Falls, below Nelson, British Columbia, on the Kootenay river. Estimates of cost run from $50 to $60 per horse-power-year when such plant is in operation, and it is believed that present milling costs of around $3 will thereby be cut at least one dollar. Coal at $6.70 per ton, shipped from Crow's Nest is now used to generate power.

Mines of the Globe-Miami District

By F. C. Calkins

The copper mines of the Globe-Miami district, Gila county, Arizona, are producing copper at the rate of nearly 60,000,000 lb. per year, most of this production coming from two mines, the Old Dominion at Globe, and the Miami mine near the town of Miami. When improvements now being made at these mines are finished, and development and construction work at the Inspiration Consolidated mine at Miami is completed, and that mine placed on a producing basis, the annual production of the district will be not far from 140,000,000 lb. of copper, or over 10% of the production of the United States. The three large and important mines of the Globe-Miami district are the Old Dominion, the Miami, and the Inspiration Consolidated.

PRINCIPAL GROUPS OF CLAIMS AT MIAMI.

The economic history of the district and of the Old Dominion mine dates from the year 1874, when a band of prospectors, braving the hostile Apaches, crossed the Pinal mountains from the west and located the Globe claim of what is now the Old Dominion mine. Other locations rapidly followed, and several small settlements were established, and during the next few years many claims were producing high-grade silver ore. With the decline of silver, attention was turned to the mining of copper, as there were numerous surface indications. In 1881 the Old Dominion company was operating a small furnace about one mile west of what is now the town of Miami, on copper silicate ore from a small vein in the schist nearby, bu this proved unprofitable, and the smelter was moved to Globe, the Globe mine was purchased, and in 1884 two 30-ton furnaces were in operation. Since that time the mine has passed through several periods of idleness and reorganization, having changed hands several times, but has been a steady producer since the advent of the railroad in 1898, and a dividend-payer since 1907. In that year the Miami orebody was discovered in a belt of mineralized schist five miles due west of Globe, and the next five years was a period of wonderful development, during which the Miami Copper Co., the Inspiration Copper Co., the New Keystone Copper Co., and the Live Oak Development Co. proved up, by underground work and churn-drilling, the third largest deposit of copper ore in the United States, it being exceeded in size by only the Utah Copper and the Ray Consolidated deposits. Four mines have been developed on what is virtually a single ore deposit which contains several breaks and barren patches, but is over two miles long and has a maximum width of 1500 ft. The ore occurs as disseminated chalcocite in silicified schist near its contact with granite porphyry. In some places the ore extends into the porphyry. A new mining district has been created in which over 1600 men are employed, and the number is steadily increasing. The town of Miami has a population of 2000, and the population of the Miami district is estimated to be about 4500. The population of Globe has increased from 1500 in 1902 to over 7000, according to the 1910 census.

Chalcocite was disclosed by adits on the Inspiration claims as early as 1902, yet it was not found in commercial quantities, and the discovery of the immense deposit really occurred on April 13, 1907, when No. 2 shaft of the General Development Co. entered 4% ore at a depth of 225 ft. By the spring of 1909 three other companies had been organized and were exploring and developing the mineralized schist belt, and by the end of 1911 over 65,000,000 tons of ore had been proved. Following is a list of the developed ore reserves according to the latest official reports:

Mine.	Tons Ore.	Copper, %.
Miami	18,000,000	2.58
Keystone	2,500,000	2.25
Inspiration	30,000,000	1.95
Live Oak	15,000,000	2.10
Inspiration Consolidated	45,000,000	2.00
Total	65,500,000	2.17

The Old Dominion Copper M. & S. Co., which also owns the United Globe mines, produced in 1911 about 26,500,000 lb. of copper at a cost of a little over 9c. per lb. Of this, about 19,000,000 lb. was derived from ore from the Old Dominion mine and the rest from United Globe and custom ores. The ore is of two classes: oxidized ore, averaging 7.75% copper, which is directly smelted, and sulphide ore, averaging 3.5% copper, which is first concentrated. Improvements of plants and mining equipment are continually being made, and $500,000 has been appropriated to be expended on new construction and equipment during the next two years. One of the most notable improvements now being made is the lining of the 2-compartment Kingdon shaft with concrete, which has been completed for a depth of 870 ft., with 130 ft. more to be lined. A separate flue and dust-chamber has just been built at the converter plant and a new converter-stand has been ordered which will replace the three now in use. Thereafter basic instead of acid lining will be used. Plans are being made for enlarging and doubling the capacity of the 500-ton concentrator and for equipping the shaft for hoisting ore in skips instead of cages.

It is estimated that when the above improvements are completed, the annual production will have been increased to about 30,000,000 lb. The mine is essentially a vein mine, and, owing to the large amount of water encountered and the heavy nature of the ground, it is impossible to block out ore very far in advance of mining, but the mine is said to have more ore in sight than at any time in its history, and it is believed that it will be a producer for many years to come. The deepest workings are only 1200 ft., and there remains much ground to be explored. About 1200 men are employed. G. H. Dowell is general manager, George Kingdon, mine superintendent, and L. O. Howard, superintendent of the mill and smelter.

Late in the year 1906, Fred Alsdorf, a mining engineer, and F. J. Elliot, a lawyer of Globe, secured an option on the mining claims that have since been developed into the Miami mine. J. Parke Channing was in Globe at the time, negotiating for the Inspiration claims, which he finally refused to consider on account of the excessive price asked, and after an examination of the Miami ground, acquired the option for the General Development Co., a Lewisohn corporation. Work was started on December 8, 1906, with Mr. Alsdorf in charge. Late in February

1907 the Red Rock, or No. 2 shaft, was 195 ft. deep, with no sign of ore, and the Captain, or No. 1 shaft, had disclosed only 70 ft. of 2% ore, and it was decided to cut a 20-ft. sump and then cross-cut into the hill. At the bottom of the sump the formation began to look a little better. Mr. Alsdorf continued sinking on his own responsibility, and in 10 ft. more, or a depth of 225 ft., the shaft went into chalcocite ore assaying 4% copper. The shaft was continued and ultimately reached the 720-ft. level, being continually in ore to a depth of 710 ft., giving a total vertical depth of 485 ft. of ore. In November 1907 the Miami copper Co. was organized, and the development of the mine, mostly by underground work and partly by churn-drilling, proceeded rapidly. By the end of 1910 there had been developed 18,000,000 tons of ore averaging 2.58% copper, and a 3000-ton concentrator, power-plant, and pumping station had been completed. On March 15, 1911, the first unit of the concentrator was started and by February 23, 1912, all six units were in full operation. The mine is now producing about 2,700,000 lb. of copper per month at a cost of about 9c. per pound, and one dividend has already been declared. The concentrator, designed by H. Kenyon Burch, is declared to be one of the best in the world, and when improvements now being made in the crushing machinery are completed, production is expected to be at the rate of 3,000,000 lb. per month. Diamond-drilling is disclosing ore below the 570-ft. level that was never included in the estimate of 18,000,000 tons, and it is conservatively estimated that at least 4,000,000 tons more will be developed. In addition to this, there is being developed by churn-drills, on the northeastern part of the property, a large body of ore averaging from 1 to 1.25% copper, which, while not now of commercial grade, will some day undoubtedly be mined at a profit. The mine is opened up by 27 miles of drifts and raises, and this figure is being added to by a mile per month. About 900 men are employed about the mine and concentrator. The concentrate is at present smelted at Cananea, Sonora, Mexico. J. Parke Channing is vice-president and consulting engineer, B. B. Gottsberger general manager, N. O. Lawton mine superintendent, and F. W. Solomon superintendent of the concentrator.

Encouraged by the success of the Miami Copper Co., William B. Thompson, of the Gunn-Thompson company, acquired the Inspiration claims and promoted the Inspiration Copper Co. in December 1908. Development was started in February 1909. Henry Krumb was the consulting engineer. At about the same time, H. B. Hovland and Hoval A. Smith secured the Live Oak mine, which had formerly produced about $600,000 worth of copper-silicate smelting ore, and organized the Live Oak Development Co., starting work early in 1909. Development of both mines was conducted partly by underground work, but mostly by churn-drilling, and by the end of 1911 there had been developed at the two mines a total of 45,000,000 tons of ore averaging 2% copper. Near the close of that year John D. Ryan and associates bought control of the Live Oak company, and in January 1912 effected its merger with the Inspiration company, forming the Inspiration Consolidated Copper Co. with a capitalization of $30,000,000. A period of active development and construction work has been begun that will involve the vast expenditure of $7,000,000 in the next two years. Three development and two main working shafts are being sunk and the first haulage level is being opened. Many miles of drifts and raises will be driven to bring the mine to the point of production. Plans are being drawn for a 7500-ton concentrator, power-plant, necessary railroads, shops, etc., and construction is expected to begin in about a month. A water-supply dam has been built across Pinal creek and a pumping plant is being erected. About 600 men are employed and the number is steadily increasing. It is estimated that the mine will be able to produce 70,000,000 lb. of copper per year. Charles E. Mills is general manager, L. D. Ricketts consulting engineer, and T. R. Drummond superintendent of the Inspiration mine.

Following the development of these orebodies a number of companies have acquired claims for prospecting purposes. The Southwestern Miami Development Co. is exploring by churn-drilling a group of claims lying to the southwest of and adjoining the Live Oak mine. The Live Oak orebody apparently continues into this property and three holes have penetrated chalcocite-bearing schist. One of these holes is reported to have disclosed commercial ore. Four other holes are now being drilled as rapidly as possible. The South Live Oak Development Co. is exploring with a churn-drill the Schultze group of claims about a mile southwest of the Live Oak mine, but has not yet discovered ore. The most important mines near Globe, in the prospect stage of development are the Arizona Commercial, Iron Cap, and Superior & Boston. Arizona Commercial, which adjoins the Gray mine of the United Globe, is preparing to sink 1000 ft. to develop the extension of the Old Dominion vein. The shaft is already down 800 ft. and is being enlarged to three compartments. The Iron Cap mine adjoins the Arizona Commercial, and its equipment is being overhauled preparatory to resuming work on the sixth level. The Superior & Boston adjoins the Arizona Commercial and is developing on the twelfth level. Shipments of ore are being made from the upper levels.

Many other prospects are being worked in a small way, some of them for gold ore. The Duquesne mine has been making irregular shipments of gold-lead ore. The Gibson mine, seven miles west of Miami, is a famous small producer of high-grade copper ore, being credited with a total production to date of about 6,000,000 lb. of copper, and is now shipping about three cars per month of 16% ore. The Black Warrior mine, now idle, has produced about 15,000,000 lb. of copper in the form of copper silicate ore. About eight miles northeast of Globe the old McMorris mine, a famous producer of silver in the early eighties, is being reopened by the White-Metal Development Co., and the 800-ft. shaft has been retimbered to a depth of 200 feet.

The towns of Globe and Miami are situated on the Arizona Eastern railroad, a branch of the Southern Pacific, which joins the main line at Bowie 125 miles southeast of Globe. Miami is ten miles by rail west of Globe, and is the terminus of the line. Globe is pleasantly situated on the Globe hills along Pinal creek, at an elevation of 3500 ft., with the Pinal mountains rising to an elevation of 8000 ft. eight miles to the southwest. It is the county seat of Gila county and has a population of over 7000 inhabitants. Miami is five miles due west of Globe, near the Miami mine and at the base of the foothills of the Pinal mountains. The town was founded in October 1909 and now has a population of about 2000, which number is rapidly increasing. Many new buildings are going up and most of the business blocks are being built of concrete.

The Globe-Miami district is pre-eminently for copper production, although there is a small output of gold and silver, most of which comes from the Old Dominion mine. Production is now at the rate of nearly 60,000,000 lb. of copper per year and should be at the rate of 140,000,000 lb. within three years. At present Miami concentrate is shipped to Cananea, as the Old Dominion smelter is not equipped for smelting it. It is believed that a new smelter will be built in the district to handle the concentrates from the various mines. About 3000 men are employed about the smelter, concentrators, and mines, and the total population is estimated at about 12,000. The miners are mostly southern European races and the minimum wages are $3.50 for eight hours work. The mines at Miami have an assured life of at least twenty years and the district will probably be producing copper after the present generation of miners has drawn its last pay check.

DEATH RATE due to accidents on Rand gold mines in 1911 was 3.57 per 1000 whites, and 4.02 per 1000 colored workers, while the death rate due to disease among all Transvaal mine employees was 12.89 per 1000 whites and 28.85 per 1000 natives.

Improvements at Ashio Mines and Mills

By H. Foster Bain

Among the mines visited by the American engineers who traveled through Japan last year was the Ashio, the leading copper producer of the Empire. This mine has already been described in the *Mining and Scientific Press* (October 14, 1911) by Thomas T. Read. I propose merely to present here supplementary data gathered at the time of my visit or supplied since through the courtesy of the engineers of the Furukawa Mining Co., the owning corporation.

The Ashio mine, of which K. Inouye is manager, produced 16,964,227 lb. of copper in 1911, an increase of 1,332,901 lb. over the output for 1910, and thereby maintained its position at the head of Japanese copper mines. Since new workings and new dressing plants are constantly being added, and some of the most extensive improvements had not been completed at the end of 1911, the production may be expected to continue to increase for several years. While pressed close by the Sumitomo and Fujita companies, the Furukawa company is the leading copper concern in the Far East. It now manufactures about 1000 tons of copper wire per month and is an extensive buyer as well as miner of ore. In Japan the era of trolley cars has just begun. Interurbans are operated between Yokohama and Tokyo and local lines in all the principal cities. In a country of dense population, abundant water-power, and mountainous topography, it takes no prophet to see a rapid extension of electric lines. This is all the more probable since in many parts of the Empire railway lines even yet fail to reach important towns. With no vested interests to overcome, the trolley magnate should thrive. The Furukawa company is not, however, looking to the local demand alone, but is already preparing to enter the markets of India and Australia. The energy and skill that have developed the company to its present prosperous condition assures success in the new fields.

In preparation for the expected larger trade extensive additions are being made by the Furukawa company to the treatment plants. At Nikko the capacity of the refinery is being doubled, and in Fig. 1, 2, and 3 is presented the flow-sheet and outline of the new mill for concentration of second-grade ore that was being built last fall at the mouth of the Tsudo adit at Ashio and which has since been completed. I am indebted to J. Kojima, engineer for the Tsudo mine, for these plans. The mill differs only in detail from those already in operation. The ores in the mine are separated into two grades known as first and second class. The first is raised by hand picking to a 12% copper content, and bagged for shipment to the smelter. The second, which averages 1% copper, is sent to dressing plants similar to the one illustrated in the accompanying figures. Essentially the ore is crushed, sized, jigged, and finally treated on tables. A peculiarity of the practice is the placing of picking tables at the head of the mill so as to sort out any remaining lumps of ore. The tables used are stationary, 8-sided, and horizontal. They are covered with boiler plate and have holes for delivery of waste and middling. The feed is through a vertical spout to the middle of each table, and around this spout is a rain of water which washes the ore as the picker rakes it toward the edge with a small cobbing hammer. Lumps of clean ore are thrown into a waiting car and the remaining material is directed to the appropriate outlet. The picking is done by women, who receive from 7½ to 12½c. per day, averaging about 10c. Women are also employed in spalling and picking out coarse rock where the ore is dumped over grizzlies and before it is wet, but none work underground.

Another interesting feature of the mill is the double cone illustrated in Fig. 4. These cones are placed ahead of the fine jigs. The pulp falls against a stream of rising water and three products are made; a lip-discharge which goes direct to the Callow cones and thence to tables, and two spigot discharges which go to fine jigs. From the dimension drawing the construction of the cones may be readily seen. The size of the opening in the bottom of the inner cone is regulated by a hand-wheel and vertical screw as usual. The discharge of the inner cone is through an iron globe which fits like a valve in the bottom of the outer cone. To regulate the discharge of the latter, the inner cone is raised or lowered by a second hand-wheel.

Still a third peculiarity of practice in the Ashio mines is that of neutralizing, as well as settling, the waste water. This process, which has in view the protection from damage of crops grown in the valley below the works, has now been so perfected as to result in saving enough copper to pay for the extra work. Details of the process have been published in the *Transactions* of the American Institute of Mining Engineers (February 1912), by J. W. Richards, and need not be repeated. Briefly, the sand and slime are settled as perfectly as possible in a first pool, metallic hydrates are carried down in a second and third, in a fourth by means of 10 to 20% milk of lime, the neutralization and precipitation is advanced, and in a fifth it is completed. Finally in a sixth pool the water is run through a sand-filter before being sent back to the mill or allowed to escape. The water as it comes from the mills carries 0.00025% copper.

In the smelting and refining plants, as well as in the concentrating mills, there are many novel and interesting things to see. The ore is smelted in blast-furnaces with pot-roasting of the fine material and with the usual bessemer converters. Prior to the introduction of pot-roasting, which has become the common practice in copper smelting in Japan, the Furukawa engineers worked out a number of ingenious methods of handling the fine ore. Mr. Read has already mentioned the plan of making the ore into a ball and casting around it a thin shell of matte. On the whole, however, probably the most successful device is the briquetting machine invented by Sabro Watanabe, but four years out of school at Tokyo, and now an advanced student in Germany. Discarding the ordinary plunger and roll types of machines, he adapted the gravity stamp to the work. The moistened oil is fed to a horizontal revolving plate which carries it successively below six stamps each weighing 120 lb. and dropping 10 in. The plate moves 1½ revolutions per minute and stops eight times in each revolution; once to permit filling the hole in the plate which constitutes the mold, six times under successive stamps to receive one blow from each, and once for a plunger to clear the mold. The briquettes are 4 in. diameter, cylindrical, and 4 in. high. The machine requires but one man and 2 hp. It prepares 35 tons of briquettes in 24 hr., and the cost is 30c. per ton.

Another interesting little trick in practice is a plan for promoting smooth running of the blast-furnaces by feeding coal, when needed, through the tuyeres. This was devised, with the assistance of T. Watanabe, by Kosahu Asano, now head of the smelting department and a graduate of the Massachusetts Institute of Technology. The device has been described with drawings in *Metallurgical and Chemical Engineering*, by J. W. Richards. It consists in placing in each tuyere double flap valves that can be opened at will, and using a cylinder of 4 in. diameter and 12 in. long with a movable piston to force coal, first placed in the cylinder, through the tuyere and into the furnace. By this means a source of heat and reducing gases may be placed at will at any critical point. In practical operation fuel equal to about 3% by weight of the ore is thus introduced into the furnaces.

One of the most interesting features of smelting at Ashio is the neutralization of the furnace fumes. As the average amount of sulphur in the ore as it goes to the roasting plant amounts to 25%, and the smelter is in a narrow valley in the midst of a rich farming country while the climate is exceptionally moist, it is extremely important to prevent

drainage from escaping SO_3 and SO_2 in the fume. The plan in operation was devised by K. Asano, and while not entirely successful, is susceptible by careful work of greatly reducing the danger of damage. The smelting plant includes three blast-furnaces, each 160 by 42 in. at the tuyeres, and 11 roasting pots. The gases from both roasting and smelting plants, after passing through a dust-chamber, are conducted through a chimney sloping up the side of the mountain and broken at four places by vertical steps 40 ft. high. These are 12 by 12 ft. in cross-section, and at the top of each is an iron plate containing 200 1-cm. holes through which rains down a solution of lime water. This reacts on the SO_3 and to some extent on the SO_2, probably forming sulphites. It requires 40 cu. ft. of water per minute and 300 lb. of burned lime per hour, to neutralize the gases, and they are reduced to a content of 0.5% SO_2. These purifying chambers are placed well up the hill so as to get the pull of the gases as far as possible. No fan is used, but one will probably need to be added when, as is planned, additional washing chambers are built. Last fall when the plant was visited the gas coming from the chimney was nearly colorless, only a slight yellowish tinge, perhaps from sulphide of arsenic, being seen. Further progress with this interesting process will be watched with interest, but enough has perhaps been said to illustrate the fact that Japanese mines are not only hives of industry, but also of invention, and are well worthy of careful study by mining engineers and metallurgists.

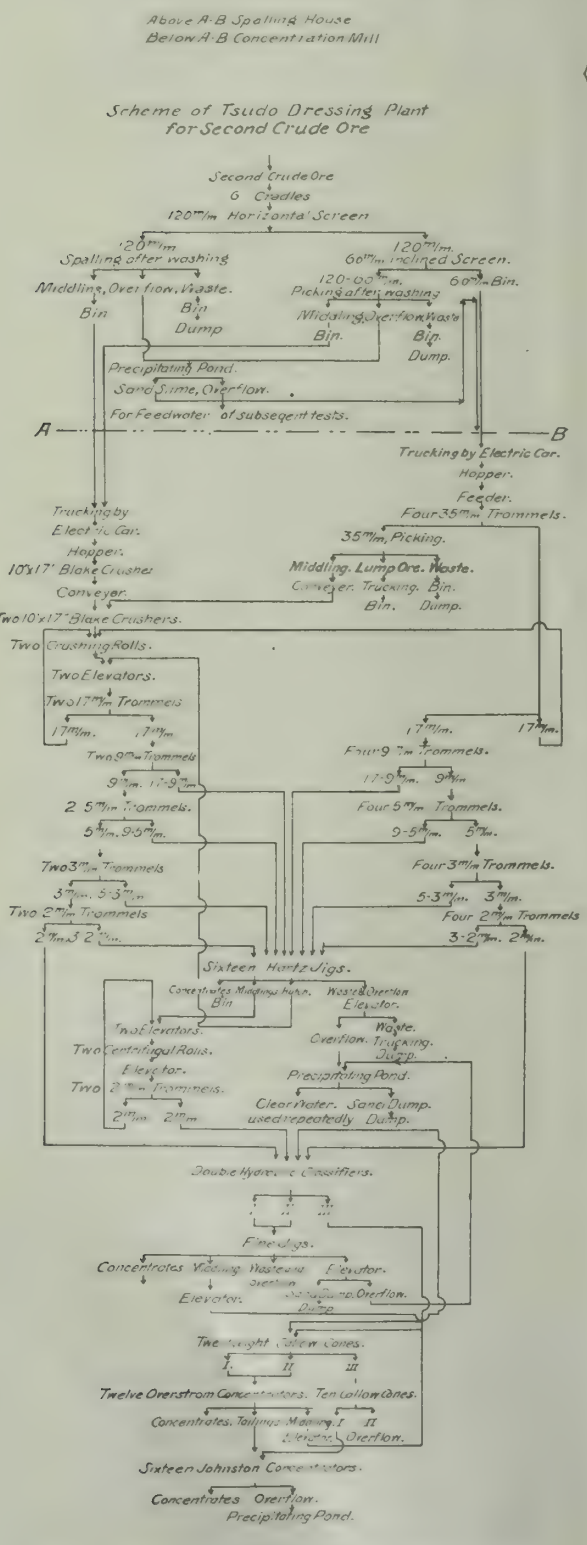


FIG. 1. FLOW-SHEET OF TSUDO MILL, ASHIO, JAPAN.

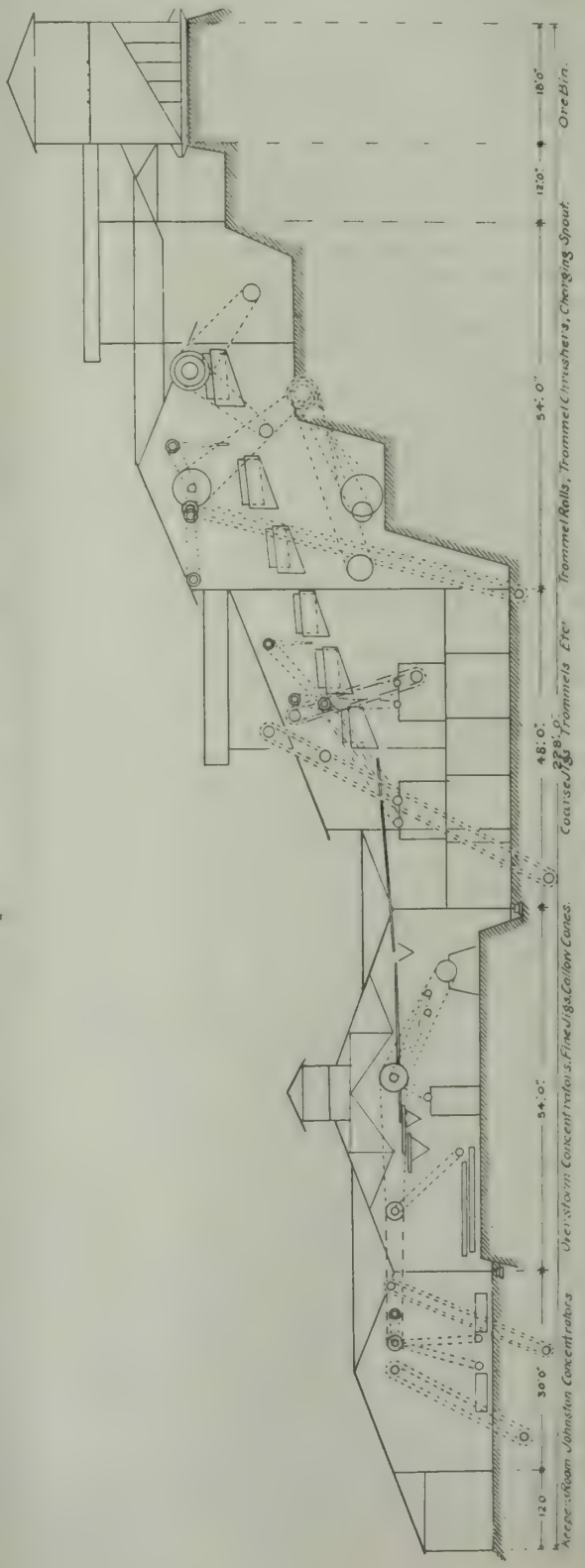


FIG. 2. PROJECTION OF TSUDO MILL, ASHIO, JAPAN.

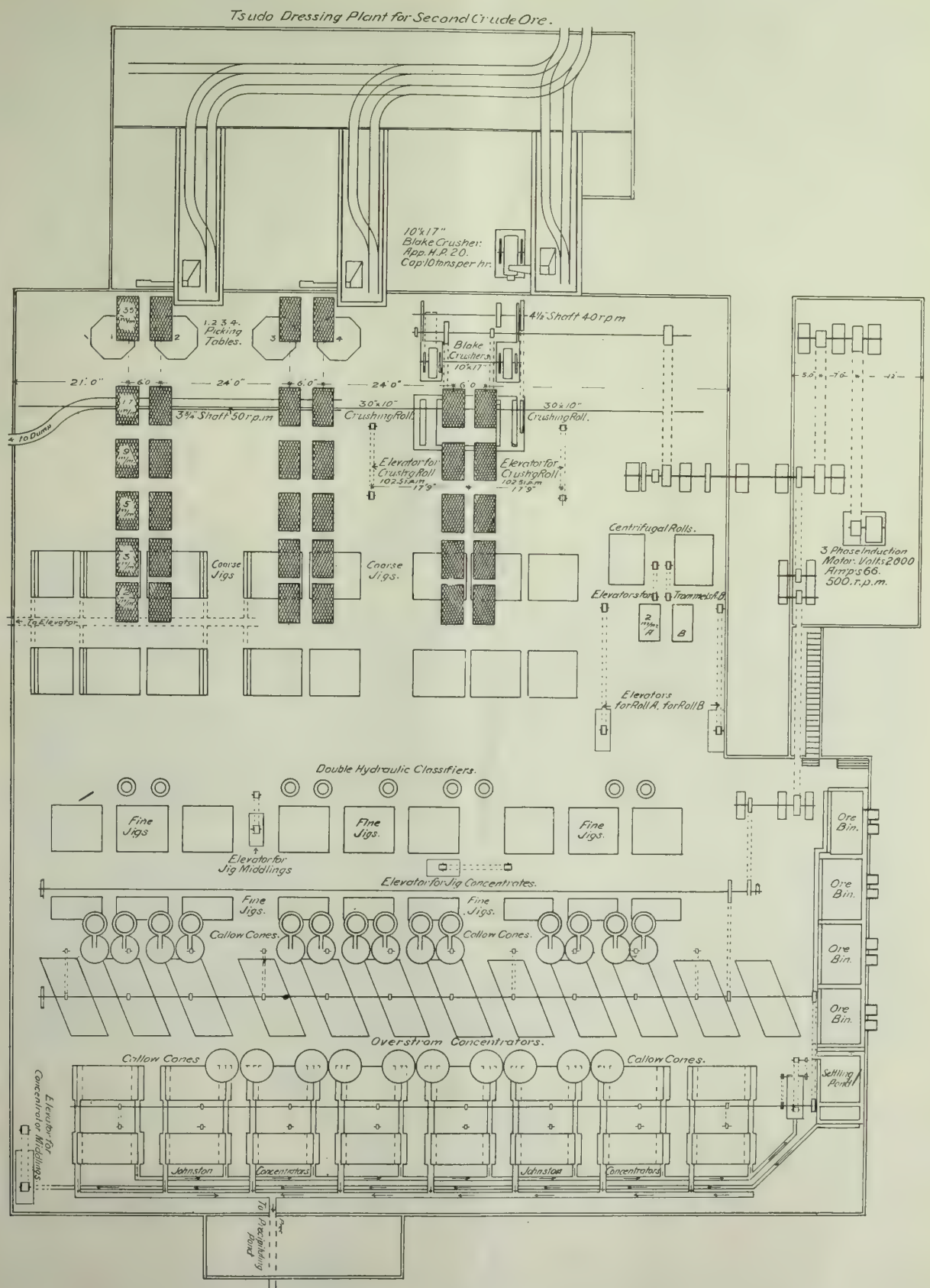


FIG. 3. GROUND PLAN OF TSUDO MILL, ASHIO, JAPAN.

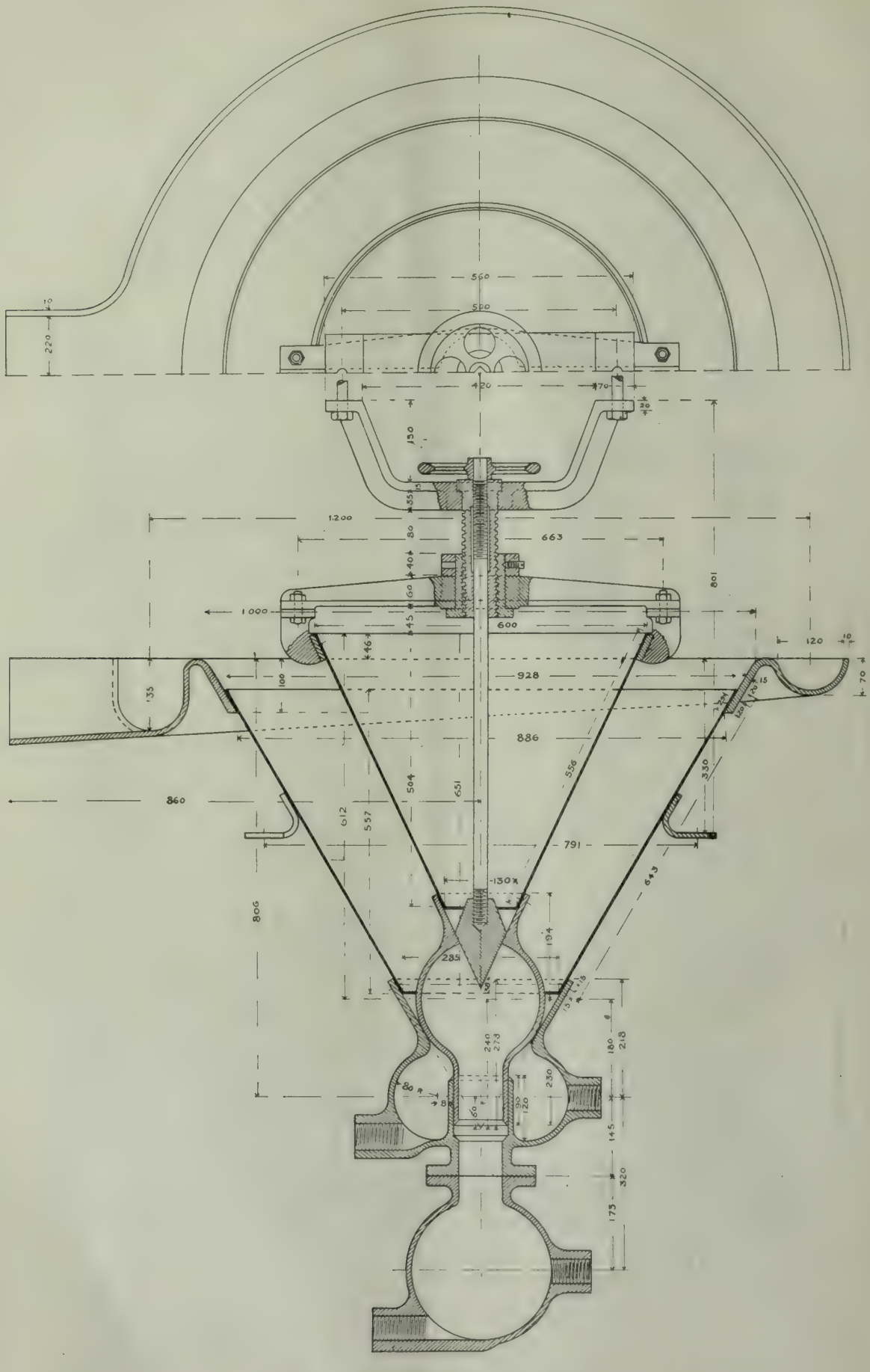


FIG. 4. DOUBLE CONE USED AT ASHIO.

Stacking Hydraulic Tailing

By W. W. Edwards

A novel method of handling the tailing from a hydraulic mining sluiceway has been devised by the North Columbia Gold Mining Co., under the management of J. M. Ruffner. This company operates hydraulic leases on Pine creek in the vicinity of Discovery, about six miles above Atlin, B. C. The method as shown in the illustration operates with poor dumping facilities, but with an abundance of water, and permits the handling of material cheaply by a new application of the monitor's stream. The company's ditch supplies 15,000 miners' inches to the giants under about 100-ft. head. This ditch, by the way, was dug by a steam-shovel mounted on a scow, which floated down an old ditch line, enlarging it from a previous capacity of 1000 miners' inches. There are two complete hydraulic installations about half a mile apart. The grade of bedrock on Pine creek here is only about one per cent. This makes impossible the disposal of tailing by ordinary means. A sluiceway 150 to 200 ft. long, with angle-steel riffles and block paving is ordinarily used, set on a grade of 3 or 3½ in. per 12-ft. box. The discharge end of the sluice is placed on clean bedrock. The grade used thus brings the sluice intake a foot or two above bedrock, but with the large amount of water available the material is easily driven into the sluice, through the action of four or five monitors used at the intake end. Ordinarily the dump would block this sluice immediately. Two or three monitors are placed at the lower end of the sluiceway with their streams directed at right angles to the tailing stream as it leaves the sluice. The heavier gravel, which would pile up in a heap, is thus forced to the side. Gradually a pile of tailing is started below the mouth and to the side of the sluice line. As this pile grows and the monitors continue to drive out more material, the stacking monitors are raised slowly, their streams following up the slope. When a monitor has driven its charge of gravel to the top of the pile, it is again lowered and the operation repeated. By this means the coarser gravel is all stacked. A good deal of the finer material is carried on down the creek by the water and fills up the creek bottom, but as this lower ground has been worked out already no harm results, especially as a great deal of this fine material is boomed out in the spring by the freshet and carried down to Atlin lake. The sluice-boxes are moved from one location to the next by teams and rollers. The piles of tailing look like dredge tailing and are about 15 to 20 ft. high, with slopes of about 2 horizontal to 1 vertical.

The abundant water-supply is also utilized to run an air-compressor which furnishes air for hammer-drills. These drills are used in breaking up the fallen slabs of clay overburden, thus saving blasting charges. High duty cannot be claimed for the water with the above described system of operation, but where, as in this case, water under a low head is plentiful, this method of tailing disposal has much to recommend it.

STACKING TAILING AT THE NORTH COLUMBIA MINES.

Zinc Production of Utah

The production of zinc in Utah in 1911, according to Victor C. Heikes of the U. S. Geol. Survey, was 17,840,261 lb., valued at $1,016,895, against 16,367,104 lb., valued at $883,824, in 1910. This shows an increase of 1,473,157 lb., or 9%. The Park City mining district alone produced 8,596,564 lb. of zinc in 1911, and the Bingham district 4,715,121 lb. The zinc concentrate, amounting to 13,156,-682 lb., all came from Salt Lake, Summit, and Wasatch counties. There were 208 mines producing gold, silver, copper, lead, or zinc in 1911, against 183 in 1910. The total quantity of ore sold or treated in Utah in 1911 was 7,268,530 short tons, an increase of 879,132 tons. The average total recoverable value per ton was $5.07 in 1911, against $5.04 in 1910. The average value per ton is low on account of the large tonnage of copper ores, of which 6,121,099 tons was sold or treated. Of the total ore of all classes, 267,111 tons went to gold and silver mills, 5,840,-091 tons to concentrating mills, and 1,103,054 tons to smelters.

The production of lead in Nevada in 1911 was 3,263,657 lb., valued at $146,865, against 4,871,130 lb., valued at $214,329, in 1910, a decrease of about 33%. Lead decreased in all counties but Clark and Douglas. The mines of Clark county, the largest producer, yielded 1,629,571 lb., an increase of 319,887 lb. over the production of 1910.

The Premier Diamond company employed 11,865 natives during 1911.

Impressions of the Comstock

By Thomas T. Read

The modern American resembles the ancient Athenian in that new things engage the greater part of his attention. Though the Comstock orebodies are in many ways the most remarkable in the world—the hottest, and richest, at one time the most studied, and now the most neglected, the scene of the invention or devising of many useful appliances and methods of work, developed by the deepest shafts and equipped with the finest machinery of their time—they have now sunk to the status of counters in the game of stock-selling. Their rôle in the history of mining in America has been one with which every engineer should be reasonably familiar, but engineers of the younger generation, while no stranger to the South African 'banket', the 'reefs' of Australia, and the placers and mines of South American countries, commonly retain only vague memories of a hasty perusal of the volumes by 'Dan de Quille', of Church, Lord, Richthofen, King, and others; books so eagerly read thirty years ago, but now quietly gathering dust upon the shelves undisturbed, except for the moment by some curious student. Twenty-five miles north of the lode, hundreds of engineers pass and repass yearly along the main line of the Southern Pacific railroad, but almost none linger by the way to follow the course of the Virginia & Truckee railroad as it winds up from Reno in the valley of the Carson river to Virginia City, a distance of sixty tortuous miles, though the direct road is but 25 miles long.

The traveler, however, who makes the journey begins to be repaid from the first moment of leaving the main line. The yellow cars of the Virginia & Truckee, waiting at the main-line station, look as though they might be well preserved specimens of the first rolling stock of the road. The story is told that in 1868 William Sharon, then local agent of the Bank of California but fast budding into a captain of finance, sent for Isaac E. James, the leading surveyor of the district, and asked him whether he could run a road from Virginia City to the Carson river. "Yes," was the reply. "Do it, then, at once," was the rejoinder, and before the end of 1869 trains were running from Carson to Virginia City over a track 13½ miles long, with a total curvature of seventeen full circles, with a maximum grade of 116 ft. to the mile, Virginia City being at 6200 ft. elevation and Carson City 1575 ft. lower. It is recorded that the line was built by Chinese labor, and confirmatory evidence is found in the interior of the cars, which surely were decorated by Chinese artists. As the train pulls out through the valley of Steamboat creek and across a low divide into the Carson valley, one accustomed to the gray deserts which border the main line is astonished at the verdure of these surprisingly green and broad valleys.

Carson City is quickly reached, but yields a sense of disappointment, for it seems more like a New England county seat than the capital city of what is, in many ways, the most remarkable mineral-producing state of the Union. Still, it is scarcely fair to judge any city by that portion of it visible from the railroad, unless, like Cincinnati, it is so conveniently inclined as to present the whole expanse to the observer in a car window. After leaving Carson City, the train soon begins to follow the course of Carson river, and the ruins of the early mills are conspicuous objects. Henry De Groot has described* vividly and in detail the pioneer mills, and their builders, and I will only note here that the first mill in Nevada was built in 1860 by Almarin B. Paul, four miles south of Virginia City, near Gold canyon, and his first contracts provided for a treatment charge of $25 to $30 per ton, even though the ore crushed was richer in gold than in silver. Some of the later mills were remarkable. The Ophir mill, near Lake Washoe, covered an acre of ground, and it is recorded that up to April 1, 1862, some 3000 tons had been milled at a cost for milling, freight, and office expense of $115 per ton. The Gould & Curry mill was built in the form of a Greek cross at a cost of $900,000. After treating about 5000 tons of ore, at a cost of nearly $50 per ton, it was remodeled, almost from the foundations, at a cost of $560,000. It need not be added that the first two decades of the history of the Comstock was a period of romance and prodigality. Fortunes were quickly made, and often as quickly dissipated. Only men of balance and a sense of proportion retained their gains and made them a basis of solid prosperity. Fair, Mackey, Flood, O'Brien, Sharon, Jones, and others thus became prominent figures in the world of finance, while scores with less balanced judgment threw their winnings into hare-brained schemes and saw them vanish as quickly as they had come.

By the middle of 1880 the Comstock had produced $306,000,000, not including the tailing, which averaged over $43 per ton, or nearly $50,000,000 more. Over one-third of this, or $108,861,230, was produced by a single bonanza found in the Consolidated Virginia, California, and Ophir, from a little over a million tons of ore. The early records are contradictory, but it has been estimated that 16 bonanzas produced $272,000,000 from 6,350,000 tons of ore; an average yield of nearly $43. In 1879 the issued capital of the companies which had been formed was $364,000,000, and only $116,000,000 in dividends had been paid.

Only about a third of the gross output of the mines had trickled through to the shareholders in dividends. But it must not be rashly assumed that all the remainder was wasted. The machinery of present-day mining and milling was then in process of development, and the development of machinery and processes on high-grade ore is ever fatal to the dividend account. Pumping was expensive, too, for the Sutro tunnel did not hole through into the Savage mine until July 1878, and it was almost a year later before it became effective for drainage, while the Ophir, for example, had been pumping 146,000 gal. per day in 1872, using wood-burning engines, operating at a cost of $72,000 per year. The cost of the Sutro tunnel is interesting. The main part is 20,489 ft. long and cost $2,100,000, and, since the contracts between the mining companies and the tunnel company provided for a royalty upon the ore hoisted instead of a charge for the amount of water pumped into the tunnel, it was indeed hard lines that it reached the lode only at the end of the period of bonanza ore production and has since served to drain mines that continue to exist largely upon assessments. In a way the Sutro tunnel was a tremendous disappointment. The Government commission appointed in 1871 reported that it would be of great practical value in exploring the ground east of the lode, but its service for drainage and ventilation would not be commensurate with its cost. The investors expected large returns from the royalty of $2 per ton of ore hoisted from the mines which it drained. But it proved valueless in prospecting (as most deep-level adits do). It has carried away rivers of water from the mines in the past thirty years, but the greater part of all the output of the Comstock had already been hoisted before the tunnel was completed.

Another great disadvantage was the heat, which began to make itself felt as soon as the mines began to reach considerable depths, and gradually increased until on the 2840-ft. level of the Yellow Jacket the rock had a temperature of 154°F. and the air of the drifts reached 110°F. and higher. Nearly all the other mines were equally hot, and only a visit to the lower levels will convince one accustomed to the summer climate of New Mexico and Arizona that such temperatures are almost unbearable. Engineers who have come to examine the Lode have found their energies almost totally consumed in conveying them from one water-spray or ice-water tank to the next, and the efficiency factor of underground labor can readily be inferred. Conditions of work underground present surprises. The men drink liberally of ice-water, with no bad effects, though the

Mining and Scientific Press, February 10, 1877.

casual visitor not unnaturally fears a congestive chill. At mealtime at some of the shafts the miners rush to the station, pull off their dripping garments, and put on others equally wet and are hoisted to the surface, where the temperature is 35 to 75° lower, to eat their dinners. It is not remarkable that, as the superintendents remark, after they have been up a little while they are glad to get back to work. A uniform wage scale of $4 per shift is paid, having been put in force in 1867. Wages elsewhere have steadily risen, but not on the Comstock. The explanation is simple, the wage is 'what the traffic will bear.' A company which exists upon assessments is not a good employer from whom to demand an increase of wages. In 1880 and 1881 assessments amounted to $12,041,590 and dividends to $370,000. In 1910 the Comstock mines produced $502,843 in gold, and in 1911 this rose to $977,349, besides which in the latter 618,006 oz. of silver was shipped, according to figures compiled by the U. S. Geological Survey.

With men working for a moderate wage under arduous conditions it might be expected that only the lowest class of workmen could be secured. But the tabulation made by Eliot Lord in 1880 showed that of a total of 2770 workmen, 816 were Irish, 770 Americans, 640 English, 191 Canadians, 83 Scotch, and less numbers of other nationalities, only 14 being Italians and 1 Slavonian. This preponderance of the Anglo-Celtic element still holds good. To me it seemed that the fascination of a bonanza must appeal strongly to the imaginative Celt, else why should a skilled miner continue to work in what is a foretaste of Gehenna for the same wage as in other mines? The workmen I saw were of fine physique, but the training of a crew offers obvious difficulties where the shoveler receives the same wage as the skilled miner.

Will the Lode yield other bonanzas? Who knows! Thirty years of desultory work has not served to disclose them, and meanwhile the mines pour out an unceasing flood of hot water. J. A. Church, who advanced the theory that the heat is generated by the kaolinization of the feldspar in the eruptive, saw no hope that the mines would ever penetrate beyond the hot zone. The water is a heavy burden, and the earlier belief that it is derived from the vadose circulation is somewhat shaken by the fact that the water being pumped from the lowest level is as hot as at first, after thirty years of pumping. It must be said that if bonanzas can be found neither heat nor water will act as effective deterrents to their exploration. Not long ago a daily chronicled the story of a mine in the southwest where the owners, in their search for ore, were driven back by an inflow of water too great to handle. After a few years of inaction the directors came to visit the mine to devise, if possible, some means of reopening it. Lo, the mine was dry; the lowest levels were even dusty. Some geomorphic movement had opened new channels and drained away the water. The apocryphal story is typical of the spirit of the miner, at once the most practical and most mystical of men.

The Comstock is notable as well because it has contributed so largely to the development of mining in America. The Burleigh drill was perfected while driving the Sutro tunnel, and square-set timbering was devised by Philip Deidesheimer to support the wide stopes necessary in taking out the bonanzas. It is perhaps less generally known that I. L. Requa, the father of M. L. Requa, devised the first self-dumping skip for use in the Combination 4-compartment shaft, which, at the time it was completed, was the deepest and best equipped in the world. The Wheeler pan and the Washoe process were likewise products of the ingenuity called forth by the exigencies of Comstock conditions. The glory of the Comstock, like the glory of Israel, has departed, but it, like the ancient people, makes its influence felt in contemporary achievement.

THE Transvaal Miners' Phthisis Sanatorium building and equipment cost $260,000, and has accommodation for 70 patients. Twenty-eight were in residence at the end of 1911. Maintenance of the institution for the term cost $18,300.

Mining in Western Australia in 1911

The annual report of the Mines Department of Western Australia is now at hand. Although the past year's work has been noted to some extent, the remarks of the Secretary for Mines, H. S. King, are of interest, as well as the corrected figures of mineral production.

There has been another decrease in the total mineral output which is being experienced by the other states of Australia. In spite of the falling output, it is hoped that the new discoveries made during the year, together with judicious advances for machinery, provision for crushing, and other facilities will cause an improvement before long. At the same time, it is to be feared that, unless capital is more easily obtained to carry properties beyond the prospecting stage, any marked increase in the gold yield is, on present prospects, unlikely. The discoveries at Payne's Find, in the Yalgoo goldfield; at Mt. Egerton, in the Peak Hill goldfield, and Weston's, in the Yilgarn field, all separated from each other by considerable distances, are encouraging and promise to come up to expectations. The severe drought has retarded operations generally. Another factor to the falling output is the general reduction in the grade of ore as greater depth is attained. The Government continues to render assistance to bona fide prospectors by loans of equipment and means of transport. That the prospector is not idle is shown by the fact of 10,028 acres being held as prospecting area for gold and minerals. The area held under mining lease for all minerals is 65,258 acres, a decrease of 843 acres against 1910. For prospecting coal and oil, 38,500 acres is held, a reduction of 11,789 acres. There was a decrease of 857 men employed in gold mines, and 264 at copper and coal mines.

During the year, 2,735,943 tons of gold ore was treated at all mines, a decrease of 148,355 tons. The East Coolgardie (Kalgoorlie) field showed an increase of 90,453 tons. On this field 5836 men are engaged at all work, and the production of $16,050,130 was recovered from 1,726,998 tons. The output is lower, but generally the field is encouraging. On the East Murchison field three mines closed down and two others reduced their output. Large decreases were reported from the Broad Arrow, North Coolgardie, Mt. Margaret, Murchison, and Coolgardie fields. In the Black Range district, the Yuanmi mine should add considerably to the output; while in the Murchison, the Cue district shows an improvement. The Day Dawn district is quiet and the Great Fingall's output decreases. Around Coolgardie there are promising developments. The prospecting which followed on the Bullfinch discovery has resulted in opening of fair prospects in outlying centres. A plant is being erected at the Bullfinch and should soon be working. At the close of the year there were 33 state mills at work, and from the inception of this system 843,780 tons of gold ore was treated, with a yield of $18,600,000; and 51,553 tons of tin ore produced tin worth $343,000. During the term under review only 59,373 tons was handled, yielding $1,161,654 in gold. There was a loss on working the mills of $37,400; $1,450,000 has been spent to date on all plants, and the total loss is $144,000. The Geological Survey department consists of 19 officers, who have been busy throughout the state at varied problems. Assistance to small mines, under the Mining Development Act, totaled $42,500. The Water Supply branch sunk 14 shafts, 993 ft. in all; hand-drilled 169 holes, 11,622 ft.; and diamond-drilled 6 holes, aggregating 1907 ft. Tanks and reservoirs were enlarged, improved, and roofed at several points.

The production of all minerals during 1911 was:

Gold, value	$29,115,000
Coal, tons	249,980
Copper ore exported, 22,676 tons, worth	$390,500
Tin ore exported, 560 tons, worth	$303,500
Lead ore exported, 1549 tons, worth	$75,000
Pyrite mined, 9739 tons, worth	$17,600
Wolfram mined, 194 tons, worth	$4,350
Silver recovered at mines, worth	$91,500

Mt. Morgan Gold Mining Co., Ltd.

Attention has of late been directed to the operation of this great gold and copper mine, on account of its gold and copper output, shortage of power, change of smelting practice, change in management, and low profits made. The power shortage has been remedied by the addition of four new blowers, and now four blast-furnaces can be kept going. Ores from this mine were formerly roasted and treated by chlorination, the copper being smelted, the necessary limestone and ironstone fluxes being obtained from Marmor and Ironstone island, in Queensland. From precipitation of mine-water, a fair amount of copper has always been won. When the Many Peaks pyrite orebodies, containing up to 2.25% copper and some gold, were opened, and the mine connected by rail with Mt. Morgan, it was decided to start pyrite smelting. Trouble was experienced, and experts from Mt. Lyell were called in to help. The present position is that the whole concern is being investigated. The local press in Australia has criticized the company for indifferent bookkeeping and high cost, but it is fair to remember that those in charge have had many unforeseen difficulties to combat. The annual report of the company for the year ended May 31, 1912, gives the following particulars:

Ore treated (oxidized, silicious sulphide, auriferous copper, and Many Peaks), tons	351,858
Limestone flux used, tons	64,066
Ironstone flux used, tons	367
Waste rock removed from open-cut, tons	222,446
Waste rock removed from underground, tons	8,752
Total gold yield, ounces	134,575
Total copper yield, tons	7,440
Auriferous copper ore content:	
Gold, dwt.	9.93
Copper, per cent	2.71
Total revenue	$ 4,945,000
Total expenditure	3,656,000
Gross profit	1,289,000
Dividends paid	1,000,000
Depreciation	245,000
Reserve funds, total	1,030,000
Ore reserves (copper, 3.5%; gold, $10), tons	1,499,000
Ore reserves, total (copper, 2.5%; gold $5 per ton), tons	2,027,000
Total revenue to date	$89,820,000
Total dividends to date	$39,395,000

Mining in the Transvaal in 1911

The annual report of the Transvaal Chamber of Mines is a voluminous affair of 509 pages, which goes into every detail connected with the mining industry, which produced $190,530,000 in gold, diamonds, coal, tin, and copper during 1911. An analysis of the gold production of this state of the South African Union shows the following:

Ore hoisted and taken from surface dumps (short tons)	27,389,872
Percentage of waste sorted on surface	13.01
Tons milled	24,456,821
Average number of stamps at work	10,020
Average number of tube-mills at work	223
Duty per stamp per 24 hours, tons	7.76
Gold yield from amalgamation	$107,780,000
Gold yield from cyanidation	$67,175,000
Total value of yield	$174,955,000
Value of ore per ton milled	$6.74
Working costs per ton milled	$4.34
Working profit per ton milled	$2.40
Total profit	$58,625,000

MT. MORGAN IN 1889. THE WHITE CROSS MARKS THE TOP OF THE MOUND.

Total gold output of Transvaal since 1884	$1,625,635,000
Total dividends paid since 1887	$415,855,000
Labor employed, white, average	25,655
Labor employed, colored	201,075

In addition to the above data from gold mining, the report gives the diamond output at 1,843,341 carats, valued at about $8,140,000, which mostly came from the Premier mine; 4,343,680 tons of coal; tin ore valued at $2,070,000; and copper ore at $258,000.

The various committees of the Chamber of Mines have dealt with what appears to be a vast amount of work in regard to native labor; miners' phthisis; the Mines and Works Act No. 12, of 1911, especially with reference to the non-working of plants on Sundays; Mining Taxation Act, 1910; Stamp Duties and Fees Act; Companies Act of 1909; Irrigation Act; Local Government Ordinance; Commerce and Industries Commission; Financial Relations Commission; patents, explosives; Workmen's Compensation Act; Water Supply. About 190 pages of the report are taken up with statistics of gold production, coal and diamonds, dividends paid; labor employed and mortality data; and amounts of stores purchased on mines. Native labor seems to be an important feature on the Rand, and much space is given to the subject from recruiting natives to the mortality statistics.

Discussion

Readers of the MINING AND SCIENTIFIC PRESS are invited to use this department for the discussion of technical and other matters pertaining to mining and metallurgy. The Editor welcomes the expression of views contrary to his own, believing that careful criticism is more valuable than casual compliment. Insertion of any contribution is determined by its probable interest to the readers of this journal.

Tonopah-Belmont Mine

The Editor:

Sir—In your issue of August 3, on page 158, an item appears listing the equipment in the new Tonopah-Belmont mill. This list refers to 12 Deister tables. This is an error and the item should read 12 Wilfley tables.

O. H. JOHNSON.

Salt Lake City, August 12.

Railroad Mineral Lands

The Editor:

Sir—The article in your issue of July 27 about railroad mineral lands seems to me to be a topic well worthy of fuller investigation and enlightenment.

In northern California particularly, there has been much confusion and dissatisfaction with the conditions entailed by the grant to the California & Oregon Railroad Co. and its successors, the Central Pacific and the Southern Pacific companies. This grant of land was made to the railroad company by an act of Congress in July 1866, "to aid in the construction of said railroad." This grant gave every other section of land in a strip twenty miles wide through the northern end of the state. Surveys made in 1866, 1868, and 1870 quite freely marked the mineral lands as exhausted, worked out, or abandoned. Later, owing to the development of quartz mining and new discoveries, there was much dissatisfaction over the grant to the railroad.

For many years miners had free access to the railroad grant, and by them it was generally understood that 'mineral land,' meaning in this region land with gold mines and gold-bearing veins, was exempt, or would be exempted from the grant. At a later time, it was claimed that the railroad had not completed its line northward from Red Bluff, or Redding, within the time prescribed under the terms of the grant, and that it would be forfeited back to the government. In some manner this fault was adjusted in favor of the railroad's holding the lands. Again there was complaint and uncertainty among the prospectors, miners, and locators, but they continued to work upon the grant as upon vacant government or public lands.

Within the last eight or ten years the Central Pacific Co. has been active in obtaining final patents to all lands within the grant; even listing and obtaining patents to small subdivisions and fractions of quarter-sections scattered about and connecting with the best mineral-bearing and gold-producing locations. Prospectors and miners were again alarmed, some meetings were held, and indignation expressed. The miners were next soothed into inaction and indifference by a general belief or understanding that, under the terms of the grant, the railroad company was obliged to sell the land at a maximum price of $2.50 per acre when it perfected title to the lands. It was generally thought that this afforded as good or a better chance for the locators and miners to get title than the government itself offered. This understanding again kept them quiet and more or less indifferent and negligent.

It was the custom of the railroad company to list and advertise in the country papers columns of descriptions of these lands by section, subdivisions, and fractional survey figures, which the average prospector or miner had neither time, knowledge, nor patience to wade through. Over the entire region of mountainous and broken land the survey landmarks, if ever properly set up, had been effaced or destroyed. No one but a person familiar with land surveying, and provided with proper instruments, could determine in many places even the section or township boundaries. Under these conditions the railroad acquired title in many instances to lands where mining was in actual progress, to land located and recorded on local district records, and over the heads of miners working their claims. In one instance, at least, patent was granted to the railroad company to land with a 10-stamp mill upon it in operation.

Where a locator or miner was aware that the railroad had 'listed' his land, his recourse was to appeal to the local Land Office, which might be a hundred miles distant, take with him at least two witnesses and prove that the land included a gold mine. To the average prospector this was harder than diorite. The consequence was that he often said, "Well, let 'em get it," thinking he could buy it outright for $2.50 per acre from the railroad company. Now the miner is confronted with the railroad patents to thousands of acres, dispersed and intersecting the best mining ground in the state. He is permitted to prospect upon these lands, but when he applies to purchase any of them he is now informed from the railroad land office that they "are not on the market." In a number of cases known to me, the company's reply to applications was "that their records were destroyed by fire" and the land had to be resurveyed, platted, graded, or whatnot. In other cases: "when the land is on the market you will be advised." Furthermore, there seems to be no limitations as to the price to be asked when it is offered.

Another phase of the situation is that the railroad company, while refusing to sell these grant lands, leases them by the year or longer to stock-raisers. The company rents whole sections of 640 acres, or a number of sections, at $50 or what it can get, per year. This arrangement helps the company and gives the stockmen a splendid opportunity to rent the railroad land and get most of the grazing on private holdings and public government land for nothing. Properly, when the railroad rents grazing land, it should build its share of fencing. It is not apparent that it is concerned on this point.

The effect the present conditions have upon mining and development of mining property is becoming more and more apparent and discouraging. Capital is slow enough, for various other reasons, to invest in undeveloped gold properties. No man or company of men is anxious to operate a claim or a property where the pay-vein may strike or dip into adjoining ground owned by a powerful corporation that will neither buy, sell, fix a price, nor join in developing the mine. The railroad company may see fit at some time in future to raise its blockade for its own interests. Probably, however, its charter will not permit of its ever becoming a charitable institution. A dog in the manger that neither eats hay nor permits the ox to do so is usually persuaded with a club. In other cases our government, by the people, usually compromises by giving the dog the hay.

PROSPECTOR.

Shasta, California, August 10.

[The situation regarding these disputed lands is a difficult one for all concerned. Naturally the railway people try to get all that any construction of the grant will allow them. Naturally also, they refuse to sell while the title they can give is in doubt. In the meantime development is stopped. The matter should be settled by the courts, and settled promptly. We are glad to understand that a test case is being arranged.—EDITOR.]

COPPER production increased in Nevada from 64,359,398 lb., valued at $8,173,643, in 1910, to 67,377,518 lb., valued at $8,422,190, in 1911, according to the U. S. Geological Survey. The increase was practically due to the mines at Ely, in the Robinson district, White Pine county, which yielded 67,033,547 lb., or 99.49% of the entire state production.

THE Witwatersrand Native Labor Association, Ltd., annual report shows that its expenditure on recruiting natives was $1,360,000.

Special Correspondence

NEW YORK

RYAN ON COPPER.—RAY AND CHINO.—SHANNON PAYS DIVIDEND.—COPPER IN STEEL RAILS.—PORCUPINE.—SILVER PRICES.

New York is manfully endeavoring to see a marked revival in business. The crop outlook is expected to redeem the situation and clear the air of all doubts and perils. All lines are counting their share in the country's agricultural prosperity. John D. Ryan returned from a two-months European trip this week, and is evidently much of a bull on the copper-metal market, expressing the wish for a much greater increase in copper output. Mr. Ryan, when interviewed, said in part: "Uses of copper metal in European countries through which I traveled, including France, Italy, Austria, Germany, and England, are increasing, and the demand for the metal is growing proportionately. Business in England, France, and other European countries is exceedingly good, but Germany is outstripping the world in manufactures of all sorts. Germany's big copper requirements are not only for home consumption, but for export goods also. Her manufactures are going all over the world. Large demands for German products are coming from South America. A material increase in production will be necessary before the supply will equal the demand. As I have already said, I would like to see stocks of copper increase both here and in Europe. I hope refinery statistics from now on will show above 130,000,000 lb. per month."

The growth of operations at the Ray Consolidated is covered by the report just issued for the quarter ended June 30. The monthly output for the first quarter of the year was 2,374,314 lb.; for the quarter ended June 30 was 2,984,024, or practically 3,000,000 lb. per month. The ore handled during the year was all of the same average copper content, 1.72; the percentage recovered during the first quarter was 69.37, a little better than the June quarter, which was 68.85. Costs for the period covered were 8.95c. per pound, and net earnings $481,944, as compared with $358,625. Ray is carrying all unsold copper at 12½c. per pound, and actual earnings for the June quarter are some $100,000 better than the earnings statement shows. During the present quarter, operations will be further enlarged. The July tonnage handled was about 4500 tons per day, and August output is expected to show an average of 500 tons per day. While Ray Consolidated is developing along these lines, undoubtedly to become one of the largest copper mines of the world, the Chino is breaking and making some wonderful records. In July the property had an output of a little more than 3,100,000 lb. of copper, and this was produced at a fraction under 6½c. per pound. This result achieved within two years from the commencement of development, is beyond question a record in the development of copper property. It is true that the high grade of the ore in which the Chino is working, and the handling thereof by steam-shovels, are jointly responsible for the result. Chino is expected to produce 70,000,000 lb. of copper per year, and to get costs down to 6c. per pound. When this is achieved, Nevada Consolidated will have to yield its place as the cheapest big copper producer of the United States.

The week saw another copper mine return to the dividend list—the Shannon. The Shannon has always been something of a market favorite in Boston. Previous dividends were 50c. per share in 1906, and $1 in 1907. The present disbursement, therefore, will be the first the shareholders have received in five years.

There is said to be a deal pending to sell the Shattuck-Arizona to a group of French brokers. The shaping of the deal covering the group of claims adjoining the Butte & Superior is proceeding rapidly. The flotation is to be made by Hayden, Stone & Co., and the shares are to be offered in the first instance to Butte & Superior shareholders. D. C. Jackling is expected to come East in a few days to close final details in reference to this property, and the Alaska Gold Mines Co. as well.

A most interesting incident has just been brought to light by the engineers of the New York, New Haven & Hartford railway. In checking over the records of rails in actual use there was noted to be some six miles of track whose rails, still in good condition, were laid long prior to any other rails still in use; further examination disclosed the fact that the rails in question had been imported from Glasgow, Scotland, and a chemical analysis showed that they contained 1¼% of copper. Already orders are being placed for rails to contain 1½% of copper, and if its use prolongs the life of the steel rail, and prevents breakage, the fact will be a doubly important one. With the greatly increased traffic and furious speed of the present day, defective rails have become one of the chief problems of the railway companies. If the use of copper will give longer wear and a tougher rail, it may be confidently expected that it will hereafter go into every rail rolled by the steel companies, and copper producers will have found an outlet for an additional hundred million pounds of copper per annum.

The present reports from Porcupine are in marked contrast to the vast promises current a little more than a year ago, when properties were spoken of as 'proved' and snapshots of trenches or head-frames were exhibited in proof thereof. The Rea Consolidated Mines, the property in which the Consolidated Gold Fields of South Africa was at one time supposed to have become heavily interested, reports a depleted treasury, and acknowledges the immediate necessity for further financing. A sharp advance and a much firmer tone is noted in the silver market, owing to cabled advices that the Indian treasury has entered the market, and is at length buying for rupee coinage. Quotations are 61¼c. per ounce in New York and 28⅜d. per ounce in London, the highest figures registered since 1900, when the announcement was made that the Indian Government would no longer buy silver.

JOPLIN, MISSOURI

ZINC ORE REACHES RECORD PRICE OF $66 PER TON.—MINING OLD YELLOW DOG PROPERTY WITH AID OF BOATS.—GASOLINE LOCOMOTIVE FACILITATES WORK OF AMERICAN ZINC, LEAD & SMELTING COMPANY.

Since the Joplin correspondence appeared in the *Mining and Scientific Press*, July 27, telling of the record prices of zinc ore which at that time had gone to $60.50, a basis of 60% metallic zinc, the market became stronger, going to $64, basis, while choice lots running high in metallic zinc brought as high as $67. The year is thus featured by unusually strong offerings for zinc ore, the nearest approach to these prices having been in 1905 when the market went to $57, basis, with choice lots bringing $60. At the time of writing, however, the market has subsided, and the close of August sees a strong demand at lower prices, the range being from $52 to $57 per ton, basis, the same as the previous record of 1905. The present price is about $15 per ton higher than for the corresponding week of 1911, although there is little apparent increase in the production of concentrate. The newly developed mines have been able to replace the old producers that have gone out of existence, and that is about all. A year ago the district was turning out about 5000 tons of blende per week, and today, although numerous mines are working double and even treble shift, the output is not much in excess of this figure. Extensive drilling hints of a possible increase from the development of newly discovered ore reserves, but this increase cannot be expected to materialize in much less than a year, and in the meantime some of the present-day big producers may be worked out. At best it looks as though the district may be able to increase its output very slowly, with the chances that 6000 tons per week will be the maximum, even if the present high scale of prices continues. Statistics from the United States Geological Survey show an increase of about 9% in the production and the consumption of spelter over

the past six months of 1911. Zinc exports have increased 60%; ore exports have increased 55%. A strong demand for zinc is responsible for the great activity, and operators in this district believe they will never see a return to the low prices that prevailed up to this year.

Heavy pumping costs at the Yellow Dog mine, once the banner producer of the district, have been avoided through the use of a flat boat in the flooded drifts of the once famous producer. The mine was worked in sheet-ground, pillars being left every 30 or 40 ft. Some of these were drawn by the former operators, but the ground was in no wise endangered and many pillars, rich in ore, were left standing. After the stope had been taken up the drifts were 20 to 25 ft. high. In these old workings the water now stands 15 ft. deep. From the main shaft to the most remote heading the distance is between 300 and 400 ft. A great area had been cut in every direction, and the cost of draining this big underground lake would have been far in excess of any returns that could have been expected from the mining of the rich pillars that yet remained. Instead of draining the ground, a sub-leasing company launched a barge. In mining the pillars they stretch a tarpaulin between the boat and the ore to prevent much of it falling into the water. When the barge is filled it is paddled to the bottom of the shaft, the ore is loaded into cans, is hoisted, and is then milled, the recovery being between 4 and 5% zincblende.

Mules have been replaced with a gasoline locomotive, the first of the kind in the district in steady use, in the underground workings of the American Zinc, Lead & Smelting Co., at Prosperity. The distance between the Sharpsburg mine and the American-Davy mine, the course of travel of the new locomotive, is 650 ft. The locomotive will pull a string of eight to ten cars. The weight of the engine is six tons, including the trucks.

Suit brought against former directors of the United Zinc Companies in Massachusets, alleging fraudulent sale of lands to the Companies, and involving a sum between half a million and $600,000, will in no manner effect the Companies' activities in this district. The alleged fraud centres on the sale of 75 acres in the Aurora camp, which the directors, through the general manager, Royal B. Young, of Boston, claim was not worth the purchase price. This tract has never been a good producer. United Zinc is operating several mines in and near the Joplin camp, the latest move of any importance being the opening of 5% sheet-ground in the United-Lehigh mine at Carl Junction. Here a big opening is being cut in virgin ground. The mill at this property has a capacity of 300 tons per shift and formerly operated on a sheet-ground lease at Duenweg by the same company.

Hand jigging is commonly used in cleaning calamine, but the high price has encouraged more substantial work. C. C. Player is completing a small mill at Spring City. The ore is thin and needs more treatment, but a big area is to be worked. Where hand cobbing is possible the dirt is not even hand jigged. Granby continues to be the heaviest producer of calamine. The price now ranges from $28 to $30 per ton, assay basis of 40% metallic zinc, with choice lots bringing $38. A 250-ton mill has just started on the O. D. Bittick land at Spring City, this being the largest concentrating plant in that camp. It is of sheet metal. Ore is found at a depth of 170 ft. The Onondaga Mining Co. recently purchased the fee on which the mill and mine are situated.

LEAD AND ZINC DISTRICTS OF MISSOURI.

BOSTON

SHANNON DIVIDEND.—MAYFLOWER.—GRANBY. — CHEMUNG SOLD.—COPPER PRODUCERS ASSOCIATION.

There were two or three strings tied to the action of the Shannon directors, a few days ago, in declaring a dividend of 50c. per share. The dividend is not payable until October 1. It is not stated whether it is to be a quarterly one or not. The directors made no commitments except the declaration of the single dividend. It is known that the Hayden, Stone & Co. interests on the board wanted a dividend declared as a concession to higher-priced copper and the pressure for increasing dividends all along the line. On the other hand, the Paine, Webber & Co. faction advocated going slow. The action represents a compromise. Shannon is earning $1,000,000 per year, or over $3 per share. Therefore, it is believed that a dividend of 50c. quarterly can be sustained. Shannon is in excellent financial shape and has so far distributed but a very small portion of its earnings in dividends to stockholders.

In the Lake country, Mayflower No. 20 and Old Colony No. 16 drills have both penetrated the Mayflower lode. The two drills are working within a few hundred feet of each other. St. Mary's Mineral Land people have not heretofore been successful in actual mine management, but Mayflower will probably turn their luck. As Old Colony is now stated to represent a uniform extension of Mayflower conditions, and as it has been selling a few points below Mayflower, there has been some disposition to give it preference in the buying. Outside of some faulting in the lode, the expectations of the management have been realized in finding it at theoretical points.

D. C. Jackling is expected in Boston in a few days to consummate the details of the Butte & Superior deal, as well as that of the Alaska Gold Mines Co., which Hayden, Stone & Co. are financing. A number of alterations and additions are being made at the Butte & Superior con-

centrator to promote efficiency. The plant will eventually be increased to 2000 tons per day. The market recovery of Granby is gratifying to Boston, which has always had a strong stake in the property. Granby is selling now around 55, about half of its high price of two years ago. It is learned here that the diamond-drill developments in Granby's Hidden Creek property are exceeding expectations and that the management has decided on building a 2000 instead of a 1000-ton smelter. It is a great satisfaction to see the old familiar mines either holding their own or coming back.

Phelps, Dodge & Co. are again in the field buying new properties. It is now practically conceded that Chemung, a Grant county, New Mexico, property, is to be taken over by the firm. Chemung is a property of 953 acres. The company was formed as a reorganization of the Tyrone Development Co. at the tail end of the copper boom in 1907. The organizers and holders of the bulk of the stock were United States Steel Corporation people. The company was incorporated under Minnesota laws, with a capitalization of 300,000 shares, $10 par, $9 paid in. Of this number, 200,000 shares were listed in the qualified department of the Boston Curb. The stock was also traded in on the Duluth board. The company probably has today less than 100 stockholders. It has good management and ample financing, but the property was shut down on account of the low price of copper. Phelps, Dodge & Co. own the adjoining Burro Mountain property and will be in position to make Chemung a considerable producer, as it has a large tonnage of concentrating ore on hand. The Phelps, Dodge & Co. bid for control was around $6 per share. The faithfulness with which the Copper Producers Association furnishes the statistics of copper production and deliveries is causing much favorable comment in Boston and is strengthening confidence in the copper situation. The July increase of approximately 6,000,000 lb. in the copper surplus was not an unmixed evil from the producers' standpoint, as it came at a time which served to emphasize even more than ever the impartial character of Copper Producers' statistics. Accurate and responsible publicity is accomplishing wonders for the copper situation at this time.

LONDON

Wheal Kitty.—South American Copper Company.

The doings at the Wheal Kitty tin mine in Cornwall are always of interest, although the mine is a small one, and the tonnage treated may seem paltry when compared to the big mines of the world. The mine, as a matter of fact, affords an excellent example of economical working and provides an effective contrast to some of the extravagant methods not unknown in the City of London and in Cornwall. In writing six months ago of the results at this mine I had to record with regret that the content of the ore mined had seriously fallen, the yield for the second half of 1911 having been 19.9 lb. black tin per ton, as compared with 28.1 lb. during the first half, and 35.2 lb. during the period from the commencement of work by the present company under the auspices of J. H. Collins to the end of 1910. The report for the first half of 1912 shows a substantial improvement in the yield, the figure being 28.5 lb. black tin per ton. The mine suffered inconvenience from the coal strike, as operations had to be entirely suspended for five weeks. This fact and also closer sorting underground caused the total amount of ore raised to be less than usual, 6090 tons, as compared with 8384 tons the previous half-year. The tin concentrate sold was 77 tons, realizing £9448. The net profit was £702, which added to the balance carried forward from the previous half-year made a disposal balance of £1522. Out of this, £375 has been written off for depreciation, and £298 has been paid as dividend on the preference shares at the rate of 10% per annum. The total cost was 28s. 8d. per ton. Sara's shaft is now down 750 ft. and a lode cut at 720 ft. is being developed. This is supposed to be in the faulted portion of the main Kitty lode which was the objective in sinking the shaft. The cross-cut at the 540-ft. level connecting Sara's with the Wheal Vottle workings is nearly complete.

In April last I sent some particulars of the South American Copper Co., which was formed in 1907 for the purpose of reopening the Aroa group of copper mines in Venezuela. These mines have been known for 300 years, and from 1882 to 1894 they were worked by the Quebrada company, an English venture. In the latter year the workings collapsed and the property was abandoned. During the year ended June 30, the ore extracted and shipped to Europe realized £75,447 gross. The cost of mining, freight, smelter charges, etc., was £47,803, leaving a profit of £27,644. Out of this, £2595 was paid as London expenses and income tax, and £2510 as directors' extra remuneration. Dividends amounting in all to £22,358 have been paid, which is 250% on the paid up capital of £9983. The nominal capital of the company is £15,000, divided into 150,000 shares at 2s. each. Of these, 75,000 formed the original issue at par, and the other 75,000 have been issued at £1 each. So far £20,170 has been paid up on the latter. These shares have been subscribed in France, and the money obtained will be available for the expansion of mining and concentration operations. W. A. Heywood has gone to the mines to report on the metallurgical problem.

BUTTE, MONTANA

August Production Short.—Guggenheims in Butte.

August copper production by the Anaconda smelter, which includes the output of all the Anaconda mines, the Tuolumne, North Butte, and some other custom ore, will not exceed 25,000,000 lb. The East Butte will add slightly more than 1,000,000 lb. to the total. The outputs of both the Anaconda and East Butte smelters are less than two and three months ago, but it is asserted that the falling off is due to natural and ordinary causes. The decrease in the Anaconda production is claimed to be due to extra development being done at some of the mines and to the fact that a portion of the concentrator at the Washoe smelter is being reconstructed. The Pennsylvania mine, one of the largest producers of the Anaconda company, is closed to permit the substitution of compressed air for steam. At the same time the shaft of the Pennsylvania is being sunk 400 ft. deeper. Sinking is also being done on the Berkeley, and extraordinary development is under way at the West Gray Rock, Silver Bow, Anaconda, Mountain View, and Tramway. The Mountain View, which was partly shut down for two weeks while repairs to one of the engines were being made, has resumed operations. Work on the 1600 and 2000-ft. levels was stopped during the shut-down. A large station has been cut at the 2000-ft. level, and a cross-cut started north. Some driving has also been done on that level. A 35-ft. sump has been cut below the 2000-ft. station and a Knowles sinking pump is caring for the water, which amounts to about 15 to 20 gal. per minute. A similar pump has been placed in the shaft at the 1900-ft. level. At the Tramway, both the main and auxiliary hoists have been remodeled to use air.

There is no longer any doubt that the Guggenheims are getting a good mining hold in the Butte district, which was generally supposed to belong almost exclusively to the Amalgamated Copper Co. It is no longer denied that the Guggenheims are in control of Butte & Superior, the big zinc property, and it is now stated officially that D. C. Jackling is the real manager, A. B. Wolvin having practically retired from the position as managing head of the company. John M. Hayes, who, with Mr. Jackling, represents the Guggenheims in the Utah Copper Co., is spending a great deal of time in Butte, and he has purchased or taken under option a score or more mining properties, mostly undeveloped ground, for the Guggenheim interests. G. O. Bradley and F. G. Janney, of the concentrating department of the Utah Copper Co. in Utah, have been inspecting the new mill of the Butte & Superior and have directed certain changes for the improvement of the mill.

Mr. Bradley expresses himself well satisfied with the working of the mill and the percentage of recovery, although the average has been considerably less than generally reported. The financial men interested in Butte & Superior have protested against the policy of misrepresentation and exaggeration which has been followed by someone regarding Butte & Superior operations and earnings, and lately there has been much less of it. As one of the men interested in the company said: "The truth is good enough, and exaggeration hurts." The entire concentrating plant is now completed, but only the first unit, having a capacity of 500 tons per day, is being used. The whole plant will not be put into operation until the new hoist is in operation. That will probably be some time early in October. The mill is designed to treat 1000 tons per day, but it is estimated that it will be able to handle 1200 tons. The Butte & Superior and allied interests own controlling interests in the North Butte Extension Co., the Butte-Milwaukee Co., the Brundy group of claims on the east side of the district, about a dozen claims in the northern portion of the district, and are still negotiating for more ground. Mr. Wolvin also tried to get possession of the Bullwhacker company, which owns a small producing mine on the east side, but made the mistake of offering too much for the stock. Other interests were about to get control of the company on a basis of 10c. per share, when Wolvin offered 25c. The result was that the big holders wouldn't sell at all and are now talking about resuming work on the mine. Patrick Clark, of Spokane, is the chief owner of the Bullwhacker. It was worked six or seven years ago and shipped some ore. A dividend of 1c. per share was paid and the stock soared to $3 per share. After the dividend had been paid and the public bought liberally of the stock the mine was shut down because it could not be operated at a profit. Mr. Clark said then that the shut-down would only last until he could erect a leaching plant. He has been back in Butte the past week with an engineer, and is talking about putting up a copper leaching plant at once. The stock has become active again and is selling at 27c. The Butte Hill Copper Mining Co. owns about 16 patented claims in the far north section of the Butte district, and the Guggenheim representatives have been negotiating for the property, but Walter Harvey Weed says he has some Duluth people who are anxious to get it, and a wire from him to the officers of the Butte Hill has added interest to the negotiations.

JOHANNESBURG, TRANSVAAL

FALLING DIVIDENDS.—SHORTAGE OF CAPITAL.—LEGISLATIVE BURDEN.—MINERS' PHTHISIS ACT.

The mining topics attracting most attention here just now are largely connected with the pressing need that undoubtedly exists on the Rand for greater economy in working, or for some other method of meeting the demands likely to be thrown on the mining industry by the Union Parliament during the next few years. The latest figures show that owing to a variety of circumstances, the Witwatersrand gold-mining industry, during the half-year ended June, although distributing in dividends £3,750,000. has failed to reach the corresponding dividends in 1911 by a sum well over £300,000. This state of affairs, following a material dividend decline in the previous year, although accompanied by a marked increase in tonnage milled and actual gold produced, has naturally caused some comment and not a little surprise, that in the face of these facts the Union Legislature at Cape Town should not hesitate to impose additional heavy burdens on gold mining, upon which the general prosperity of South Africa so largely depends. It is worthy of notice in passing that this dividend decline is largely due to market conditions over which those in charge of the mining industry do not appear to be able to exercise any control. As far as the total working profits are concerned, they have, during the past half-year, increased to a much larger extent than the dividends declared have declined, thus making the dividend shortage appear all the more serious. The explanation may be given that the working profits have had to be used to a much larger extent than formerly for what was, strictly speaking, capital expenditure; owing to exhaustion of working capital, or insufficient working capital in the first instance having been provided for most of the new producers which have so largely contributed to the gold output and working profits during the half-year. The bad odor into which the South African mining-share market has fallen prevented any other course being adopted with any prospect of success, and where there were no prospects of producing working profits within a reasonable time, the somewhat serious step of closing down the mines has been adopted, as it was hopeless to attempt to raise additional working capital on satisfactory terms in the share market. There are also instances where the carrying out of the merging policy of mines of doubtful value with occasional dividend-payers has only resulted in increasing the capital without adding to the immediate dividend-earning capacity of the amalgamated concern. Other merged concerns have found it necessary to spend large borrowed sums in capital outlay and extension, thus entailing additional interest and redemption charges on the working profits. There may also be added to these drawbacks those of constant falling grades and increasing working costs. The latter drawback has continued for several years, for where the grade, by manipulation, or selective mining as it is now called, has been improved, the benefits have been neutralized by the resulting higher costs of working. It is clear, therefore, that the actual working profits have only increased as a result of several promising new producers entering the list, such as Modder B, City Deep, and others, whose efforts have added to the working profits without benefiting the dividends. The mismanagement at the East Rand Proprietary Mines has reduced the dividends by £183,442, a loss which even new dividend-payers like Brakpan, Bantjes, and Jupiter mines combined have not been able to make up while, owing to natural exhaustion of many of the outcrop mines and failure of the deep-level mines to neutralize the consequent effects, the dividend list has also had to considerably suffer during the last six months. Little wonder need therefore be expressed that such an additional drain on the dividend capabilities of the mines should have been imposed as that of the Miners' Phthisis Compensation Act which comes into force on August 1 without the Government contributing to the cost, as in other countries. By this act of the legislature, each miner suffering from phthisis, and the relatives of any miner who has died from this disease in the past, will become entitled to claim a maximum amount of £400 from the employers. It has been estimated that one out of every three white miners now working on the Rand is a victim to the disease, and thousands have died from the disease in the past. The new liability now thrown upon the mines is difficult to estimate, but it is possible that during the two years' continuance of the act it may be in the neighborhood of £4,000,000, and it is certain to be over £1,000,000 per year. Toward this amount the Government contributes the paltry sum of £100,000 to relieve the poorer mines which would otherwise probably close down. This act of Parliament is also accompanied by what is termed a 'Miners Phthisis Insurance Fund,' giving much the same benefits, to which the men contribute 2.5% of their wages and the mine-owners 2.5% of the wages paid to the miners for the first two years and 5% thereafter, the Government contributing nothing. It is as impossible to estimate the liability to be thrown on the shoulders of the mines in these days of declining grades and dividends by this Miners' Phthisis Act as it is to estimate the losses the mines have suffered in many ways in the past through the prevalence of the disease. Much more might probably have been done in the past by mine-owners, miners, and Government to keep it under control, but the feeling prevails that where neglect has been common to all three parties concerned, all, as in other countries, should equally contribute to its relief.

General Mining News

ALASKA

FAIRBANKS

(Special Correspondence.) — The property of Hudson brothers on Ester creek has been partly sold to C. Wichtman and M. Bigler, who are working on Eva creek placers. A 2-stamp Nissen mill has been ordered, and will be erected this summer. The shaft is down about 100 ft., with good ore showing at the bottom. At one part a cross-cut shows 11 ft. of pay-ore, besides which some high-grade ore has been opened. F. Fay has sold his interest at the head of Chatham creek to W. Burns and T. McIlroy. Jesson brothers have also sold out to the latter. A few days after acquiring the property, the owners broke into rich ore. At present there is two feet of good ore in the face of the drift. A 4-stamp mill, consisting of two 2-stamp batteries, is already at the claim. C. Furstenau and McCarty have a good deal of ore opened in the Fairbanks creek claim, and have bought a mill of the Little Giant type and a Monarch concentrator. This will be erected as soon as it arrives by the next boat. A 5-stamp mill is about completed at the Newsboy Extension on upper Cleary creek by McGillvray and Fisher. They intend crushing for claims in the vicinity. A joint pumping plant will probably be put on Cleary creek to supply water for both the Newsboy mill and that on the Extension. The Newsboy mill at present is working when water is available. The east 200-ft. stope in this mine should open well, judging by carefully taken samples. L. Golden is general manager. A 2-stamp Nissen mill will be soon erected at the Tolovana mine. The present Huntington mill will be used for regrinding. A shaft is being sunk near the mouth of the main adit, as good ore has been proved in the lower levels. Rich ore has been cut on the Pioneer lode at the Chatham. Enough ore is in sight to pay for a 5-stamp Joshua Hendy mill, so one has been ordered. W. L. Spaulding, on upper Dome creek, has a small 3-stamp mill at work on rich ore, and a five-days run resulted in gold worth $780. A fair percentage of cobalt has been found in the sulphide ore of J. F. Zimmerman, and a small shipment will probably be made this summer. The 100-ft. level in the Rainbow has opened a good width of pay-ore. A boiler and hoist are being erected. The small rich vein at the Rexall, on Wolf creek, has opened out well, and a 1-stamp Nissen mill has been ordered. There is a good millsite and plenty of water. The reported finding of tin ore in the Hot Springs district has been confirmed by C. F. Robinson, the discoverer. Holes sunk in the lode show it to be from four feet in width. Samples of ore shown seem to be an altered dike rock carrying cassiterite. The prospects so far are low grade, but the size of the placer tin leads the owner of the claim to think that there are rich placers in the lode.

Fairbanks, July 14.

ITIDAROD

Nine boilers are being built in on Flat creek by the Guggenheim people. There will be 400 hp. developed, which will drive engines and generators for power used on the big dredge which should be soon at work. Prospects are bright for the present season at the Susitna and Cache Creek districts. Bubb and Barenburg, on Dollar creek, have two giants at work and have found some rich gravel on their benches. Their output will be about $50,000 for the summer. The output of the Innoko-Iditarod region in 1911 is estimated by the U. S. Geological Survey at $3,000,000, as compared with $825,000 in 1910. Perhaps $500,000 went to Seward by dog-train.

ARIZONA

GILA COUNTY

(Special Correspondence.)—C. C. Tinkler, representing McArthur Brothers, who have a contract with the Inspiration Con. Copper Co. for building a spur from the Arizona Eastern railroad to the millsite and main shafts at the Inspiration camp, is in Globe getting the work started. A camp is being established. Machinery, horses, and supplies are being unloaded at Miami, and work will be started in a few days. McArthur Brothers also have the contract with the railroad company for the construction of the extension of its line from the town of Miami to the Inspiration and the Live Oak. This work will be carried on at the same time. The main west working shaft of the latter is now 300 ft. deep, and the main east shaft about 100 ft. deep. Sinking is progressing at the rate of over 6 ft. per day. The churn-drill at the South Live Oak has been moved to the northern end of the property on the schist area, and hole No. 3 will be started within the next two or three days. P. G. Beckett, formerly assistant superintendent of the Copper Queen mine at Bisbee, has been appointed general manager of the Old Dominion mine at Globe, and took charge on August 16. He succeeds G. H. Dowell, who has been promoted to the position of assistant general manager for the Copper Queen company. The Superior & Boston is making small shipments from the second and third levels of the Limestone vein, and the sixth level of the Great Eastern vein. Driving has been resumed on the eighth level east on the latter vein, and cross-cutting is in progress on the twelfth level. W. G. Rice, president of the company, is visiting the mine. Development work has not been resumed at the Black Warrior mine, as predicted by the management a month ago. The mine is now idle and there seem to be no definite plans for reopening it.

TOLOVANA MINE AT MOUTH OF WILLOW, A TRIBUTARY OF CLEARY CREEK, FAIRBANKS DISTRICT, ALASKA.

Globe, August 15.

The properties of Cobre-Verde company, near Globe, were bought last week by the Calumet & Arizona company of Bisbee, the price being $500,000. The former leases consist of 81 claims, and besides these the latter company has taken options on others around Globe.

MARICOPA COUNTY

The Monarch company is now erecting the 50-hp. Fairbanks-Morse engine, and Rumsey pump. The latter has a lifting capacity of 8400 gal. per hour a height of 2000 ft., but will only have to elevate water 1232 ft. from the river to the mine, a distance of seven miles.

MOHAVE COUNTY

From de la Fountaine mine, M. A. Burke and associates have a 40-ton car of zinc ore for shipment and will soon have a similar quantity of lead ore to send out. Samples

from each class of ore have given high returns. It is said that a strong company is to take over the Bi-Metal mines near Kingman, and will erect a large plant. The lode is very wide and worth about $3 per ton, and could be cheaply mined and milled.

Pinal County

The Copper Queen company has completed the purchase of the Giesemann claims, some 30 or 40 miles from Tucson, in the north end of the Catalina mountains. For some time past the company has had a fair number of men prospecting and developing the purchased properties.

Santa Cruz County

A lease, involving $80,000, has been taken on the Chief group of 12 claims in the Patagonia district. These adjoin the World's Fair mine. Several hundred feet of development has been done in the Chief, and high-grade silver ore opened. It is intended to drive a tunnel about 500 ft., which is expected to cut the World's Fair vein at a vertical depth of 300 to 350 feet.

Yavapai County

The Kay copper mine, situated on the banks of Agua Fria river, in the southern part of the county, is shipping 1000 tons of ore to the Swansea smelter. The Tip Top concentrating plant will soon be at work. Driving has been continued in the Fortune mine adit and is now in 412 ft., with 20 to 36 in. of pay-ore opened the length of the work.

CALIFORNIA

Nevada County

The Pennsylvania company is pushing on the excavations for its 75-ton cyanide plant, which should be working in about two months. The plant will be similar to that at the Empire mill. There will be about 15 vats and one large Oliver continuous filter.

The shaft of the R. G. Gillespie mine, at Indian Flat, has been cleared of water, and sinking will be continued several hundred feet, and the vein prospected. Delay has been occasioned by shortage of water for power, but electric power has been installed for pumping and the air-compressor, water-power being used for hoisting.

Sierra County

A fair quantity of ore has been opened at the Willoughby mine, above Gold Valley, and it is intended to start the mill early in September. At the Sierra Buttes the upper mill is crushing ore from the new shoot opened on three levels in the mine.

Siskiyou County

(Special Correspondence.)—A company of Portland and Yreka people is being organized to develop a coal deposit north of Montague. Tests of the material are said to have shown it to be of a good quality. W. W. Narham and B. K. Collier, of Yreka, are among those interested. Thrash & Coalson are mining rich quartz from their claims on the Forks of Humbug. A lease has been taken on the McCook mill and crushing is about to start. James Ironside has intersected a 4-ft. vein of free-gold ore on one of his claims in the Cherry Creek district. San Francisco people have taken over the Cherry Hill mine and have a small crew at work. Work has been resumed at the Drummer Boy, after an idleness of several years. At the Gum Boot, near Scotts Bar, a full force is engaged and good ore is being opened. San Francisco interests have taken a bond on the Mount Vernon and have arranged for immediate development. C. H. Bryant has bonded the old Elk Creek quartz property and has commenced driving an adit. Good ore has been found in the old workings, but considerable driving will be necessary before the deposits can be cut at depth. Bruce Aldrich and Paris Mathewson report the finding of a strong vein near Sucker creek, supposed to be the Hegler, which was lost several years ago. When first found the shoot was 14 in. wide, and has since widened to over 25 in. The adit has exposed about 60 ft. of the vein and is progressing steadily. The ore is said to average $40 per ton. Representatives of San Francisco capitalists have been recently inspecting quartz and placer claims in this neighborhood, and several deals are reported pending.

Yreka, August 17.

COLORADO

Clear Creek County

Nelson and associates, who have been working a lease at the Bellevue-Hudson property near Lawson, have shipped a carload of galena, rich in silver. The lode worked is from 10 to 24 in. wide, of good smelting ore. Drilling is being continued at the Capital claim on Griffith mountain. By the middle of September the hole should be through to the Capital workings. The Mineral Chief mill is producing about five tons of 72% lead concentrate per shift. The zinc product averages 35%. Hummer & Herber, lessees at the Capital mine, are making regular shipments to the local sampler, which yield highly profitable returns.

Gilpin County

An average of 120 tons of ore per day is being produced by the Frontenac mine, and about 65 tons from the Aduddell. Recently the 600-ft. level of the latter was timbered and connected with the 900-ft. depth of the former. Generally these two properties are opening fairly well. From the 600-ft. east level of the Chase mine, 17 tons of ore averaging 2½ oz. gold was shipped. The shaft will be sunk another 100 ft. T. Hughes and associates have shipped 4 tons of $40 ore from Trail, in Russell district, and the Galena mine, on Central hill, has shipped 6 tons for $35 per ton.

Gunnison County

The new compressor of the Elk Mountain Tunnel Co. was started last week and is working well. It is driven by a Pelton wheel, worked under a 500-ft. head. The tunnel now in 1200 ft. should cut the many veins of Queen basin, about 1000 ft. below their apex in the basin. The district is suitable for cheap mining operations, as there is plenty of timber and water-power. A siding is to be constructed to the Elk mountain coal mine. Coal will be brought down from the mine by means of an aerial tramway 4200 ft. long, which has a capacity of 500 tons per day. There will be 100 men employed at the mine, when the plant is complete. The company will spend $30,000 on general improvements, and should be in full working early next year.

Ouray County

The Mountain Top company is to start its adit at the west side of Virginius basin, at an elevation of about 12,000 ft., where there is little danger of snowslides. The adit, 7½ by 6 ft., will be driven 2000 ft., and should cut the Smuggler-Union-Humboldt-Sweepstakes vein at a depth of nearly 600 ft. below the lowest workings on the Sweepstakes. Twenty-five men are to be put at this work. E. Krisher is mine superintendent.

Teller County (Cripple Creek)

Treatment at the Gaylord mill is said to be satisfactory, and 60 tons per day is being handled. Three mills, Portland, Gaylord, and Kavanagh, are now dumping their residue into Eclipse gulch. At Stratton's Independence about 200 tons per day is now being treated from the ore-house. Forty sets of lessees are working at the mine. It is not expected that the Colburn mill will be finished before October.

Two men were killed on the 400-ft. level at the Gold Sovereign mine on August 12, through the mysterious explosion of 40 sticks of giant powder. The theory of the mine inspector is that the accident was probably caused by the striking of crystallized powder with the candlestick. The explosion of one stick set the rest of the dynamite off. The usual method locally is to make an incision in the stick of powder with a candlestick, and then put a cap in the hole made. The verdict of the coroner's inquest was that there was no explanation of the cause of the accident. The Portland mine was inspected last week by the directors, who announce that further improvements

are to be made to the mill. About 500 tons per day is now being treated. The main shaft has reached 1620-ft. depth, and a station is being cut out for the 1600-ft. level. The water-level was encountered at 1610 ft., but sinking the extra 10 ft. was not hindered by water. To date the Miners' Protective Association has issued 3442 cards to men employed at the camp.

The Elkton company is now down 175 ft. with the Raven and Beacon shaft. On the eleventh level of the main Elkton lode the shoot is said to be 900 ft. long and averages 6 ft. wide of a good value. Seven sets of sub-lessees are working at the second, third, seventh, and twelfth levels of the Last Dollar. About 15 cars of ore per month can be shipped.

IDAHO

Coeur d'Alene

Fire destroyed the boiler house, laundry, and dry room at the Snowstorm mine on August 12. The damage is about $10,000, and is covered by insurance. The boarding-house, worth $65,000, was in great danger for a time. Spokane men have inspected the Standard property in Revenue gulch. The Ajax tunnel is in nearly a half mile, and it is said that a vein was cut last week, containing quartz and galena. The Success mine, five miles north of Wallace, on Nine Mile, recently paid $45,000 in dividends, making $90,000 for the current year. The main working tunnel is now 1000 ft. long, and large orebodies are being stoped above it. Sinking is under way from this level, and a drift 150 ft. long has been driven at 160-ft. depth. High-grade ore containing zinc and lead is being mined. The mill has a daily capacity of 225 tons, and machinery for zinc recovery has been fitted up. About 50 tons of concentrate is produced daily, and 90 men are employed in all.

MINNESOTA

A new record in Lake Superior iron ore shipments was made in July, when the total was 7,600,233 gross tons, against 5,221,373 tons in July 1911. To August 1 the total this year was 21,290,904 tons, which is also a record at that

STEAM-SHOVEL STRIPPING OVERBURDEN AT THE OLIVER IRON MINES.

point in the season. The shipments by ports last month and to August 1, with corresponding figures for 1911, are given below, in gross tons:

Port.	July, 1912.	To Aug. 1, 1911.	To Aug. 1, 1912.
Escanaba	836,346	1,711,806	2,478,294
Marquette	511,924	843,177	1,430,814
Ashland	771,057	1,102,263	2,103,858
Superior	2,324,324	4,698,855	6,668,655
Duluth	1,540,324	3,158,450	4,385,802
Two Harbors	1,616,258	2,549,740	4,223,481
Total	7,600,233	14,064,291	21,290,904

These great shipments have been made possible largely through the wide adoption of steam-shovels.

MONTANA

Cascade County

(Special Correspondence.)—After pumping for three months, the Florence mine at Neihart is now clear of water, and a crew of men is cleaning out the drifts and laying tracks. The levels are in good order, considering that the mine has been shut down for six years. It is intended to start deepening the shaft, and a new hoist will be soon completed. The Florence is a somewhat famous old mine, being opened in the good old silver days, with adits and no development ahead of ore extraction. Production is said to have totaled $1,500,000. There are several thousand tons of ore on the dump, worth about 30 oz. silver per ton. The mine was shut down in 1906, because all ore above the adits was worked out, and the money had been paid out in dividends. Formerly the ore was shipped to Tacoma.

Neihart, August 15.

It is officially announced that the Great Falls smelter of the Anaconda company will be entirely rebuilt, and the concentrating plant of the Washoe smelter will be remodeled for the more economical treatment of copper ores. Structural steel has already been ordered for the former plant.

Fergus County

The Barnes-King Development Co. promises to become active again through the acquisition of a valuable gold property in the Kendall district, and adjoining the ground of the Barnes-King company. Engineers of the latter long ago recommended the purchase of the property known as the Santiago, owned by John A. Drake and associates of the North Moccasin Mining Co., but the Barnes-King directors could not make a satisfactory deal. However, when the Santiago mine suffered disastrously from a cave, and financial difficulties involved the company, the holders of $100,000 in bonds instituted foreclosure proceedings and the property was sold. As soon as the period of redemption had expired a bank in Lewistown took title as trustee for the bondholders and turned the property over to the Barnes-King in confidence and under the assurance that bondholders would get back their money, although the price at which the property has passed to the Barnes-King company, is to be paid in royalties from the ore mined. The price is $150,000 and the purchaser pays but $5000 in cash. It would have taken a large sum of money to rehabilitate the North Moccasin mine and recover the workings, but the Barnes-King will be able to mine the property economically through the Barnes-King workings, which extend to the end lines of the Santiago claim. The Santiago orebody is an immense one and gives an average of about $22 per ton. The ore will be treated in the Barnes-King mill at Kendall. Barnes-King engineers have made optimistic reports on the Santiago group and have expressed confidence in the company's ability to earn $25,000 to $50,000 per month net profits. In addition to this important purchase, the Barnes-King company is about to close a deal for the purchase of even a more valuable property than the Santiago, but in another part of the state.

NEVADA

Clark County

Holmes and Montgomery, lessees at the Quartette, are breaking out four or five tons of ore per day averaging over $20 per ton. The old Blossom mine, three miles from Searchlight, will soon be worked again, J. P. Young having secured a lease. About $325,000 was won from the claim years ago.

Esmeralda County

Bullion worth $80 was found in the possession of a man at Goldfield, and it is stated that the Consolidated officials have evidence that a number of employees have been involved in a conspiracy to steal bullion from the refinery. At the Silver Pick Consolidated the drift at the 260-ft. level is being extended from the main shaft toward the Mohawk, and the ground of the old Sheets-Ish lease has shown a strong vein which gave several good assays. A new lease is being worked about 800 ft. northwest of the main company workings, where an old shaft has been

repaired and is being deepened. The shaft of the Lone Star mine is down 300 ft., and a station is being cut out. Some rock from the new workings is similar in appearance to the pay-ore of the Mohawk and Clermont, but so far the assays are low in gold. The Goldfield Mining & Ore Reduction Co. has resumed work at the Third Chance claim adjoining the C. O. D. and Atlanta. Two machine drills are at work. The shaft is 380 ft. deep, and a drift is being driven to cut a vein which is known to traverse the ground between the shaft and the C. O. D. Consolidated. The Jumbo Extension is interesting mining men, and its mill is ready to begin testing ore from the Polverde mine. From the 1300-ft. level of the Grizzly Bear mine the Goldfield Consolidated is mining ore carrying gold, silver, and copper, and shipping it to Tooele.

Humboldt County

The National Mines Co. intends to sink a shaft from its No. 5 level to open up below the present workings. This will be done pending the outome of the present litigation with the Mammoth company. The latter will continue its east cross-cut. The Kennedy-Macdonald mine is making good headway in the shaft workings on the National Mines extension of the high-grade vein. Most of the rich ore in the latter was mined beween No. 3 and 5 levels. This would be about 400 to 600 ft. on the dip of the vein. The Kennedy-Macdonald shaft starts at nearly the same level as the Stall shaft, and the vein has a similar dip; it also shows many of the characteristics of the latter. At the Buckskin National, the winze in the south adit is down 70 ft., in ore worth $50 per ton, over 4 ft. wide. The ore contains iron sulphide, antimony, and a little free gold. A man was arrested last week for stealing about 10 tons of antimony ore from the Bloody Canyon mine. It is alleged that the ore was shipped East and sold.

Lander County

(Special Correspondence.)—The Maricopa Mines Co. is completing final installation of mill machinery, and expects to commence crushing within a short time. The main adit is in over 2000 ft. and progressing at the rate of 5½ ft. per round. In the stopes three drills are blocking out ore. The adit has penetrated the Chase estate and is expected to soon intersect one of the rich shoots that formerly made the Chase one of the best properties in New York canyon. San Francisco capital is interested. The Jersey Valley mine, near Battle Mountain, is showing favorably under vigorous developments. Work is centred on the completion of a 1200-ft. adit which will tap the orebodies at fair depth and give good backs. Daily shipments of ore are being maintained to Battle Mountain and 20 men are employed. It is reported the directors are contemplating erecting machinery. W. F. Pinkham is superintendent. The Glasgow & Western M. & M. Co. is erecting a small mill and cyanide plant on its Copper Canyon properties, near Galena. Development is progressing with a force of 30 men. A good tonnage of ore is said to be available. The Iron Canyon Gold Mining Co. is erecting a small mill at Iron canyon, 12 miles southwest of Battle Mountain. Two shifts are working. The mine has been a consistent producer during recent years. Several small camps in various sections of the county report improving conditions, and in and around Austin the situation is promising.

Austin, August 16.

Lyon County

Two stamp-mills and three cyanide plants are kept busy at Silver City. Hamilton and Pollard crushed about 1000 tons of ore at the Nevada Mining, Power & Reduction Co.'s plant, and the McTigue mill crushed over 300 tons during July. The Woodbury and Donovan cyanide works treated 1900 tons of tailing. Quite a number of mines are producing ore. For the week ended August 1 the Thompson smelter received 5323 tons of ore.

The new hoist and compressor plant for the New Yerington Copper Co. has arrived and will be erected at once. The Smith Valley company has opened 3 ft. of ore in its adit, worth $60 per ton in gold, silver, and lead. At a distance of 900 ft. to the north another adit has been driven into the hill 120 ft. on another vein, 18 in. wide and up to $100 per ton. This gives 300 ft. of backs from which to stope. Copper ore has been opened to the east of the latter.

Nye County

Early on Sunday morning, August 18, fire started in the Miners' Exchange Hall, at Tonopah, and seven buildings were destroyed, valued at $30,000, with only $1000 insurance. The fireproof wall of the Nye County building stopped further progress of the fire. This is the second fire at Tonopah within six weeks, the first one resulting in $100,000 damage.

Last week J. E. Spurr and seven officials of the Tonopah & Goldfield railroad visited Manhattan, and inspected the Consolidated, White Caps, and Big Four mines. Three hundred flasks of mercury are produced monthly by the Mercury Mining Co., which is working at Ione, in the northwest corner of the county. C. G. Dennis, the manager, states that the cost of mining and reduction is not over $5 per ton. The cinnabar is found in a rhyolite. Wood is used in distilling mercury from the ore.

The Kendall-Douglas lease at the Manhattan Consolidated has cut rich ore, and a width of six feet has assayed from $175 to $1583 per ton. Work has been going on at this point for several months, and something permanent appears to have been found. Two stopes are being worked by the Muskett and Wittenberg lease at the Manhattan Consolidated. Rich ore is still being mined in the winze being sunk from the 130-ft. level to the 250-ft. level.

The Tonopah company reports that during July, 13,832 tons of ore was treated yielding $216,950, of which $186,850 was the value of bullion shipped and $30,100 from 65 tons of concentrate. The net profit for the month was $119,205. During the week ended August 17, seven mines at Tonopah produced 10,201 tons, with an estimated value of $255,025. The Golden Crown has been purchased by Tonopan men, and a new company has been formed called the New Golden Crown Company of Tonopah, with a capital of 1,500,000 shares of $1 each. The property is situated between the Montana and Midway mines, and about 600 ft. east of the Tonopah Merger mine. A shaft has been sunk 620 ft., is in order, and has a good steam-hoist which will be used for the present. A compressor will be erected. Sinking will be continued to 1200-ft. depth.

Storey County

A meeting of the United Comstock Pumping Association was held in San Francisco last week, to confer with the Starret pump people relative to the situation at the Ward shaft, where a pump of that make is trying to unwater the shaft, which was flooded at the time of the fire on the 2475-ft. level some months ago. The Pumping Association granted the Starret pump people reasonable time in which to make another attempt to lower the water; and if they do not succeed, some decisive action may be taken regarding the future of the Ward shaft, which has been a heavy burden upon assessment payers of the entire Comstock lode, particularly on the properties at the north end. At the C. & C. shaft work is being rushed on the new pump, three shifts per day being at work getting ready to lower the new vertical centrifugal pump to the 2500-ft. level. On this level at the Ophir, the south drainage drift is being reopened, and other work done for enlarged pumping operations. A new cross-cut has been started on the 2200-ft. level, 107 ft. in the northeast drift, which runs from the bottom of the 2000-ft. winze. Stoping on the 2400 and 2500-ft. levels of the Mexican is opening good ore. The 2400-ft. stope near the Union line has widened out considerably, and may prove to extend into Union ground on the intermediate level.

At the meeting of the Union Consolidated company on August 20, B. F. Shaw, president and director, resigned, and J. H. Goldman, representing the De Sabla interests, was elected to fill the vacancy on the board. J. Landers was elected president in place of Mr. Shaw. The resignation of

C. E. Julian, the superintendent, was accepted; and Whitman Symmes, formerly superintendent, as well as the present superintendent of the Mexican mine and of the Pumping Association, was reappointed to fill the vacancy. This will place Mr. Symmes in control of the pumping and ventilation of the north-end mines, as well as the Mexican-Union-Sierra Nevada joint shaft.

During the week ended August 17 the Consolidated Virginia mined 11 tons of ore, worth $26.63 per ton, from the understope on the 2500-ft. level. The Ophir shipped 99 tons to the Kinkead mill. From stopes at the 2300, 2400, and 2500-ft. levels the Mexican mine produced 601 tons with a total value of $18,074. The mill treated 530 tons averaging $23.10, with 92% extraction. Water in the Yellow Jacket shaft is 36 ft. 11 in. below the 1400-ft. station on the incline.

NEW MEXICO

El Paso County

The Deadwood Mines mill has been treating 30 tons of custom ore per day in addition to the regular mine output, and when the automatic sampler is erected the capacity of the plant will be much increased. The Ernestine mill produced 4½ tons of concentrate from the first 10-days run in August, while 542 tons of ore was treated during the first week. During the week ended August 16 the Oaks Company shipped 130 tons of ore worth $20 per ton.

Grant County

The Utter mine at Pinos Altos will ship over 1,000,000 lb. of zinc concentrate this month to Bartlesville, Oklahoma. The mines near Hanover are shipping a good deal of zinc ore.

UTAH

Juab County

The May Day company is sending zinc ore to the smelter at Argentine, Kansas. About 1000 tons of 37% zinc ore is ready for shipment. The new electric hoist is working well. The Eagle & Blue Bell has let a contract for a 300-ton ore-house. The Grand Central has paid a dividend of $30,000, the total to date being $1,632,500. Development at the 2300-ft. level is encouraging, this being the deepest mining in the Tintic district.

Salt Lake County

Seven mining companies paid dividends amounting to $289,849 in July. Bulletin No. 471-I, the U. S. Geological Survey has given a preliminary though thorough review of the coalfields in Uintah and Wasatch counties. It is estimated that the Deep Creek field contains 49,461,000 tons of coal, and by careful mining at least 60 to 75% can be recovered. The coal is a low-grade bituminous. The Blacktail mountain coalfield, in Wasatch county, is also of a low-grade bituminous character, its calorific value being about 12,000 British thermal units.

After September 1 the wages of miners at the Bingham camp will be increased 25c. per day, which will make the wage about equal to 1907.

Utah County

On the 1500-ft. level of the Lower Mammoth, the lode carrying zinc ore is now 18 in. wide. On this level, 100 ft. west of the shaft, assays return 2.1% copper, $1.40 in gold, and 24.6 oz. of silver per ton. From a vein being prospected at the 1000-ft. level the assays have shown 239 oz. of silver, 21.5% lead, and $1.20 in gold; also 17.4% lead, 16.8 oz. of silver, and 80c. in gold. These samples were from the vein, but so far there is no large quantity of ore opened at this point. Shipments are to be made from the Union Chief mine. On the lower adit level the lode in the northeast drift is about 24 in. wide, consisting of iron ore carrying lead, similar in character and value to that in the upper levels, and also has a seam of galena on one wall.

CANADA

Cobalt

During the week ended August 10, nine mines at Cobalt shipped 631 tons of ore and two sent out 64,624 oz. silver, the Coniagas heading the list of ore shipments with 208 tons, and the Nipissing with 45,263 oz. silver. For the current year the total shipments of ore and silver from the camp are 6649 tons and 2,969,268 oz., respectively. Foundations have been completed for the new high-grade mill at the Buffalo. It has been planned on somewhat similar lines to that at the Nipissing, where amalgamation and cyanidation are used in a tube-mill. There will be a few modifications of the latter plant. Hydraulicking at the Nipissing has uncovered a vein which is probably an extentions of No. 128.

From the main vein at 150-ft. depth, in the McKinley-Darragh mine, 38 tons of ore was shipped to Perth Amboy smelter, containing 231,270 oz. of silver. Some of the high-grade ore carries as much as 13,000 oz. per ton. The value of this carload is a record for the district. The Minister of Mines announced that that portion of the Gillies Limit open to prospecting on August 20, can be staked on identically the same terms as other Crown lands open for staking, and no special conditions are attached whatever. There was a fear among prospectors that a royalty would of Mines announced that that portion of the Gillies Limit be exacted. Prospectors have been examining the district with much interest.

Yukon

Indians have found placer gold in the Stikine country, in Yukon Territory, above the northern boundary of British Columbia. A rush has set in for the isolated place, where there are no people, and it is hard to reach. Bishop Du Vernet says that "any attempt to reach the district this winter would probably be inviting disaster." To get there, a coast steamer is taken to Wrangel, Alaska, or failing this, a gasoline boat up the river 160 miles to Telegraph creek, the head of navigation. From here there are pack-trails in four directions. The field is on the South Nahanni river, 450 miles by trail and river from Telegraph creek, beyond the northern boundary of British Columbia, 120 miles east of the Hyland river, across country. The July return from the Yukon Gold Co. amounted to $644,000, as compared with $476,844 for July 1911. The average yield for the month was 63c. per yard, and for the season to date, 71c., as against 57c. for the same period last season.

MEXICO

Sonora

According to refugees from La Dura, the Mexican rebel leaders, Rojas and Campos, after two weeks of nearly constant fighting, captured and destroyed that town. What the rebels could not carry away they burned.

The Protrero company is erecting a 60-ton stamp-mill, about 35 miles from Casal. About 45,000 tons of ore worth ₱15 is ready for the mill. The San Felipe company is employing 25 men, and its shaft is down 280 ft. There have been no interruptions to work through the revolution.

One hundred and fifteen men are employed by the Democrata company, and the smelter of 125-ton capacity will be blown in during the week. Considerable ore has been broken, and over 600 tons was mined in two days in the carbonate stope on the adit-level. The smelter matte will be sold to the Cananea Consolidated company. A 75-ton smelter is to be built for the Minneapolis Copper Co., which owns considerable property in the Moctezuma district, near Cumpas.

NORWAY

(Special Correspondence.)—During the month of July the Elmore vacuum plant at the Sulitjelma mine produced 1078 tons of copper concentrate.

London, August 1.

SOUTH AFRICA

Transvaal

The Rand output for July was valued at $16,284,000, as against $16,012,000 for June and $15,060,000 for July 1911.

Personal

Professional men are invited to send news of their engagements and travels. Such news is interesting to friends.

W. W. MEIN is in San Francisco.

F. J. DENNIS is back from Nome.

T. T. READ is at Spokane, Washington.

TOM COX was in San Francisco Tuesday.

STUART L. RAWLINGS is in San Francisco.

J. E. SPURR was in San Francisco this week.

S. W. MUDD was in San Francisco last week.

B. B. THAYER was in San Francisco this week.

F. A. KEITH visited San Francisco last Friday.

E. P. MATHEWSON was in San Francisco Thursday.

R. Y. WILLIAMS is at Seattle on his way to Alaska.

C. W. PURINGTON sailed from Seattle for Nome this week.

ELWOOD MEAD is up from Melbourne, Victoria, for a visit.

W. H. STORMS has returned from High Grade, California.

R. B. MCGINNIS is back from Arizona and leaving for Oregon.

H. W. TURNER has returned to San Francisco from London.

JOHN H. EGGERS is at the Golden Eagle mine, Fort Jones, California.

T. A. RICKARD and D'ARCY WEATHERBE have been golfing in Belgium.

J. D. HUBBARD is returning from Korea to California for a short stay.

CHARLES JANIN has returned from Alaska and will go to Nevada today.

RALPH STOKES is to assist W. W. MEIN, of the Canadian M. & E. Company.

F. P. PAUL arrived from Sydney on the *Sonoma* last week on his way to London.

P. JANSEN of the Simau mines, West Sumatra, will be in the United States soon for a vacation.

J. M. HILL has been studying High Grade, Modoc county, California, for the U. S. Geological Survey.

E. J. DUNN, for many years director of the Geological Survey, of Victoria, Australia, recently resigned from the service.

HYMAN HERMAN, a well known Victoria geologist, has been appointed director of the Geological Survey, of Victoria.

W. H. WESLEY, assistant metallurgist at Mt. Lyell, Tasmania, has been appointed metallurgist for Mt. Morgan mine, in Queensland.

F. A. LEACH is again in government service, having taken the place as superintendent of the Mint at San Francisco, made vacant by the death of JOHN SWEENEY.

W. A. MCLEOD, formerly of the Charters Towers School of Mines, but lately with the Brilliant Extended company, has been appointed to take charge of Bewick, Moreing & Co.'s business in Western Australia, in place of J. A. Agnew, who recently resigned.

Obituary

VICTOR DE GOMEZ, long associated with Hagin & Hearst in the management of mines, died at Durango, Mexico, August 8, of dysentery. Mr. Gomez was an old army officer who spent the past quarter of a century in Mexico and had an excellent reputation for ability and integrity. He was a man of fine nature, who made and held friends, and he will be greatly missed.

WILLIAM POLLARD, one of the best known mining 'captains' in the Michigan copper mines, was killed by a fall of rock last week. Mr. Pollard was from Cambourne, Great Britain, but had been in this country since 1887. He had worked at the Ahmeek, Centennial, Calumet, and other properties before going to the Wolverine, where he had been employed for the past dozen years, and had also had experience in Arizona. He was 52 years old and leaves a wife and eight children.

Market Reports

LOCAL METAL PRICES

San Francisco August 22.

Antimony	11—11¾c	Quicksilver (flask)	42.50
Electrolytic Copper	17¾—18c	Tin	50—51½c
Pig Lead	4.75—5.70c	Spelter	8—8¼c

Zinc dust, 1400 lb. casks, per 100 lb., small lots $9.50—9.75; large $7.50—8.50

METAL PRICES

(By wire from New York.)

NEW YORK, August 22.—Copper and lead are strong and in good demand. Spelter prices are firmer.

Average daily prices for the past week, in cents per pound, based on wholesale transactions, standard brands, are given below.

Date.	Electrolytic Copper.	Lead.	Spelter.	Silver, per oz.
Aug. 15	17.48	4.50	6.90	62⅜
" 16	17.45	4.50	6.95	63
" 17	17.45	4.50	6.95	63¼
" 18	Sunday.		No market.	
" 19	17.45	4.50	6.98	62¼
" 20	17.48	4.50	6.98	62⅜
" 21	17.46	4.50	7.00	62⅜

LONDON QUOTATIONS

(By cable, through the courtesy of C. S. Burton & Co., New York.)

	August 22.
Camp Bird Ltd	$ 6⅞
El Oro	3⅝
Esperanza	6½
Oroville Dredging	1¾
Santa Gertrudis	7½
Tomboy	6⅝

COPPER SHARES—BOSTON

(By courtesy of J. C. Wilson, Mills Building.)

	Closing prices, August 22.		Closing Prices August 22.
Adventure	$ 8	Mohawk	$ 67½
Allouez	46	North Butte	33⅝
Calumet & Arizona	79¼	Old Dominion	58¾
Calumet & Hecla	551	Osceola	117
Centennial	22¼	Quincy	91
Copper Range	58¾	Shannon	16½
Daly West	4¾	Superior & Boston	2
Franklin	11½	Tamarack	43
Granby	55⅛	Trinity	6
Greene Cananea, ctf.	10⅛	Utah Con	12
Isle-Royale	36	Victoria	3
La Salle	3½	Winona	5
Mass Copper	7¼	Wolverine	107

NEVADA STOCKS

(By courtesy of San Francisco Stock Exchange.)

San Francisco, August 22.

Atlanta	$ .26	Mexican	$2.70
Belcher	.38	Midway	.60
Belmont	9.75	Montana-Tonopah	2.00
B. & B.	.09	Nevada Hills	2.02
Booth	.07	Ophir	.92
Chollar	.08	Pittsburg Silver Peak	.95
Combination Fraction	.15	Round Mountain	.40
Con. Virginia	.54	Savage	.08
Florence	.90	Tonopah Extension	2.75
Goldfield Con.	3.67	Tonopah Merger	1.95
Gould & Curry	.04	Tonopah of Nevada	6.50
Jim Butler	.66	Union	.71
Jumbo Extension	.40	Vernal	.10
MacNamara	.23	West End	1.72

MINING STOCK QUOTATIONS—NEW YORK

(By wire from C. S. Burton & Co., New York.)

	Closing Prices. August 22.		Closing Prices. August 22.
Amalgamated Copper	$ 87⅜	Miami Copper	$ 29½
A. S. & R. Co.	87	Mines Co. of America	3
Braden Copper	6⅞	Nevada Con	22½
B. C. Copper Co.	5	Nipissing	7⅞
Chino	38½	Ohio Copper	¾
First National	2⅜	Ray Con	21½
Giroux	5½	Tenn. Copper	44
Goldfield Con.	3¾	Tonopah Belmont	9¾
Greene-Cananea	10½	Tonopah Ex.	2¾
Hollinger	12¼	Tonopah Mining	7
Inspiration	19	Trinity	6¼
Kerr Lake	2⅞	Tuolumne Copper	2⅞
La Rose	3	Utah Copper	63¾
Mason Valley	12¾	West End	1¾
McKinley-Darragh	1⅝	Yukon Gold	3⅝

Concentrates

Most of these are in reply to questions received by mail. Our readers are invited to ask questions and give information dealing with the practice of mining, milling, and smelting.

MANGANESE dioxide amounting to 15% of the weight of gold precipitate from a cyanide clean-up may be used with good results in a clean slag and better grade of bullion than usual.

INTERMITTENT washing of sand in a leaching vat has often been found to give better results than continuous leaching, as in the former system the sand gets extra aeration when the washes are completely drained.

BREAKAGE of cams does not form any great expense in a well run stamp-mill. At Treadwell, only 42 were broken out of 540 in use last year; while at the Ivanhoe, at Kalgoorlie, the average is 19 out of 100 in use.

HORSE-POWER totaling 2095 is generated by high and low-pressure turbines and generators at the Horse-Shoe mine, Kalgoorlie. The output for 1911 amounted to 7,363,300 units, at an average cost of 1.5c. per unit.

GAS made in an ordinary producer, for a suction gas-engine, is used with much satisfaction for melting bullion at Waihi at a cost of 8c. per hour. Kerosene melting furnaces to take a No. 200 crucible are also used in the district for melting precipitate.

MEN working in mills and smelters should have plenty of light, and fairly comfortable surroundings, if they are expected to be contented and to work efficiently. Men cannot be blamed if they neglect to pay enough attention to machinery in dark corners, where danger lurks.

SELECTIVE action of cyanide solutions is at its maximum in solutions of greater dilution than are found most economical in regular working; but fortunately, great solvent effect is exerted by small concentrations, and the cost of cyanide per ton of ore is therefore low.

GROOVING of crushing rolls is the cause of much expense in that thick shells have often to be discarded. In order to reduce this trouble in the new rolls made for the Miami Copper Co. by the Traylor company, the free roll is automatically moved backward and forward.

DISPOSAL of residue from vacuum or filter-press plants may be cheaply done where water-power is used in driving machinery. The tail-races, carrying waste water from Pelton or other wheels, can often be constructed under the leaves or frames of such filtering machines, and the residue thus washed away into creeks or ponds.

MACHINERY has a certain noise when working, and attendants quickly note any unusual sounds, knowing that all is not right. The same applies to the feel of certain working machinery. A millman has been known to pass along and feel 100 stamps dropping, pick out one and say that it was not quite correct. When inspected, a small piece of steel was found under it.

SOOT has been the cause of considerable investigation and discussion. According to R. C. Benner, professor at the University of Pittsburgh, laundry articles to the value of $500,000 are destroyed yearly by the smoke of that city. Lace curtains last one-third longer in other cities, and over 20% of the dust in its streets is composed of soot. A cubic mile of Pittsburgh air contains 4½ lb. of soot.

COCOANUT matting in leaching-vats is sometimes laid over the filter-bottoms, with the cloth caulked down over it; and sometimes the reverse way; that is, the cloth is caulked over the bottoms, and the matting is laid on top of it. It is mostly a question of experience as to which system preserves the filter-cloth longest. When the sand is shoveled out of a vat, light boards are sometimes put over the filter to prevent its being cut.

GAS is not a mineral, according to the decision of the Privy Council in the case of Farquharson *v.* the Canada Land County. The Indiana Supreme Court once held that gas was a 'wild' mineral comparable to wild game and belonged to the man on whose land it was found, if captured and brought under restraint while still on his land, but, unlike the domestic cow, could not be followed and claimed if it strayed down the country lane.

SAND-FILLING of stopes is practised at many mining centres, both by using dry sand and by pumping in wet pulp. On the continent of Europe it is known as the flushing system, in which old rubbish and fine coal is used. At Treadwell a large proportion of the power generated at Nugget creek is to be used for pumping the tailing from the stamp-mills to the mine stopes, thus preventing a possible settling or caving of the ground.

SAMPLING pulp from a battery, before it goes over copper plates and to the cyanide plant, is an easy matter if the ore has been crushed with water. At some mills it is the practice to take a cut of the pulp stream, by drawing across it a small scoop which discharges the sample into a barrel or other receptacle. This is done hourly; and on pulling the sample the reverse way, another sample may be obtained to check the first one. At one mill in particular, results check well right through treatment, using this sampler.

OIL and hard water are generally troublesome in boilers, and various devices are used to protect the latter from oil and scale, such as passing condensed water from engines through a box in which the oil is deposited on thin cast plates by an electric current; passing oily water through a series of tanks containing coke, bricks, and straw; the use of alum; boiler compounds containing soda as a base; passing hard water over sheets of aluminum exposed to sunlight; hanging slabs of zinc in boilers; and after a boiler has been cleaned, coat the inside liberally with graphite.

MINING BOOMS generally result in inflating, out of all reason, the prices of blocks in new townsites thrown open. When the district settles down to steady work, there is invariably a slump in land values. A case in point is the well known Bullfinch boom, in Western Australia, in 1910. The Government sold 128 town blocks at prices up to $4000 each. A 10% deposit was required, followed by monthly payments. It appears now that only 34 blocks have been paid for, and the rest will be forfeited. The original sale days were ones to be remembered at Southern Cross, the main business centre of the district.

CERTAIN creeks and rivers in New Zealand have been declared sludge channels by the Government, so that mining companies are allowed to discharge their battery residue into them. When such rivers are flooded, the slime and sand is carried many miles, and if low-lying farming country is near, these products are deposited on it, much to the alarm of farmers. An instance of this is the Ohinemuri river, flowing through the Waihi and other mining districts of New Zealand. A silt commission was appointed and a deal of interesting evidence taken. The companies discharging into the river have now to pay a small sum annually.

Utah Copper Quarterly Report

The report of the Utah Copper Co. for the second quarter of 1912 gives the gross production of total copper contained in concentrates as follows:

	Pounds.		Pounds.
January 1912....	8,156,162	April 1912.....	9,069,237
February "	8,612,739	May "	10,068,336
March "	8,160,199	June "	9,234,465
Total	24,929,550	Total	28,372,038
Average monthly production	8,309,850	Average monthly production	9,457,346

During the quarter there was treated at both plants a total of 1,503,884 tons of ore, as compared with 1,299,315 tons for the previous quarter. Of this tonnage, the Magna plant handled about 70% and the Arthur plant about 30%. The average assay of the ore treated during the quarter was 1.42% copper, as compared with 1.435% copper for the previous quarter. The average cost per pound of net copper produced during the quarter, after allowing for smelter deductions and without crediting miscellaneous income, was 8.127c., as compared with 8.62c. for the first quarter of 1912. If net miscellaneous earnings in Utah, including those from the Bingham & Garfield railway, were applied as a reduction of costs, the net cost per pound for the quarter would be 7.55c. The financial results of the operations of the company for the quarter are shown in the following table:

Milling profit for quarter.....	$2,237,485.24
Other income, rents, etc., in Utah.....	10,026.01
Income from Nevada Con. Copper Co. dividends	375,187.50
Total net profit for the quarter.....	$2,622,698.75
Dividends paid	1,181,347.50
Net surplus for the quarter.....	$1,441,351.25

The earnings are computed on the basis of 16.43c. per pound, which is approximately 0.15c. less than the average net price received from actual sales during the period. At the close of the quarter, no copper due for delivery from the refinery remained unsold.

The Magna plant and nine of the thirteen sections of the Arthur plant were in operation throughout the month of April, but their tonnage was much reduced by reason of the numerous snowstorms during the month, causing some delays in the coarse-crushing departments on account of wet ores. During the month of May conditions were more satisfactory, and both plants were operated continuously to full capacity for the sections then in commission. During June the Magna plant was operated to full capacity, but the tonnage of the Arthur plant was considerably reduced on account of the installation of new and heavier machinery in the coarse-crushing department. The tenth remodeled section of the Arthur plant was finished and placed in operation about the middle of May, and the eleventh section about the middle of June. The twelfth section of this plant is ready for operation, and the thirteenth and last remodeled section will be completed about the middle of August. This will conclude the heavy expense of rebuilding the Arthur plant and leave, for the completion of both mills, only the enlargement of their coarse-crushing departments to insure sufficient capacity during winter and wet weather when the ores are more difficult to handle in these departments. The expense of these improvements will be comparatively nominal, and it is expected to have them completed before winter weather begins. The snowstorms during the month of April interfered materially with the stripping operations, but in the months of May and June good progress was made, as weather conditions were favorable. There were removed for the quarter a total of 1,589,648 cu. yd. of capping, as compared with 1,354,761 cu. yd. removed during the first quarter of 1912, being an increase of 234,887 cu. yd. The operations of the Bingham & Garfield railway during the quarter were satisfactory in every respect. An average of 10,203 tons of ore per day was hauled from the mines to the mills for the period, as compared with 7910 tons per day for the previous quarter. An average of 1265 tons per day of other freight was transported over the line compared with 571 tons per day for the first quarter of 1912. Passenger train receipts for the quarter also showed a substantial increase, as compared with the previous quarter.

Mining in British Columbia in 1911

The annual report of the Bureau of Mines, by the provincial mineralogist, W. F. Robertson, shows that the total value of all products in 1911 was $23,499,072, being a decrease of $2,877,994 as compared with the previous year. Up to and including 1911, the province has yielded $397,696,722. The following table shows quantities and values of the mineral products for the year:

	Quantity.	Value.
Gold (placer), ounces	.....	$ 426,000
Gold (lode), ounces	228,617	4,725,513
Silver, ounces	1,892,364	958,293
Lead, pounds	26,872,397	1,069,521
Copper, pounds	36,927,656	4,571,644
Zinc, pounds	2,634,544	129,092
Coal, long tons	2,193,062	7,675,717
Coke, long tons	66,005	396,030
Miscellaneous	.....	3,547,262
Total		$23,499,072

For a period of eight months there was no production of coal from the East Kootenay district, owing to a labor dispute, hence production fell off by over 600,000 tons, and that of coke by 152,000 tons. This trouble had its effect on the mines and smelters in the Boundary district. Lode mines produced 1,770,755 tons during the year, a decrease of 445,673 tons, the Boundary district yielding 70.25% of this total. The Atlin camp produced $225,000 in placer gold. The snowfall of last winter was above the average, but it was not followed by the usual spring and fall rains, this preventing several fall clean-ups. The Cariboo and Quesnel divisions show a decrease of $54,000. Rossland with $2,411,837, Boundary with $1,813,690, and Slocan with $364,619 gold output, made the total from lode mines. The Nickel Plate mine at Hedley treated 57,500 tons with a return of $675,000, in its large stamp-mill. There are stamp-mills in other centres. Most of the silver produced in British Columbia is found with the lead ores in the Slocan district. The Fort Steele division produced 63.82% of the lead ores, Slocan following with 24.96%. Owing to the labor dispute, the copper output from the Boundary district was about 9,000,000 lb. less than last year. The Grandby mine produced only 605,880 tons of ore, as against 1,075,000 in 1910. But the Coast district had an increase of about 7,900,000 lb. The average assays of copper ores based on copper recovered were: Boundary, 0.89%; Coast, 3.67%; and Rossland, 0.67%. The Van Roi and Hewitt mines produced most of the zinc, the Whitewater and Lucky Jim mines not being able to ship on account of loss of rail connection due to a fire. Details are given on the yield and prospects of iron and platinum, and production of building materials.

"Notice---This Means You"

The *Chicago Tribune* prints the following as posted at a New Mexico coal mine:

"Notice to all employes

aney Person or Persons that Mooves into A house Without My Consent shall be Put out Without anney Cemmony.

Dam it I Must and Will have some Sistom.

HEN FILSTER."

Decisions Relating to Mining

Specially reported for the MINING AND SCIENTIFIC PRESS.

ORE REDUCING CONTRACT—SUIT FOR ACCOUNTING

Where a contract was made with an ore-reduction company to reduce ores at a specified sum per ton, and a suit was thereafter brought for an accounting based upon the entire gross value of the ore, a judgment for the plaintiff for the full amount was reversed, the appellate court announcing that it would take judicial notice of the fact that there could not be 100% extraction, and that the percentage of extraction would have to be determined on a new trial.

Richardson *v.* National Ore Purchasing & Reduction Co., (Nevada) 124 Pacific, 779. July 13, 1912.

OIL LEASE—CONSTRUCTION

An oil lease provided for stipulated payments to the lessor for the lessee's failure to commence drilling, and also provided that the lessee might suspend drilling operations if the price of oil went below 75 cents per barrel. When the lease was executed, the price of oil was below 75 cents per barrel and thereafter remained below that price. It was held that the lease merely authorized a suspension of drilling operations and did not authorize a failure on the lessee's part to commence drilling.

McComber *v.* Kellerman (California), 124 Pacific, 431. June 4, 1912.

DRAINAGE OF MINES—LIABILITY OF UPPER OWNER

The owner of a mine on a higher level may permit the water to flow where it naturally will, in the course of ordinary mining, and is not bound to protect a mine-owner upon a lower level from such water, and if an injury is caused from such natural flow of the water from the higher level to the lower, there is no liability; but if the owner of a mine on a higher level opens up old workings which he knows or has reason to know may be filled with water, or otherwise allows or causes water to flow into the lower mine which would not ordinarily go there, he is liable for resulting damages.

Spadra Creek Coal Co. *v.* Eureka Anthracite Coal Co. (Arkansas), 148 Southwestern, 644. June 17, 1912.

ADVERSE CLAIM—SCHOOL LAND—ASSESSMENT WORK

Where a mining location was made upon a section 36, granted to the state of Utah as a school section prior to date of location, it was not necessarily invalid as being on land presumed to be non-mineral. If the officers of the Land Department have recognized the claim as being located on mineral ground, the character of the land cannot be assailed in an adverse suit in the courts. The findings of the Land Department are conclusive in this respect. Where it is shown that the land was known to be mineral in character prior to the passage of the Congressional Act purporting to grant it to the state, no title passed to the state under such a grant. Where in an action in aid of an adverse claim, there was direct and positive evidence from expert miners and mining engineers that the assessment work had been properly done, the trial court properly refused to substitute its own judgment therefor, even though evidence was introduced tending to show that the shaft was too far distant from some of the claims or that the drift run from said shaft would not tap said claims at an appreciable depth. The requirement is merely that the work commenced should be such that, if continued, will lead to the discovery and development of supposed veins, or facilitate the extraction of ores known to exist. A finding of the trial court that the claim was not forfeited for non-performance of assessment work will not be disturbed on appeal unless clearly shown against the preponderance of evidence.

Nevada Exploration & Mining Co. *v.* Spriggs, (Utah) 124 Pacific, 770. June 10, 1912.

Book Reviews

Any of the books noticed in this column are for sale by, or can be procured from, the MINING AND SCIENTIFIC PRESS.

CHEMICAL ARITHMETIC AND CALCULATION OF FURNACE CHARGES. By R. Chauvenet. 300 pp.; index. The J. B. Lippincott Co., Philadelphia. For sale by the *Mining and Scientific Press*. Price $4.

This volume will be found to be useful to students, and anyone connected with chemical or smelting works. The opening pages contain the usual laws of chemistry, definitions, and explanations of thermometers and the metric system found in other works, but given here in a condensed form with examples of problems. Under chemical problems, there are given, among others, the equation for determining the weight of any other substances, the actual weight of one substance entering into a chemical reaction being known; given the formula of a chemical compound, to deduct its analysis, or composition expressed in percentages; given the analysis of a chemical compound, to derive its formula; given the equation for the production of a gas, and the weight of any one of the solid compounds entering the reaction, to deduce the volume of the gas; given the volume of a certain mass of gas, to find the volume under a given change of pressure. Under these and other heads are given a number of problems coming under the fundamental laws of chemistry. A variety of specific gravity problems is given, and explained. There are discussions on calculation of analyses, and assay weights and calculations in a simple style. Under volumetric analysis, 41 examples are explained, while 255 miscellaneous questions and answers are given on all chemical problems. Twenty-two pages are devoted to tables of all kinds. The calculation of furnace charges is an important feature if good results are to be obtained in smelting plants, and in the work under review great space is devoted to examples of fluxes used and slags desired, especially in the part dealing with pyritic smelting.

Recent Publications

BUREAU OF MINES NEW PUBLICATIONS

Bull. 18, 'The Transmission of Heat into Steam Boilers.' By Henry Kreisinger and W. T. Ray. 180 pp. 1912.

Tech. Paper 17, 'The Effect of Stemming on the Efficiency of Explosives.' By W. O. Snelling and Clarence Hall, 20 pp. 1912.

Tech. Paper 18, 'Magazines and Thaw Houses for Explosives.' By Clarence Hall and S. P. Howell. 32 pp., 1 pl. 1912.

Tech. Paper 23, 'Ignition of Mine Gas by Miniature Electric Lamps.' By H. H. Clark. 5 pp. 1912.

Bull. 40. 'The Smokeless Combustion of Coal in Boiler Furnaces.' By D. T. Randall and H. W. Weeks. 188 pp. Reprint of U. S. Geol. Surv. Bull. 373, revised by Henry Kreisinger.

Tech. Paper 21, 'The Prevention of Mine Explosions.' Report and recommendations by Victor Watteyne, Carl Meissner, and Arthur Desborough. Reprint of U. S. Geol. Surv. Bull. 369.

The Bureau of Mines has copies of these publications for free distribution, but cannot give more than one copy of the same bulletin to one person. Requests for all papers cannot be granted without satisfactory reason. In asking for publications, please order them by number and title. Applications should be addresed to the Director of the Bureau of Mines, Washington, D. C.

THE LOWER COPPER RIVER BASIN, ALASKA. The Taral and Bremner Districts and Chitina District. By Fred H. Moffit. Advance chapter from Bull. 520, 'Mineral Resources of Alaska, 1911.' U. S. Geol. Surv. Bull. 520-C. 19 pp. Map. Washington, 1912.

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EDITORIAL

CONGRESSMEN are at last free to go home and rebuild their dilapidated fences. Before they are through many planks are apt to be missing from party platforms.

CERRO, New Mexico, is the most recent district to bid for fame and prosperity by means of an artificially created boom. There are real veins in the district and some chance of finding orebodies of importance, but Denver papers report that the recent flurry was created solely by men owning hotels and livery stables at Cerro and Questa, on the route.

REDUCED rates have been granted by the Western Passenger Association for the meeting of the American Mining Congress at Spokane, November 25 to 30. The fare from Missouri river points will be $52.50 for the round trip, and that from Chicago will be $68.80. Tickets will be on sale November 9, 10, 11, 21, 22, and 23, with a final return limit of December 31. This granting of reduced rates out of season is an unusual favor, and the officials of the Congress are to be congratulated upon being able to make the arrangement.

METAL-MINING problems are after all to be investigated by the United States Bureau of Mines, Congress having, in the final adjustment of the Sundry Civil bill, granted $50,000 for the work. There is a large and important field to be cultivated, and with such good engineers as Messrs. F. G. Cottrell and W. J. Sharwood in the service, work of definite value is assured. The Director of the Bureau, Mr. J. A. Holmes, might well have become discouraged at the long and persistent fight waged against this item in his estimates. Fortunately, his enthusiasm is of the unquenchable sort, and fortunately also, the wiser counsels prevailed in the final framing of the much-contested act.

HOW deep does the ore extend? That is the critical question in considering most mining investments. The very fact that the question is asked illustrates that experience has taught that ore-shoots are limited in depth to an extent that may be decisive in determining the purchase of a property. Systematic collection and tabulation of observations on this line are much needed. Mr. T. A. Rickard has performed a real service in bringing together the material embodied in his two articles, of which we print the second part this week. We well remember some years ago when he, while state geologist of Colorado, delivered an address at the State School of Mines in which he attacked the ancient fallacy that 'true fissure' veins become richer with depth. There was loud public outcry that such heresy had no place in the instruction of the young engineers of the state and was sure to discourage Colorado's chief industry. Times have changed, and nowhere is there a keener or more intelligent interest in ore deposits now than in that same state. Facts may be stubborn, but knowledge of facts is essential to sound business. We need more data. Will not the engineers in practice write out

the exact measurements of ore-shoots they have worked, so that the foundation may be laid for better practice and sounder theory?

DEFINITE proposals for changes in the organization of the American Institute of Mining Engineers are now in order. The report of the Committee of Five has been before the membership several weeks, and the adjourned annual meeting is to be held in New York October 7. General complaint leads to nothing unless specific constructive measures are proposed. In another column Messrs. C. R. Corning and George C. Stone make such proposals. Discussion of the subject will be welcomed by the officers and all loyal members of the Institute. We shall be glad to print letters from our readers who are interested.

Civil Service and Pensions

Vetoes serve frequently a good purpose, and however much any may differ from Mr. Taft as to points of policy, there is general approval of his continued interposition of the veto to defeat general legislation tacked on to general appropriation bills. This method of forcing through doubtful legislation has become entirely too common, and the President does well to stand for the principle that important matters must be settled on their merits. A case in point, that did not receive deserved recognition, was the proposed limitation of appointments in the civil service to seven years. It is contended that this was merely a device to reintroduce the spoils system, and there is little doubt that the provision, if enacted into law, would have had such a tendency. We do not believe, however, that this was the intention of Congress. As it stands now the civil service is a great organization for building up a corps of employees of mediocre ability. The requirements for entrance are sufficiently severe to prevent more than an occasional inefficient worker obtaining a place, but, on the other hand, there is neither adequate recompense for the man of exceptional ability, nor means of disciplining or dismissing the lazy or incompetent. One administrative officer, long in the government service, said, when several of his men resigned to go into private work, that he would not regret quite so keenly the loss of good men if he were permitted at the same time to dismiss an equal number of poor ones, and thus to maintain the average. Practically that cannot be done, though theoretically it is possible. With all due respect to the many excellent and conscientious men in the government service, it may be fairly stated that the majority of the good men either are financially independent and are therefore able to stay in comfort, or that they keenly regret not having resigned while still young enough to make places for themselves outside. This is not right, and is poor business besides. The government service, affecting as it does most intimately the common good, should be made attractive to the best young men and women in the nation. It should not be necessary for anyone to have private means that he serve his country.

The conditions outlined are thoroughly familiar to everyone who knows life at Washington and to many who come into contact with government employees elsewhere. It continues because of an assumed popular prejudice against civil pensions. A Congress that votes thousands of private pensions to deserters and bounty jumpers, that increases the pension roll $75,000,000 per year by one act, still hesitates to pass a civil pension bill for fear of public wrath. The very excesses in the present military pension system, prevent introduction of a reasonable and business-like system of pensions for civil employees of the Government. More than one bureau chief has estimated that by retiring on half-pay the superannuated employees he has inherited, work could be accomplished more rapidly and money saved to the Government. As it now stands, the old employee either draws full pay or nothing, and in a choice between the two, the bureau chief naturally continues the pay as long as the man can be present and even pretend to work. There is no reason in good morals or in business why a man who has spent his life in the civil service should be turned out to starve. In the military and naval branches of government service, while salaries, as in the civil service, are moderate, ample provision is made for a decent old age. At the same time it is to be remembered that army and navy officers are educated at the expense of the Government, while men in the Geological Survey, Bureau of Mines, Reclamation Service, and other branches, must fit themselves for their work at their own expense.

Congress proposed to meet the difficulty by automatically discharging everyone at the end of every seven years. That would prevent anyone becoming old in the service, but it would also disrupt any organization and greatly increase the already sufficiently difficult task of the bureau chief who is trying to accomplish results efficiently and economically. It was a cowardly evasion of responsibility. To vote an unheard of increase in pensions on account of a war that occurred a half century ago, and then solve the problem of the old clerk by firing him into the street, is a fair measure of the 'statesmanship' of the men who framed the Sundry Civil bill of 1912. We frequently blame government officials for being slow and the bureaus for being inefficient. It would be well occasionally to look beyond to the body that determines conditions under which government officials must work. When your Congressman solicits your vote this fall on the basis of having secured large slabs of pork for his district, why not ask what he has done to accomplish economy and efficiency in the conduct of this, our common business?

Alaska Gold Mines Company

As already foreshadowed last week in our columns, a new company has been formed to hold a majority interest in the Alaska Gastineau Company and to supply funds for equipment and development on a large scale. The sponsors for the concern are Hayden, Stone & Company and the engineers reporting on it, and participating in the flotation, are Messrs. D. C. Jackling and A. F. Holden. On another page we publish a brief extract from their report covering estimates of the size of the orebody, cost of operation, and profits, and in our news letters from New York and Boston, additional details are given.

The Alaska Gastineau Company was but recently formed through the efforts of Mr. B. L. Thane and Mr. W. P. Hammon, who effected a consolidation of ownership of the Alaska Perseverance mine, certain adjacent claims, conflicting apex rights, and important water-rights, the whole lying in Silver Bow and Sheep Creek basins, back of Juneau, Alaska. The lode running through the properties is large and well known, and the Alaska Perseverance has long been regarded as a prospective big mine. With threatened litigation regarding the apex, with insufficient capital, and without the water necessary to run more than a few months each year, the property missed the success to which the size of the lode justified expectations. In the Alaska Gastineau Company were brought together all the properties necessary to economical working of the mine, and now the Alaska Gold Mines Company is to furnish the necessary capital. The Alaska Gastineau Company is capitalized at $12,000,000, and in addition has outstanding $3,500,000 of 6 per cent bonds. The company has a 100-ton mill and has

been operating four to five months in the year. With a gross recovery of $1.50 and a cost of $1, the earning capacity has been not more than $40,000 per year. It is understood that interest on the bonds is in arrears and the stock has been held at a low price. As full reports are not available to the public it is not known how much stock remained in the treasury. Interesting details of the plan for financing the property through the Alaska Gold Mines Company have been given in a circular distributed by Hayden, Stone & Company. Many important facts are, however, left unexplained, and in the interest of sound mine financing more information should be given the subscribers for the stock.

The new company is to be capitalized at $7,500,000, represented by 750,000 shares having a par value of $10 each. The company is to hold $1,790,000 in the bonds of the Alaska Gastineau and $9,801,000 par value of its stock. The underwriters offer 614,700 shares of the Alaska Gold Mines Company to the public and agree to turn over from the proceeds of its sale, $1,250,000 to the Alaska Gastineau and $3,250,000 to the Alaska Gold Mines. The remaining shares of the Alaska Gold Mines Company, amounting to 135,300, are to be held in the treasury for general purposes and to buy, if it can be done on reasonable terms, the outstanding $1,710,000 in bonds, and $2,199,000 in shares of the Alaska Gastineau. From the last statement it is evident that Alaska Gastineau bonds and stocks are held by the underwriters to be worth much less than par, or that Alaska Gold Mines stock is expected to command a large premium. We are reliably informed that the promoters of the new enterprise paid $1,000,000 in cash for the $1,790,000 in bonds and an option on $9,801000 in stock of the Alaska Gastineau Company, which is to be placed in the treasury of the Alaska Gold Mines Company. At what price, and for what consideration, these securities were transferred from the promoters to the new company is not made clear. It is true that, assuming that the new stock be sold at par (it is now quoted at $7 or $8 in Boston) there would be a profit of $1,670,000 in underwriting the issue. Possibly the $1,000,000 already advanced is to be taken out of this profit, but in view of the small chance that the new stock will go out at par, and the expenses and commissions usually incident to underwriting, this does not seem likely. If we are correct in the latter surmise, the new company starts with a debt of $1,000,000, direct or indirect, which is not mentioned in the announcement. Another point upon which light is desirable is the consideration for which the Alaska Gold Mines Company, in return for its shares sold by the underwriting syndicate, permits $1,250,000 to go direct to the Alaska Gastineau Company. Is this for treasury shares or bonds, and, if so, what part do they form of the total holdings of the new company? Still another point is, what is the method by which the $3,250,000 to be paid by the underwriters to the Alaska Gold Mines Company, is to pass to the Alaska Gastineau, and becomes available for construction and development? If our information is correct, to the effect that the promoters turned in an option on the stock rather than the stock itself, and if, further, this stock is still in the treasury of the Alaska Gastineau Company, it is presumed that the latter will receive the cash in payment for stock. The circular distributed by the underwriters is as interesting for what it does not tell as for what it reveals, and is surprisingly vague at critical points.

It should not be forgotten that the property will be expected to pay profits on a total capitalization of $15,500,000, and that no allowance is being made for amortization. Granting that the 50,000,000 tons of ore 'indicated' measures the tonnage that will be milled, and that the profit per ton will be between 50 and 75 cents, allowance must still be made for the rate at which this profit will be earned. The plant will wear out, and the bonds, presumably, are to be retired. A 6 per cent dividend on Alaska Gastineau stock would be roughly equivalent to 10 per cent on Alaska Gold Mines. On the proposed scale of operations, and not allowing for extensions of orebodies—offsetting the fact that 50,000,000 tons is 'indicated' and not 'ore reserve'—the life of the mine would be 25 years, and at 50 cents per ton profit the earnings would equal 7 per cent on the capitalization. At 75 cents profit, the rate would be 10 per cent. Assigning equal value to the stocks and bonds and assuming a 7 per cent dividend with reinvestment at 4 per cent, the present value of the mine on these estimates and with a profit of 50 cents per ton is $10,691,200; at 75 cents this becomes $17,226,800. Evidently the profits in the enterprise are dependent on reducing costs and increasing capacity. These calculations, it need hardly be said, are not for those who buy shares with the expectation of selling them at a profit on the basis of a temporary high dividend rate.

Turning from the financial to the engineering phases of the new project, the prospect is more alluring. The mine is to be opened by an 11,000-foot adit, tapping the orebody 700 feet below present workings and permitting direct transport of the ore to a 6000-ton mill to be built on the beach. A large hydro-electric plant is to be built, and while ultimately steam generation will be necessary, there is believed to be enough water-power to run the first mill the year around. Working on the present small scale, costs have been reduced to $1 per ton, and at the Treadwell, hoisting from 1600 feet, ore has been mined at a cost of 90 cents. It does not seem impossible that the expectation of mining Perseverance ore at 75 cents will finally be realized, but even at $1 per ton there would be substantial profit, provided the new milling plans are successful. The main recovery from the Perseverance mine has been by amalgamation and in a concentrate containing about 20 per cent lead. This has been saved by careful classification and use of James tables. It is understood that in the new mill the ore is to be quickly 'roughed out' so as to get rid of the large amount of waste promptly. It will be a pretty problem to do in a large mill working for capacity, what has been accomplished by slow careful work in a small plant; and the total amount recoverable is too small to allow much shrinkage. Cost of the new adit is estimated at $440,000; a hydro-electric plant to furnish power for a 2000-ton mill was figured at $300,000, and for the 6000-ton mill now proposed will be proportionately larger. In the Treadwell mine it costs $300,000 to open a level, and several must be opened at once to keep up a 2000-ton production. To prepare for 6000 tons per day at the Perseverance may well cost $1,000,000 for underground development aside from the adit. While the money which it is proposed to expend therefore seems large, it is not out of proportion to the task. Incidentally it may be noted that with the Alaska Gold Mines, Alaska Juneau, and the Treadwell groups operating, a couple of years will see in the Juneau district a series of mines comparable in tonnage handled to the largest on the Rand. In May 1912, the East Rand Proprietary hoisted 183,939 tons and the Crown Mines 190,055. The Treadwell group the same month crushed 144,221 tons, and the Alaska Gold Mines will be equipped with its first unit, to handle 180,000 tons. While the Alaska Juneau is beginning more modestly, it is expected finally to rank with the others. Another matter of general interest is that large-scale production at the Perseverance mine will make available on the Pacific coast a supply of lead concentrate that may materially affect smelting conditions. Mr. Thane and Mr. Hammon have been interested in Alaska for some years, and with Mr. Jackling and Mr. Holden will form an active and able group sure to be prominent hereafter in the Far North.

Persistence of Ore in Depth—II

By T. A. Rickard

In controverting the old idea, now proved a fallacy, that lodes become richer in depth, we must not swing too far in the opposite direction. Since man has had the full aid of modern mechanical science for sinking, hoisting, and pumping, he has never yet had to desist from following rich ore in depth. In many cases he has satisfied himself that the ore 'petered out' underfoot, that is, it became too poor or too patchy to be exploited profitably. Yet there exist deep mines that have not bottomed the ore, such, for example, as the Morro Velho mine, of the St. John del Rey Co., in Brazil. This is 4926 ft. deep vertically and 7000 ft. on the dip of the vein. The mine is still profitable at this great depth, the yield during the past year being at the rate of 45s. 10d. or about $11 per ton on an output of 192,600 tons. The net resultant profit was about 6.6s. or $1.58 per ton. The main shaft is still being sunk, so that in this case the pursuit of ore in depth has not been abandoned.

Another more important case is the Kolar goldfield, in India, where the Mysore, Ooregum, Nundydroog, and Champion Reef mines have workings that are 3100, 2420, 2500, and 3900 ft. deep vertical respectively. These mines have suggested the existence of zones of relative impoverishment and enrichment, they have not become uniformly poorer in depth, and no positive proof exists that the lodes will not continue profitable to a further depth. At the Nundydroog mine, for example, the workings passed through a poor zone in 1898 to 1900; the Ooregum has passed through two such poor zones and is now in comparatively low-grade ore; the Champion Reef was continuously successful until four years ago, since then the profits have been greatly reduced; but the bottom workings are now in ore as rich as that broken in the upper levels; the Mysore mine has escaped similar vicissitudes and is doing as well as ever. These mines, of course, are far from being the deepest existing workings made in search of the metals. The zones of relative poverty and richness appear to be related to structural conditions that in turn are connected with the trend of the ore-shoots, which have a flat pitch. This pitch may be dependent upon the folds in the enclosing schistose rocks. On the whole, I shall ask for more proof than is now available that the Kolar goldfield is distinctly exceptional. I would rather have the gold in the first 3000 ft. of these lodes than that to be found in the next 6000 ft. of quartz, without regard to the increased cost of mining. At Kalgoorlie, in Western Australia, it is also a fact that while general impoverishment is recognizable, yet, once below the effects of secondary enrichment, the lodes have exhibited zones in which the mine workings have been productive for several hundred feet vertically, to be succeeded by barren horizons, giving place again to conditions more favorable to the miner. Despite these departures from uniform impoverishment, the big mines are approaching exhaustion. All experience warrants us in expecting that the lodes of Kalgoorlie, Kolar, and Minas Geraes alike will cease to be profitable to man within a limit attainable by modern machinery. To argue that the Kolar veins will continue to unknown depths is no more reasonable than it would be to expect a man possessed of unusual vitality at 90 to continue with unabated force for another half-century. Increasing age after maturity entails debility and eventual decay of strength; increasing depth below the water-zone involves impoverishment and the eventual cessation of profitable mining.

Before going further it is necessary to recognize differences of geological environment. The most persistently rich lodes are in Archean and Algonkian rocks; they are associated with acid eruptives of the granitic type; they are presumed to be in their primary condition, that is, they owe little or nothing to the secondary enrichment observed within the water-zone. Thus they are held to be superior to the ordinary vicissitudes of veins of a different origin, namely, those associated with Tertiary eruptives, of which the Nevada and Colorado gold-silver lodes are a familiar type. In the latter case the ore-forming agencies are associated with rocks having a structure proving that they are solidified near the surface, that is, where they were relieved from such pressure as exists deep in the earth's crust; while the eruptives associated with the typically persistent lodes in the Archean rocks have a structure indicative of solidification under great pressure, that is, at a profound depth. If a lode can be proved, by faulting or other structural evidence, to be not much younger than such a rock, then it may be assumed to have a great geologic antiquity and to have been formed so far below the original surface is to be immune to such changes as are due to waters circulating in the shallow zone. Hence some authorities, for instance, Malcolm Maclaren,[1] argue that this question of persistence as it affects the miner is not to be made a generalization. The Archean schists and the Tertiary andesites afford conditions notably unlike; in the one the lodes are so old as only to be modified by profound regional metamorphism; in the other the lodes are young and susceptible to the thermal activities of expiring vulcanism.

While appreciative of the scientific reasoning on which a special plea may be based for lodes associated with rocks of uncommon geologic antiquity, I am not impressed greatly thereby, for it remains to be proved that the rich ore is so ancient as to have escaped modification by the geologic agencies that come into play near the surface. It is fair to ask the mining geologist to remember that it is only the enriched portions of a lode that have economic value to the miner and that such enrichments represent a concentration or re-precipitation necessarily more recent than the lode as first formed. Moreover, the cases that can be quoted as an exception to non-persistence of ore are so few that they hardly suffice to prove a theory. If one lode in the Archean, or in association with ancient eruptives, has continued rich to 3000, 4000, or 5000 ft. vertically, how many in the same terrain have ceased to be productive at shallow depths, even among those that survived the trials of the water-zone?

Physical conditions, as we know them, militate against the persistence of rich ore to a great depth, such as 8000 or 10,000 ft. Pressure and heat increase. The increment of temperature is variable, but it may be taken as about 1°C. for every 90 ft.; the pressure at successive depths is roughly equal to the weight of a column of rock of 2.8 sp. gr. equal in height to the depth in question. A decrease of pressure and temperature is favorable to precipitation; an increase gives greater solvent power to underground waters. Hence, other things being equal, the approach to surface would favor deposition and the distance from surface would promote solution. Solution is necessary to enable the underground waters to collect the metals previous to their transfer and concentration in such receptacles as are provided by fractures, fissures, shear-zones, porous sediments, and soluble rocks. Precipitation, it is true, is often only the effect of interchange, but it is usually the exchange of a less soluble for a more soluble substance.

Beyond the direct results of pressure and temperature, we have to recognize a change in rock structure. Natural sections of strata once buried deeply under later formations indicate that there exists a horizon at which rocks cease to be fragile, that is, they do not crack or fissure, but undergo deformation by pressure. They become plastic. C. R. Van Hise[2] was the first to show the mining geologist the sig-

[1] 'Gold,' by J. Malcolm Maclaren. Pp. 76-79.

[2] 'Some Principles Controlling Deposition of Ores.' By C. R. Van Hise. Trans. A. I. M. E., Vol. XXX, pp. 31-33.

nificance of this 'zone of flowage' as a limitation to an indefinitely deep water-circulation. The later experiments of F. D. Adams[3] and the studies of Mr. Van Hise unite in placing the zone of flowage at about 35,000 to 40,000 ft. But the effect of this change must be felt at a much less depth. The openings through which mineral-bearing waters circulate, and in which they lay down their metallic freight to constitute the orebodies for which the miner seeks, cannot persist indefinitely. Without them the circulation is too restricted to permit of the wide gathering and intense concentration precedent to ore formation. As the openings become smaller, by the closing of the larger ones; as they approach sub-capillary size and become discontinuous, the circulation of water tends to diminish. When water ceases to circulate it is no longer an agent in forming ore. Of course, gases under high pressure may still be active, but it is not necessary to go into an even more obscure part of the subject, for the lodes exploited today by the miner are for the most part undoubtedly the work of aqueous solutions.

All this bears on the lower fringe of our problem. Man will never be able to test the reasoning on which such deductions are based, for no shaft or bore will be sunk deep enough. We need not go so far. The openings made by the miner give him a good inkling of the facts. The rock penetrated by the deepest workings is harder and drier than that cut near the surface. Every deep mine is dry; what water may be seen on the lowest levels is the drainage from the upper workings. Openings of every sort—whether fissures, faults, or vugs—are less common at 4000 ft. than at 2000 ft. The miner expresses it by saying that "the ground is tight," and it is so dry that the water used by him in drilling must be brought from some upper level or from the surface to the place where he is at work. We have long recognized a 'water-level,' that is, a horizon at which water rises in a shaft if it is not drained by a pump; we have been shown by different geologists how great is the effect of this ground-water in modifying the orebodies found in the shallow zone. On the other hand, the fact that there is also a lower limit to the ground-water has not been overlooked by most geologists. Even Van Hise speaks of 10,000 metres as the bottom of the ground-water or "belt of saturation," and places a limit on the basis of temperature, suggesting that below the 10,000 metres the H_2O is no longer in liquid form as water.[4] That is 33,000 ft. On the other hand, as I have shown in a previous discussion of this matter,[5] the evidence of mining all goes to prove that the zone of free circulation is relatively shallow.[6] The shallowness depends upon the climatic conditions at surface and the texture of the rocks, for in arid regions the water-level is struck early and the base of the ground-water is reached soon, while in wet districts, especially where snow abounds in winter and thaws freely in summer, the water-level is deeper and the wet ground has a greater vertical extent. No average figures can be accurate, but it suffices to say, for the purpose of illustration, that it is a common experience to "strike water" at 200 ft. and to "get through it" at 1000 ft. A mine foreman will tell you that he is "taking up" the water at the 900-ft. level; he places the big pump where he can catch most of the drainage from the upper workings; and he expects that in the deepest workings he is not going to be bothered by the seepage. The miner has experience to justify him in his fancy that water is a favorable indication of ore. It is not necessary to discuss the question whether dusty rock is 'dry' in a chemical sense; such rock may contain 3 to 5% moisture; and after that there is still the water of crystallization. But it suffices to point to the important fact that a zone of superabundant water exists, that it is fed by the rain and the melting snow, that it has a well-defined upper limit and an ill-defined bottom, but whatever the particular form of its base, it presents a factor that must profoundly have affected the agencies of ore formation.

It may be profitable to consider the misapprehensions whereby the fallacy of enrichment in depth has originated.

1. The point at which ore is discovered at surface may not coincide with a rich portion of the lode; in other words, the outcrop of an ore-shoot may not be uncovered. In sinking, the shaft may penetrate into richer ore by intercepting an orebody on its pitch. This may give rise to the idea that the lode has become richer.

2. Again, some lodes containing the more soluble minerals are apt to have poor outcrops by reason of weathering and superficial leaching. Thus the copper veins of Butte were first worked for gold because that metal had become concentrated at the outcrop. In depth, the gold diminished and a zone of enrichment, by re-precipitation of silver, gave the district a reputation for the less valuable of the two precious metals. Finally, the silver contents diminished to a point threatening a cessation of profitable mining, and then, at the next horizon, a marked increase in copper, due also to sulphide precipitation, gave Butte a new and much prolonged career of productivity. That career has not ceased, despite the deepening of the workings to 2500 and 3000 ft., because in that locality a series of fractures at successive periods has permitted the descending enriching copper solutions to penetrate to an exceptional depth.

3. In gold mining especially, but in the mining of the other metals also, the shallow zone of oxidized ore is followed by pyritic ore that was long regarded as more refractory than the gossan and therefore less profitable. Hence the downward penetration of the workings might coincide with fewer dividends. But when processes were devised to treat the ore formerly refractory, the successful issue out of this trouble prompted operators again to scout the idea of impoverishment in depth, particularly as the top of the new sulphide zone was usually marked by exceptionally rich ore, due, as we now know, to precipitation of metal derived from the overlying leached and oxidized portion of the lode.

4. A false idea of enrichment may in some cases have been fostered by an improvement in metallurgical treatment, whereby relatively poorer ore from deep workings may have yielded a bigger profit per ton than the relatively richer ore broken at a shallow level.

5. But the main impulse toward the acceptance of the fallacy is due to the commercial optimism of the promoter, the gullibility of the ordinary speculator, and the ineradicable tendency of humanity to chase rainbows. A good example was furnished lately by the statements made by the chairman of the Lonely Reef mine in Rhodesia at the recent annual meeting. He stated that the mine had "increased in values as depth has been attained." He also said that the increase was "quite regular." The official figures indeed showed[7] a progressive enrichment from 16.27 dwt. per ton above the second level to 42.73 dwt. per ton below the seventh level. At the same time the width had increased continuously, so it was stated, from 27 in. to 51 in. of ore. Upon investigation, however, it could be ascertained, from the figures given in the preceding annual report, that the stoping of the richer portion of the reserve in the upper levels had served to confuse the facts. For example, in 1910 the 15,788 tons between the second and third levels had averaged 27.6 dwt., but in 1911, owing to stoping, the tonnage had decreased to 7100 tons, and the grade had fallen to 20.32 dwt., thus making a favorable comparison with the 19,949 tons of ore between the fourth and fifth levels, which had an average assay of 26.06 dwt. Taking each 'lift,' or

[3]'On the Limiting Strength of Rocks Under Conditions of Stress Existing in the Earth's Interior.' By Frank D. Adams. *The Journal of Geology,* Vol. XX, No. 2.

[4]*Op cit.,* page 36.

[5]'Waters, Meteoric and Magmatic.' By T. A. Rickard. *Mining and Scientific Press,* June 27, 1908. Also 'Water in Veins—a Theory.' *Engineering and Mining Journal,* March 14, 1903.

[6]'The Rôle of the Igneous Rocks in the Formation of Veins.' By James F. Kemp. *Trans.* Amer. Inst. Min. Eng., Vol. XXXI, pp. 185-190.

[7]*The Mining Magazine,* June 1912, pp. 405-407.

tonnage between levels, when at its maximum, I find the following figures to be correct, as nearly as can be ascertained from the company's reports:

	Tons.	Gold content, dwt.	Assay for stoping width, dwt.
Above 2nd level	12,750	13.5	10.1
Between 2nd and 3rd level	15,788	27.6	21.5
" 3rd and 4th "	14,847	28.2	22.2
" 4th and 5th "	19,949	26.06	19.62
" 5th and 6th "	24,155	29.22	22.65
" 6th and 7th "	25,180	37.66	30.54
Below 7th level	8,544	42.73	34.68

This indicates that the ore above the second level is relatively poor, probably by the leaching to which most gold-quartz lodes are subject, for reasons now fairly well understood.[8] Between the fourth and fifth levels a drop in grade is evident. On the whole, however, from the second to the sixth levels, the assay-value is fairly steady, the range being only from 19.62 to 22.65 dwt. for a full stoping width. Below the sixth and at the seventh levels there is a rise in grade to 30.54 and 34.68 dwt. per ton, but on the bottom level the development is not complete and it is likely that the work so far done is in the best part of the orebody. In any event, the mine is still shallow. Unless its history is wholly contrary to that of the other Rhodesian mines, it will give evidence of a character stultifying the reckless assertion of the chairman. His statement, nevertheless, would ordinarily suffice to confirm inexperienced people in the pleasant fallacy that enrichment in depth is normal.

Another sad example of the perversion of fact is afforded by the East Rand Proprietary fiasco. That enterprise is a huge consolidation of mines formed four years ago to the accompaniment of expectations and promises not justified by the evidence then available. That evidence was not made public. In 1907 Frederick Hellmann, then manager of the parent mine that gave its name to the consolidation, was called before the Mining Industry Commission at Johannesburg. His evidence referred to the prospects of the group of mines under his charge and incidentally to the question of impoverishment in depth as it affected the future of the Rand mining industry. The evidence was given *in camera*, but it was published in a Blue Book that must have been known to the directors of the East Rand Proprietary before the consolidated company was floated in 1908. It is also noteworthy that the local technical press avoided giving publicity to testimony of such importance, for Mr. Hellmann testified that a decrease in gold content was "most marked" in "all the mines" with which he was acquainted on the Rand. Even in the Driefontein "the poor zone was much more extensive" than he had expected. On cross-examination, he said frankly: "I refer to the Rand generally. I have been around, and I know the conditions of the deep levels, and I can say generally that you have got a falling grade in depth, and that it is most natural it should be so. You would expect it from the start from the method of deposition. In depth any mine gets poor. That is the history of every gold mine in the world." The obvious frankness of this reply would be convincing as regards the sincerity of the witness, even to anyone ignorant of his high reputation as an engineer. Here we have one of the most experienced and most thoughtful men in the profession, and at that very time the manager of one of the biggest mining enterprises in the world, testifying most explicitly on the fundamental problem. Yet in March 1910, Sir George Farrar and Sir Lionel Phillips, two of the directors of the East Rand Proprietary company, stated in public meeting to their shareholders that the Angelo Deep had "added to the evidence that the Witwatersrand series were not decreasing in value" in depth. It was also stated by one of them that "if they excluded the surface area down to 200 or 300 ft., there seemed to be no evidence whatever that the gold contents at the deepest levels were not fully as high as they were at the surface, or within 300 ft. of the actual surface." Thus the testimony of Mr. Hellmann is to be regarded as "no evidence whatever," but shareholders are to accept the confident but amateurish statements of these two gentlemen. Of course, in a technical matter of such importance the opinion of an experienced engineer is worth that of a dozen financiers. Since then I have seen the stope-sections of several of the big mines of the Rand, and I add my testimony to that of Mr. Hellmann. Taking all the mines started on the Rand, but leaving out the oxidized zone or down to about 300 ft., I would rather have the gold in the ore mined in the next 500 ft. than that extracted in the succeeding 1000 ft., and I would rather have the gold extracted in all the productive mines of the Rand for 1000 ft. below water-level than the gold to be won from 1300 ft. to the centre of the earth.

In decrying the perversion of experience, I do not belittle the reasonable optimism that stimulates the miner to take the risks incidental to the search for valuable minerals. Without a hopeful temperament no man can be a miner. But this attractive and necessary characteristic may prove his undoing and the ruin of those who accept his guidance.

More than twenty years ago I remember discussing this subject with my friend, John B. Farish, then and now recognized as one of the most distinguished of the experienced mining engineers trained in the Rocky Mountain region. He agreed with me that it would be well for the Colorado Scientific Society or some kindred technical organization to collect data on the persistence of ore in depth as ascertained by mining, with a view to more light on the subject. But he also suggested that the notes thus contributed by mining engineers should be burnt as soon as read, for fear that the facts might prejudice public participation in mining ventures. This is a view shared by many men, but I am not one of them. It seems to me clear that the art of mining is based upon the application of scientific methods; it is based not on scientific mechanical devices only, but upon scientific ways of thinking. These do not include make-believe in any form; on the contrary, the frank recognition of facts, and of the inductive reasoning that follows logically therefrom, is the only safe guide to the profitable search for ore.

[8] "The Formation of Bonanzas in the Upper Portions of Gold Veins.' By T. A. Rickard. *Trans.* Amer. Inst. Min. Eng., Vol XXXI, p. 198, *et seq.*

BAHIA, one of the leading states of Brazil, is rich in minerals. Gold is found both in the north and in the south, but has been chiefly worked on the bottom lands of the streams rising in the Serra of Assuruá and the chapadas that form the divide between the rivers Paraguassú and Verde, the richest deposits being those of Genito in the Serra de Assuruá, which are still exploited in a desultory manner. Gold also occurs and has been worked at Arubá, Jacobina, Serra do Sincorá, the rivers Eromadinho and Itapicurú, and at many other points. Diamond mining is still actively carried on in Bahia, though for the most part in primitive fashion. Diamonds are found chiefly at the headwaters of the Jequitinhonha, the Rio das Contas, and the Paraguassú. Diamond mining is the staple industry around the large city of Lençoes, where in 1845 over 400,000 carats were taken from the diggings. Between 1844 and 1848 over 30,000 persons were engaged in the industry in the district of the River Mocugé, an affluent of the Paraguassú. At Aroeiras and Barra da Solidão, Cajueiro, and Cotinguiba Grande, and on all the headwaters of the rivers Paraguassú, Una, Preto, Piabas, Rabudo, Lençoes, and Andarahy, diamonds have been and in most instances still are worked. Copper is found in the vicinity of the Rio das Contas, at the Cachoeira do Inferno, and at other points of the Serra de Assuruá, but at present it is only worked at the Carahyba mines, near Jaguarary, on the river São Francisco. Manganese occurs in many parts of Bahia, but the chief deposits worked are those at Nazareth, within easy reach of the sea. Lead, according to O. A. Derby, is found in the Serras of Assuruá and Acacuá, and at other points of Chapada.

The Mason Valley Copper Smelter

By Thomas T. Read

That unexpected difficulties are usually met in the operation of a new plant, and that alterations are frequently necessary, is well known; so much so, indeed, that recently the correspondent of a well known mining journal, in describing one of the new mills erected at Porcupine, naïvely remarked that ample provision had been made for changes in the design of the plant. Not all designers make this provision, but this smelter, constructed to treat ores not previously successfully smelted, and which within six months of the time of its blowing in is successfully handling double the expected tonnage, with no delays or shut-downs and only minor changes in the design, is correspondingly unusual. The plant was designed by and erected under the supervision of Jules Labarthe, now its general manager. A. J. McNab is superintendent. To both these gentlemen I wish to express my appreciation of the courtesies extended me during a recent brief visit to the plant.

Fig. 1. General view, Mason Valley smelter, Thompson, Nevada.

The Mason Valley smelter, owned and operated by the Mason Valley Mines Co., is at Thompson, Nevada, about two miles northwest of Wabuska, on the Reno-Goldfield branch of the Southern Pacific railroad. The site was chosen after records of the direction of the prevailing wind had been kept for over a year, and is such that for 90% of the time the smoke is carried in the direction of Carson sink, and for only 2% of the time is carried in the direction of the agricultural districts along the Walker river. At present this is an almost unnecessary refinement, for the sulphur content of the smelting mixture is so low that the escaping smoke carries very little SO_2, while arsenic and similar deleterious elements are absent. 'Smoke farmers' need but little cause for complaint, however, and the care and forethought exercised in the choice of the site were justified.

Ores.—The smelter is handling at present 750 to 800 tons of charge per day. Of this, the Nevada-Douglas contributed about 350 tons per day, the Mason Valley mine a little less, and the remainder is largely made up by shipments of copper ore from the smaller properties near these two, although about one car of ore per day is received from the Luning district. A small amount of gold and silver ore is also received, and it is necessary to use about 25 tons per day of limestone as flux, as the Nevada-Douglas ore is rather silicious. The ore arrives at the smelter over the standard-gauge line of the Nevada Copper Belt railway, in 50-ton hopper-bottom cars, and is dropped into one of the two bins of the sampler. The general plan of the smelter is shown in the illustration. From these bins the ore is drawn directly into the throat of a No. 8, style K, Allis-Chalmers gyratory crusher, the crushed product being elevated to the top of the building by a manganese-steel chain-bucket elevator. This type of elevator was first used at the smelter at Trail, B. C., and is found to give longer service at a less cost. At the top of the building a Vezin sampler takes out one-tenth as a sample, the reject passing over a small grizzly, which screens out the fine sulphides and diverts them to a small bin on the rear side of the building. For reasons which will be explained later, this is not now in use, the grizzly being covered with a steel plate. The reject passes by a belt to the main 20-in. belt, which extends the length of the ore-bins and is provided with a tripper so adjusted that the ore may be discharged into any of the existing bins, or into the 10 new flat-bottomed bins, of a total capacity of

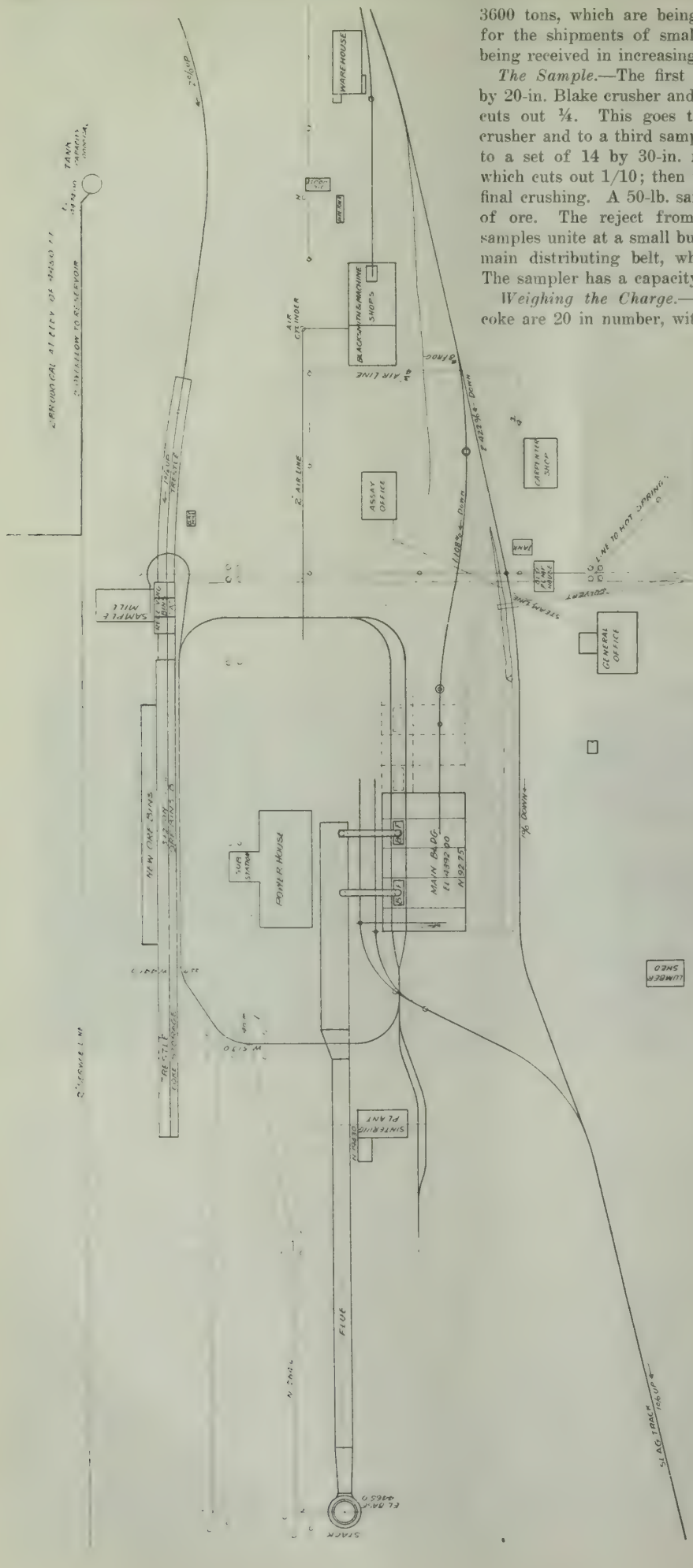


FIG. 2. GENERAL ARRANGEMENT OF PLANT.

3600 tons, which are being built to serve as bedding bins for the shipments of small lots of custom ore, which are being received in increasing quantity.

The Sample.—The first cut of the sample goes to a 10 by 20-in. Blake crusher and then to a second sampler, which cuts out ¼. This goes to a second 10 by 20-in. Blake crusher and to a third sampler, which cuts out ⅕; this goes to a set of 14 by 30-in. rolls, then to a fourth sampler, which cuts out 1/10; then to a set of 14 by 30-in. rolls for final crushing. A 50-lb. sample is thus obtained from a car of ore. The reject from the second, third, and fourth samples unite at a small bucket elevator and is raised to the main distributing belt, which deposits it in the ore-bins. The sampler has a capacity of 150 tons per hour.

Weighing the Charge.—The charging bins for ore and coke are 20 in number, with inclined bottoms and having a total capacity of 4000 tons. Each is provided with two discharge gates and two Howe weighing-hopper scales. The ore from the bedding bins will be drawn out upon a belt beneath them and delivered to the main elevator in the sampling mill, then discharged to a belt-conveyor and thence to charge-bins. Weighing the charge will thus be somewhat simplified, duplication of the equipment of weighing hoppers will be avoided, and an accurate sample of the bedded mixture will be obtained. The capacity of the sampler is amply large to perform this added duty. As shown in the plan, the bins and furnaces are connected by an elliptical track, and the charge is drawn from the hoppers into two-ton cars, of which six or seven, making up a train, are drawn by a four-ton Jeffrey MB-24 electric locomotive. These are shown in place beneath the hoppers in the accompanying illustration.

Blast-Furnaces.—There are two blast-furnaces, 42 in. by 25 ft. at the bottom, and 47 in. wide at the tuyeres. From the tuyeres to the charge-floor level is 15 ft., but the charge is kept 3 ft. below this, making the height of the smelting column 12 ft. The tuyeres are 4 in. diam., 25 on each side. The blast is admitted at 42-oz. pressure, and is furnished by two No. 11 Connelsville blowers. Each blower is driven

by two 200-hp. A. C. motors, and is capable of furnishing 30,000 cu. ft. of free air per minute. Only one furnace is now in use; this furnace during the month of May smelted an average of 720 tons of ore and 80 tons of seconds and limestone per day. This corresponds to a smelting rate of 12 lb. per square foot per minute, considering the hearth area as the area at the tuyere level. Remembering that this is attained by the use of 9 to 10% of coke on the charge, the smelting rate here attained is the fastest of which I have any knowledge. High smelting speed has been attained in pyrite smelting, but in that case the bulky coke

FIG. 3. BLAST-FURNACE, DUST-CHAMBER, AND STACK.

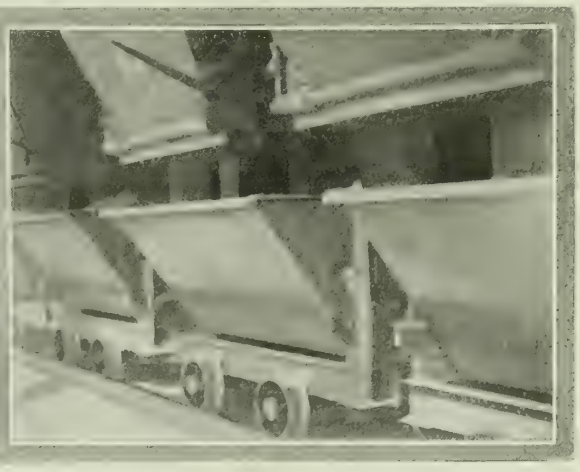


FIG. 4. WEIGHING-HOPPERS AND CHARGE-TRAIN.

is not present to displace a much greater weight of smelting mixture. For a low sulphur, high-coke charge this must be either a record smelting rate, or very close to it, but I shall be glad to be corrected if I am in error in making this assumption. The rapid rate of smelting makes necessary the use of an increased amount of jacket-water, as might be expected.

Charging the Furnace.—The furnace is charged directly from the cars. Adjustable feed plates, as shown in Figure 5, are provided, the angle of their inclination being capable of adjustment within the range 30 to 60°. By a little experiment the proper degree of inclination was found so that coke automatically falls in the position which gives the maximum smelting rate. After this was obtained it was found that the necessity for barring down crusts and punching tuyeres had almost totally disappeared. This, of course, contributes to the rapid smelting rate of the furnace. The operation of dropping a charge is quick and simple. A charge train usually consists of two cars of coke and four or five cars of ore. The furnace feeder draws up the charge doors as the train approaches, and as each car of coke is dumped the motor draws it slowly the length of the furnace to distribute its contents evenly. One car of ore is next dumped, and the other cars are then in position so that they may be at once dumped into the furnace. The operation of charging takes but 1½ to 1¾ minutes, and a round trip, loading and dumping the charging train takes but five to eight minutes. The smelting charge contains about 4% copper and 6% sulphur. Coke forms 9 to 10% of the smelting mixture.

Handling Slag.—The water runs continuously through a tapping jacket of cast iron with pipe coil cast in. The spout is jacketed, the inner sheet being sheet copper. It is customary in many places to cast the spout from blister, but as only matte is made at this plant, sheet copper was employed and gives good satisfaction. The slag and matte go to two 5 by 12-ft. movable settlers. These were employed, as it was feared that trouble would be experienced from the formation of sows. The expected trouble did not materialize, and it is now planned to replace these by a stationary 8 by 18-ft. settler. The slag flows from the second settler into a 225 cu. ft. (21 ton) capacity steel slag pot, hauled by a 15-ton electric locomotive. In changing the pots a small pot pivoted on a jib-crane is swung under the slag spout while the full pot is being pushed out, and the empty one drawn into its place. The contents of the small pot are then emptied into the large one. The slag pot is pushed to the dump, and dumped by electric motor controlled by motorman in cab of locomotive; the skulls being sufficiently free of matte so that no attempt is made to remelt them. The motorman of the slag car also performs a similar service on the locomotive which draws the train of matte-cars, and operates the crane, without being overtaxed. The track on the dump is shifted from time to time, as required, by a gang of surface laborers, and the only persons regularly employed in dealing with the slag are the tapper and the motorman, the latter giving only a part of his time to it. The average composition of the slag is:

SO_2	FeO	CaO	Al_2O_3	MgO	Cu
42	26.8	22	7.3	1	0.38%

Handling Matte.—About 50 tons of 45% matte is made in a day, and it is necessary with the present settlers to tap at intervals of ½ to ¾ hour. The second settler is only

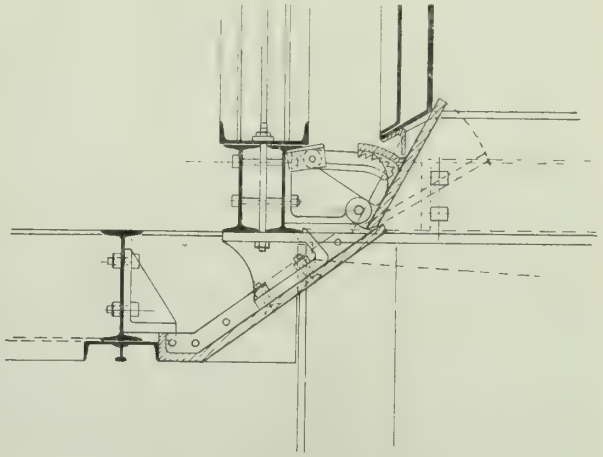


FIG. 5. CHARGING DEVICE.

tapped once each shift, yielding a few hundred pounds of matte. The method of handling this is the only instance in which any important change has been made in the original design of the plant. Three Kilker matte-cars, operating on a circular track were placed in the plant. The particular cars employed proved too small for this situation and are not now used. The method now employed is similar to that formely used at the United States plant at Bingham Junction, Utah, except that the wire rope there employed for moving the train of matte-cars is replaced by a 4-ton electric locomotive. The matte molds are carried on light steel cars; the molds are of cast steel

and have shown no sign of cracking. Each mold holds about 100 lb. of matte; and resembles a waffle-iron in pattern. The train will accommodate 50 molds; about 40 are in use. When the matte is tapped these are drawn back and forth below the matte-spout until all are completely filled. The operation of tapping takes 7 to 8 minutes. Then the cakes of matte are allowed to cool down to the point where it is safe to play a hose upon them, and are dumped into an ordinary 5-ton matte-pot, placed below the track. The cake in falling breaks up into eighty roughly cubical pieces weighing 12½ lb. each. The pot is dumped into a 50-ton railroad car, for shipment to the Garfield smelter. This handling is done by an ordinary 20-ton crane, with a 5-ton auxiliary. A certain amount of matte unavoidably spatters about; as this is cleaned up it is loaded into small dump cars which are hoisted by the crane to the charging floor. The building enclosing the blast-furnaces has been made large enough to contain converters, which will be erected when the daily output of matte reaches a tonnage large enough to permit reasonably continuous operation of a converter. The crane has been provided for this purpose, so the only construction necessary will be the addition of stands, shells, and blowing engine.

Flues and Flue-dust.—The downcomers from the blast-furnace enter the brick expansion chamber, which has a cross-sectional area of 500 sq. ft., and is 200 ft. long. The flue beyond this point is 18 by 10 ft. and ascends the hillside to the base of the stack at a point 40 ft. above the furnace level. The stack is 200 ft. high, 18 ft. diam. at the base, and 15 ft. at the top. On the side of the expansion chamber next the furnaces automatic discharge gates for the flue-dust are provided which permit it to escape to an automatic dust-conveyor that conveys the dust to the Dwight-Lloyd sintering machine. This is so placed that dust can be drawn by the conveyor from 50 ft. of the flue as well. It was planned to mix the flue-dust with fine raw sulphides before sintering, but delivery of the machine was delayed and the blast-furnace had been in operation for three months before the sintering machine was started. The flue-dust had thus accumulated to a point where it was necessary to handle it as rapidly as possible. The attempt was therefore made to sinter the dust without the admixture of any raw sulphides, and after a little experiment success was attained. The necessary heat is supplied by mixing with the dust ½ to 2% of coke-dust, prepared by grinding coke breeze in a clay-mill. Sufficient water is added to give a mixture containing 8% moisture, and since the aim is to secure the maximum sintering with the minimum of desulphurization the machine is run rapidly, treating 60 tons per day. The speed of travel of the pallets varies from 1 to 5 ft. per minute. Some trouble has been experienced from the tendency of the cast-iron grates to crack, and it is planned to use malleable iron for the grates of the second unit, now under construction. The work of this sintering machine is of great interest, since it is the first instance of its use to treat flue-dust, unmixed with raw sulphides.

Fuel.—The coke used in the blast-furnaces is that of the Utah Fuel Co. The coke has 7% ash, and is somewhat stringy, but is a good burden carrier, and as it has to stand but little handling, it arrives at the smelter in good condition and works well. There is no steam plant at the smelter, all machinery being motor-driven, so there is no occasion for the use of fuel other than coke, beyond a small amount of coal in the blacksmith shop.

Water Supply.—There are two sources of water supply. Near the wagon-road between Wabuska and the smelter, a hot spring was first developed. This yields 40 gal. per minute at a temperature of 170° F.; the water is excellent and it was formerly cooled and used for domestic purposes. Later a well was put down at a point south of the smelter, about half way between it and the line of the Southern Pacific, and 90 ft. below the smelting level. This is a flowing well, 600 ft. deep, yielding 120 gal. per minute; another adjacent well yields 30 gal. per minute more, so an ample supply is available. The jacket water is cooled in a cooling-tower just below the general offices, to avoid the necessity of the 90-ft. lift on water than can be re-used.

Power Supply.—Electric power for the operation of the plant is purchased from the Truckee River General Electric Co. The current mainly comes from the new plant at Verdi, but there is another line connecting through Mason with the older line, so that the smelter has two independent supply-lines, and can draw current from any one of four power plants. Current is received at 60,000 volts, and is transformed to 440 or 220 volts for the A. C. motors. The cost of electric power is $70 per horse-power year.

Ore Supply.—The ore supply of the plant is rapidly increasing, as the low treatment rates accorded have served to stimulate a number of small shippers who are largely engaged in development work, while both the Nevada-Douglas and Mason Valley mines are prepared to increase their shipments; it is especially desirable to increase the tonnage of Mason Valley ore treated, as it is slightly basic, and if used in sufficient amounts the necessity for limestone flux is removed. Accordingly the No. 2 furnace, which has not yet been blown in, is being increased to 30 ft. in length; when it is ready to operate the No. 1 furnace will be blown out and increased to 35 ft. in length.

It is a pleasure to a smelterman to watch a furnace operate so smoothly as this one does, without the constant necessity for barring down crusts. This is partly due to the good smelting mixture, perhaps partly due to that more or less fortuitous harmony of parts which makes one 6-cylinder motor car a much better hill-climber than another of identical pattern and make, but is largely due to its excellent design and management.

New Topographic Maps of the U. S. Geological Survey

Topographic maps of the quadrangles named below are now ready for distribution.

Beverly, Washington, embracing parts of Grant and Kittitas counties. Ivanpah, California-Nevada, embracing parts of Inyo and San Bernardino counties, California, and Clark County, Nevada. Laurelville, Ohio, embracing parts of Hocking, Pickaway, and Vinton counties. McCall's Ferry, Pennsylvania, embracing parts of Lancaster and York counties. McKeever, New York, embracing parts of Herkimer, Lewis, and Oneida counties. McKittrick, California, embracing parts of Kern, San Luis Obispo, and Santa Barbara counties. New Berlin, New York, embracing parts of Chenango, Madison, and Otsego counties. Newhard, California, embracing parts of Butte and Glenn counties. Quarryville, Pennsylvania, embracing parts of Chester and Lancaster counties. Thibedeau Lake, Montana, in Chouteau county. Welch, West Virginia, embracing parts of McDowell and Wyoming counties.

The following sheets have been issued in a preliminary edition, each sheet showing only a portion of the quadrangle. This edition is limited to a few copies, which will be sold at the same price as the regular atlas sheets:

Keefers, California, in Butte county. Naugatuck, West Virginia, embracing parts of Mingo, Lincoln, and Wayne counties. Oroville, California, in Butte county. Pounding Mill, West Virginia, in McDowell county. Singer Creek, California, embracing parts of Butte and Tehama counties.

TEXAS production of gold, silver, copper, and lead in 1911, according to Charles W. Henderson, of the U. S. Geological Survey, showed an increase, compared with the yield in 1910, of $11,415. The output of silver, which represents over 97% of the state yield, was 424,394 oz., valued at $214,929, an increase of 44,072 oz. in quantity and $9555 in value. The yield of lead was 122,800 lb., compared with 65,068 lb. in 1910. The yields of gold and copper, both nominal, showed decreases for 1911. The greater part of the output was from the Shafter district, Presidio county.

Government Policy and Coal Lands

By Walter L. Fisher

*You may not have noticed a recent sale of government coal lands in your state which was made in the Evanston land office on June 3 last. Six hundred and sixty-five acres in this section, which lies a short distance north of Rock Springs, were sold by the government at prices ranging from $370 to $410 per acre, the aggregate sum received for the section being $263,330. This sale is significant as illustrating the practical effectiveness of the present policy in the administration of the coal-land law. The fact that this large acreage, the maximum that can legally be acquired under existing law, has been sold at these prices which represent nearly the highest valuation that has been placed by the Department upon any of the public coal lands, indicates that the policy of selling these lands at appraised prices, based upon the quantity and quality as well as the accessibility of the coal, is a practical businesslike policy.

The charges that you have so often heard, and indeed have repeated to me, to the effect that the valuation of these coal lands by the government geologists is academic, and that the prices thus established are so excessively high as to defeat the purposes of development and paralyze the coal industry of the Rocky Mountain states, is directly and effectively answered by this action on the part of several of your Wyoming fellow-citizens. These practical men have had this purchase under consideration for some time, and have doubtless thoroughly acquainted themselves with the inherent value of these lands. Probably their estimates were based largely upon the same information that was available to the geologists who made the field examination on which the government valuation was based.

This sale illustrates well certain phases of the general public-land policy of today. As you know, it is the purpose of this administration to encourage present-day development of the resources of the West, so far as that is attainable under existing law, and at the same time to protect future utilization from the ill effects of present-day speculative and industrial waste. The purpose in placing moderate valuation upon the millions of acres of coal land still in public ownership is to make the prices at which these lands are offered low enough to encourage their acquisition for immediate development, but high enough to prevent purchase with no idea of immediate use. It is evident that the Wyoming business-men who have acquired this section of coal land expect soon to begin to realize on their large investment, an end that can be attained only by an early beginning of mining operations. Thus one purpose of the public policy is fulfilled. Again, it will be noted that the amount received for this land in excess over the minimum price allowed by law is almost exactly a quarter of a million dollars, so it follows that the administration of this policy has resulted in the contribution of a quarter of a million dollars to the Reclamation Fund, which amount is immediately available for the development of the irrigable lands in the Western states.

Nor can it be contended that the sale of these coal lands at this high price constitutes a tax upon the consumer of Wyoming coal. The several coal beds underlying this tract of land together include so great a thickness of coal, and the tonnage therefore available for mining is so large, that in so far as this coal is immediately mined the highest acre-price on this tract, when translated into price per ton of minable coal, is considerably less than one-half cent a ton. The result is that even were the Wyoming citizen to buy an amount equivalent to the average per capita consumption for the whole country —which includes of course not only coal burned in homes, but that consumed by the railroads and any other generators of power—he would suffer an annual per capita tax of less than two cents.

All that this increased government price can do is to eliminate a portion of the unearned profits of the speculative middleman. The price realized by the government for these lands is a very moderate fraction of their value. Had the present purchaser secured them at the old price of $20 instead of at $400 per acre, he would still have sold them or the coal from them at a market value determined, not by the fact that earlier grantees secured government coal lands for $20 per acre or for nothing, but by the fact that private or corporate holders of these lands can and do secure from them returns that justify that market value. That this value is in excess of $400 per acre is proved by the recent sale. The present purchaser of the tract, therefore, as a result of the modern policy, has contributed to the public funds for use in the reclamation of the West a quarter of a million dollars, which under the old policy would have been added to his profits without being earned and with no public benefit. It seems to me indisputable, therefore, that this gain to the citizens of the public-land states by reason of this policy is tangible and direct, and that any loss that they may suffer is theoretical, inappreciable, and probably nonexistent.

I think you will agree with me that stability through the elimination, or at least the reduction, of the speculative element is desirable in any industry. So long as coal can be acquired only by purchase, not of the actual tonnage mined as under a leasing system, but of some estimated amount present beneath a given acreage, as under the present system, there will be a large speculative element at the very foundation of the coal business. Therefore, while the present plan of selling coal lands at values based on careful estimates of the quantity present is a great advance over the earlier practice of selling at a low flat rate wholly without consideration of either the quantity or the quality of the mineral present, neither method is the equal in fairness to the operator or to the consumer of that adopted in principle by your own state of Wyoming, a method which I have frequently publicly advocated as a policy that should be adopted by the Federal Government in the management of its coal lands. I refer of course to the leasing system. Under that system the coal operator buys and pays for the actual amount of coal that he mines. Under the present purchase plan he does not know absolutely what he is receiving, and in the absence of this exact knowledge he will, as a conservative business-man, base his selling prices upon the most adverse supposition. The consumer must pay these prices and must suffer accordingly. These elements of uncertainty would be iliminated under a federal leasing system, so that the speculative charge would disappear. With it would go the legitimate interest charge upon the purchase price, which may become of considerable importance in the case of the heavy investments required by large coal operators who buy reserves in anticipation of future needs and pay middlemen's profits because under present statutory limitations inserted to protect public interests by restrictions to prevent monopoly they are unable to buy large tracts direct from the government. No interest accrues against lands held by the government, so that no interest charge enters into the price at which the government sells its coal under either the leasing or the sales system. Nevertheless, because the government geologist, when estimating the reserves for purposes of sale, resolve every doubt in favor of the purchaser, in the great majority of cases he probably acquires tonnage several times greater than

*From a letter by the Secretary of the Interior to F. W. Mondell, of the House Committee on Public Lands, Washington, D. C.

that for which he pays. For this reason and because a higher tonnage charge can properly be made under the leasing system, the returns to the government would be much larger under it without a corresponding increase of hardship or cost to the producer, since the hazards which he must capitalize and the interest charges which he must pay are eliminated in that system.

The Rock Springs field is one which has been largely developed and thoroughly prospected, so that closer estimates of tonnage can be made there than in most fields, and a fairer comparison of returns from the leasing and the sales system is possible. The geologists who classified this field believe that the section recently sold contains at least 136,000,000 tons of coal. Assume that one-half of this amount can be economically recovered in mining and that the low royalty of two cents per ton is charged. The returns to the government on this basis compared with those from the recent cash sale and with those under the old flat-rate plan, for the 665 acres recently sold, are as follows:

Sale price at $20 per acre	$ 13,300
Sale price tonnage basis	263,330
Returns leasing basis at $0.02 per ton	1,360,000

Such practical considerations and examples as this carry their own lesson. It is clearly evident that the present coal-land policy is from every point of view superior to the old and that it is a practical working policy. It is equally clear to me that a leasing policy is as much superior to the present plan as that is to the old. I have been glad to note that your own state has had the wisdom to adopt the general policy of leasing. As a loyal Wyoming citizen believing in the policies of his own state, and as a Western man desirous of fostering the healthy development of the West and of advocating means to that end, you, I am sure, will be interested in the transaction which is the occasion for this letter.

Cyanogen Compounds From Distillation of Coal

*In the distillation of gas from coal, nitrogen appears combined in the by-products in many different forms. Among them, it is found in the gas, the tar, the ammoniacal liquor, and, after the gas is purified, in the purifying material combined with carbon to form cyanogen and cyanogen compounds, such as the ammonium salts, the thiocyanates, and others. There have been many methods of cyanide recovery devised. Among them is the Bueb process used to some extent in this country. It consists briefly in scrubbing the gas, before the ammonia and sulphur are removed, with a solution of copperas, whereby ammonium sulphate, which remains in solution, and ferrous sulphide, which remains in suspension, are produced. The hydrogen cyanide and free ammonia in the gas now react with the ferrous sulphide, giving ammonium ferrous ferrocyanide of the formula $(NH_4)_2Fe.Fe(CN)_6$. Some of this double ferrocyanide may be converted into soluble ammonium ferrocyanide by the reagents present, and to prevent this the 'mud' is either boiled or made slightly acid with sulphuric acid. In either case the insoluble double ferrocyanide is formed, and the mud changes color almost from black to light yellow. The final products are an insoluble double ferrocyanide, and a solution of ammonium sulphate. These are separated from each other by filtration. The process has been found to work best at temperatures not exceeding 100°F. Under these conditions, 90 to 100% of the total cyanogen is extracted. On a yield of 1.75 lb. of cyanogen per ton of coal carbonized, equivalent to about 110 grains of cyanogen per 100 cu. ft. of gas, the amount of copper as required theoretically is 6.3 lb., and the amount varies little from this in practice.

The absorption of cyanogen by the Bueb method generally takes place in a standard washer. The gas should reach the washer freed from tar, and at a temperature not over 100°F. The solution of ferrous sulphate is run into the outlet end of the washer, where it is first converted into ferrous sulphide and ammonium sulphate. There is a tendency for the former to build up on the exposed surface. In the original method of operating the washers, the material was pumped from tray to tray, whenever the first tray was saturated. This involved a deal of pumping, so operating the washers on the principle of an ammonia washer simplified the work. The material in the inlet tray is tested from time to time. In Germany the mud from the washers is generally sold to chemical works, while at the Astoria plant of the Consolidated Gas Co. of New York it is pumped into lead-lined tanks, heated to about 200°F., and acidified with sulphuric acid. Just enough acid is used so that the mineral is slightly acid to litmus.

The mud is tested for soluble ferrocyanide with ferric chloride solution on a piece of white filter-paper; and if the blue color appears, ferrous sulphate solution is added a little at a time, until upon test the blue color no longer appears. This converts all the cyanogen into an insoluble form. The mud now consists of insoluble double ferrocyanide of ammonia and iron, and a solution of ammonium sulphate, with a little ferrous sulphate, and very little free acid. This is pumped into filter-presses, which, when full, have hot water pumped through in order to wash as much as possible of the ammonium sulphate. The best results are obtained by finishing the pressing with mud made by stirring up some of the finished press-cake with water, until it disintegrates. The presses are about two-thirds filled with the neutralized mud from the washers, and then finished with the mud made from final cake. The solution of ammonium sulphate from the presses is neutralized with ammonia, settled, and the clear solution evaporated in lead-lined pans. It contains about one pound of ammonium sulphate per gallon.

The cyanogen cake from the filter-presses contains approximately 40 to 50% water, 22 to 28% cyanogen, and 5.3 to 7% of ammonia, about 6 lb. of press-cake being produced per ton of coal carbonized. About 2.5 to 3 lb. of ammonium sulphate is produced per ton also. The press-cake is sold to chemical works to be converted into sodium or potassium ferrocyanide. This is done by first distilling with lime, which drives off ammonia, and forms calcium ferrocyanide. This solution is filtered from the residue of iron hydrate, and is then treated with sodium or potassium carbonate, forming the corresponding ferrocyanide, and calcium carbonate, which settles out. The clear solution is concentrated and the ferrocyanide crystallized.

*Abstracted from 'By-Products in Gas Manufacture,' a lecture delivered by C. E. Munroe at the centenary celebration of the first commercial gas company held at Franklin Institute, Philadelphia, April 18, 1912.

DIAMOND-BEARING lands in Bahia, Brazil, are state property; the person who wishes to dig may either rent a claim for his exclusive use or take out a miner's license at a small cost and dig on unoccupied land or in non-leased river beds, concessions of which are readily granted by government. The outlook for a well-managed concern entering the most attractive part of the industry, namely, the working of the carbonado, or black diamond, deposits, is said to be distinctly promising. Good carbons—and 90% of the stones found are good—sell when over ¾ carat at about $5 per carat. Bahia diamonds of good color and shape are sold by the miners at about $11.25 per carat; small stones of good quality and color fetch about $10.50. Only a small proportion of the diamontiferous alluvium has been explored, and the river gravels, except in shallow reaches, are untouched. Moreover, these gravels are reputed often to carry enough gold to pay for dredging.

The mines producing zinc in New Mexico in 1911 are at Kelly, Socorro county, and in Pinos Altos and Central districts, Grant county. The yield decreased in both counties.

The High Grade Mining District

By William H. Storms

High Grade mining district, which has the past few months attracted considerable attention from prospectors, and investors as well, is situated in Modoc county, California, and extends a short distance northward across the state line into Oregon. It is on the summit of the Warner range of mountains which lies between Goose lake, on the west, and Surprise valley on the east. The entire district is in a region of volcanic rock—andesitic and rhyolitic flows and tuffs, forming the central portion of the range with later flows of basalt and agglomerate on the eastern borders.

The history of the district extends back for many years, but the entries are few. At one time the Government maintained a military post in Surprise valley, known as Camp Bidwell. This place, now called Fort Bidwell, is about twelve miles southeast from High Grade, and is near the eastern base of the Warner mountains. Soldiers from the fort, and others, found gold in the Warner range many years ago, but the principal prospector was a man named Hoag. He did considerable work at the surface on various claims, and the district came to be known by his name. In 1905 new discoveries in these mountains resulted in renewed interest in the possibilities of the region, and then, for the first time, some real development was accomplished, which has since been followed by a much more general interest in these prospects and the renaming of the district, it being now known as High Grade. It is needless to say that this newest name for an old district was suggested by commercial considerations. Nevertheless, there is high-grade ore in several mines of the district.

MAIN STREET, HIGH GRADE.

The geology of the district is comparatively simple when viewed in its broader features, but somewhat complicated here and there locally. The Warner mountains consist of a thick series of volcanic flows and sediments which form a portion of the great volcanic plateau which covers all of Modoc county, a large part of Shasta and Lassen counties, and extends northerly and easterly into Oregon and Nevada. The general history of the Warner range, as indicated by exposures in that region, shows that a vast mass of nearly horizontal volcanic strata, chiefly andesites, rhyolites, and tuffs, were cut by a great fault which skirts the east shore of Goose lake. In fact, it looks as though Goose lake were the direct result of the faulting of this region. Israel C. Russel has written a most interesting description of a number of these faults which occur in southeast Oregon and extend southward into California. Several of the valleys formed by the faulting of the great volcanic plateau are the sites of lakes; others have been filled with detritus and are now fertile valleys. Along the east side of the Goose lake fault the volcanic beds were lifted 2000 ft. or more, the entire series dipping 10 to 20° to the eastward. Russel describes a similar fault along the eastern base of the Warner range in Paradise valley, so the Warner mountains as a whole represents a great fault block, lifted above the surrounding valleys, the strata having a general dip to the eastward. In the central portion of this range the rocks do not all lie so nearly flat, but are found more or less disturbed, at some places standing in vertical position. There are in the central area several minor faults which have divided the district into a number of fault blocks. It is in the vicinity of these faults that the principal mineralization has taken place, along zones of brecciation, or following fissures in the breccia, which strike in various directions, though usually north-south and east-west. Where these fissures have intersected each other there has, in some places, been an enrichment, and it is the occurrence of this rich ore that doubtless suggested to the miners the name of the district—High Grade.

There is evidence to prove that after the uplift of the range and the formation of the brecciated zones and fissures in which the gold-bearing ores are now found, there was a long period of erosion, as the strata of rhyolites and tuffs are found planed off in some localities on the higher hills, and the gentle slopes to the northeastward, which at first might easily be mistaken for dip-slopes are really the result of erosion. The theory of a period of erosion at that time is proved by the fact that the later flows of basalt and andesite with their accompanying tuffs, overlie the adjacent hills to the eastward, tongues and remnants of the basalt being found lying on the older rhyolite and tuff, which would be impossible had the upper rhyolite not been removed by erosion. These later volcanic rocks have no connection whatever with the mineralization of the district, but it is interesting to know that the ore-bearing formations extend eastward and northward beneath the more recent volcanics, as it admits the possibility of the extension of the known mineralized zone in that direction. I was shown some ore, a silicified brecciated rhyolite, from the east side of the Fort Bidwell range, that much resembled some of that found in the High Grade district. For lack of time I did not visit that locality. Since the period of basalt flows the entire region has been subjected to tremendous erosion, as indicated by canyons 3000 ft. deeper than the top of the basaltic plateau.

The accompanying sketch, Fig. 1, is a northeast-southwest cross-section of High Grade district, drawn through Yellow mountain, one of the highest points in the district. It will give a general idea of the structural geology of the district as a whole. The time at my disposal was not sufficient to admit of a critical examination of the entire region in detail, so at this time generalizations only can be submitted. The sketch map, Fig. 2, shows the drainage of the country, and on it are also indicated some of the faults which appear to have important bearing on the structural features of the district, and incidentally on the mineralization.

I did not ascertain the natural succession of all of the rocks in the undisturbed area lying in the western part of the Warner range, but know that these rocks are principally white flow-rhyolite and white rhyolite-tuff. These comprise the greater part of the front or west range. About half way between the base of the mountains, and High Grade camp, I believe the rocks have been faulted, and some of the rhyolite and tuff found in the front range appears to be repeated to the eastward of this fault, if it actually exists. This should be verified, as the fault-line

may be said to be suggested by topography rather than by actual evidence. However, about half a mile east of the electric-light plant on Pine creek, an abrupt facade of purplish rhyolite rises several hundred feet above the bottom of the canyon, with a steep talus at its base. Its course is a little west of north and east of south. Bluffs and knobs of what appeared to be the same rock may be seen for a distance of a mile and a half or more, occupying a similar position on adjacent hills, and in direct line with the main palisade on the north side of Pine creek. This I think to be, in all probability, the main cause of bringing the rhyolites of the front range once more to the surface in the vicinity of High Grade. If this fault actually occurred it must have a throw exceeding 2500 feet.

The principal rocks of the High Grade district are a white flow-rhyolite at the top, underlain by a bed of variable thickness of white rhyolite-tuff, usually buff colored near the surface, and this in turn is underlain by purple porphyritic rhyolite. These rocks extend from the extreme northerly end of the district, where they pass under the more recent basalt, to the south end, at the Sugar Pine and Mountain View mines of the Fort Bidwell Consolidated group. Southerly from there the rock is principally an ancient andesite of very fine texture, ranging from bluish-black to greenish-black and grayish-black in color. I did not see a single intrusive dike in this portion of the range, though dikes of basalt cutting the tuffs and rhyolites south of Cottonwood creek are numerous. These latter are five to six miles southwest of this district. In that vicinity, on and near the Snyder ranch, are also fissure veins containing gold, some of them being very encouraging prospects.

There are several types of ore deposit in High Grade district. The most common are zones of brecciation, highly silicified and auriferous. These occur in flow-rhyolite and tuff, and also in the earlier andesite at the south end of the district. A second type is that of rather small fissure veins

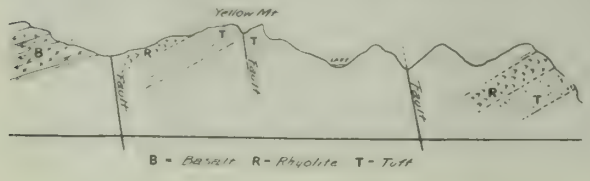


FIG. 1. CROSS-SECTION AT HIGH GRADE.

cutting at high angles through the zones of brecciation. In some of the mines these fissures run at nearly right angles. At the intersections rich ore has been found.

A third type occurs in the form of nearly flat sheets of rhyolite or tuff, highly silicified but with little or no brecciation, though auriferous. These may be considered as zones of impregnation. Still another type is the fissure vein occurring outside of any zone of extensive brecciation. This latter is represented in the North Star mine, where a fissure, varying in size from an inch or two to three feet or more, runs through the earlier andesite. Some of this rock contains payable ore; some of it is low grade. The quartz is white and saccharoidal, and shows some blue and green copper carbonate. This is said to be the discovery vein of the district. It is developed by several hundred feet of workings. It is at present held under lease and option.

The Sunset workings, consisting of about 800 ft. of development, are entirely in the earlier andesite, which here is found sheeted by pressure, the structure making it appear like a nearly vertical dike, or intrusion. I think that a fault of considerable displacement passes just east and south of this locality, its course being denoted by the neighboring canyons, Evening Star gulch and Sunset gulch. On the opposite side of this canyon and about 100 ft. south of the Sunshine mine, the basaltic strata of Mount Vida are seen to have a northwesterly dip, which is opposite to the general dip of the formations to the northward. This fact appears to lend color to the probable existence of the fault here referred to. This fault has a curving strike, the concave side facing the west. Unfortunately, at the several points where these faults pass through low saddles, in every instance examined, the evidence of their existence is obscured by low flat surfaces, covered by deep soil, or piles of rock.

The Fort Bidwell Consolidated property comprises several claims. The Mountain View, one of these, occurs in a zone of breccia at the contact of the earlier andesite with the rhyolites, whereas the Sugar Pine, another of its properties, is wholly in the rhyolite.

The Shasta View, adjoining the Mountain View on the southwest, is wholly in the earlier andesite. Both of these properties have some high-grade ore, and much that is too low in value to ship, but which is still a good grade of milling ore.

The Fort Bidwell company is operating a 10-stamp mill. The ore is delivered to the mill from the Mountain View by drift and tramway on the mill-level, and from the Sugar Pine, which is on the opposite side of the divide, by aerial

FIG. 2. SKETCH MAP OF THE HIGH GRADE DISTRICT.

rope-way. The workings of these two claims are to be connected, when all ore can be sent to mill through the main adit, which will prove a great advantage, as the deep snow in winter interferes with the operation of the rope-way.

The Alturas company's property is on the east slope of Yellow mountain, and is wholly in the rhyolite. The principal shaft is 105 ft. deep. Hoisting is done with a horse-whim. In this shaft a shoot of ore in purple flow-rhyolite is being developed. This ore contains more sulphide (pyrite) than was observed in any other mine in the district. Yellow mountain slopes from its crest, at 10 to 15° eastward for a distance of a mile, when it plunges steeply downward into Evening Star gulch. Along the rim of this sudden descent, and on the flat back of it, are a number of promising prospects. Some of these belong to the Alturas company, others to the Seven Lakes company, while still others are held by the locators. Among these latter is the Dandy Fraction, which makes an encouraging surface showing. These workings are mostly in the brecciated flow-rhyolite, though a few are in the tuff. Some of them are of the impregnation type. On the northeast side of this rim considerable work has been done on a claim called the Mountain Sheep, but the mine is idle, due to pending litigation. The cause of the contention lies in the fact that the Mountain Sheep conflicts with three other locations, having been laid diagonally across them.

To the eastward of Yellow mountain and between it and Camp High Grade is the property of the Big Four company. The ore deposits here are of several types, including practically all of those found in the district. One of these

is that of a flat sheet of much silicified rhyolite which shows little evidence of brecciation. This ore is being treated in the companys' 5-stamp mill, with good results, so I was informed. In this property considerable work has also been done on a nearly vertical fissure vein, in which high-grade ore was found.

The Sunshine, Yellow Jacket, and Last Dollar mines are on Sunshine hill and are practically in the camp of High Grade. The ore here occurs mostly in brecciated masses of rhyolite with north-south and east-west fissures cutting the zones of brecciation. It is at the intersection of these fissures that the rich ore has been found. The first shipment of 10 tons carried over $250 per ton gross value. Another shipment was ready at the time of my visit. On the Sunshine hill there are at least three separate zones of brecciation, and there may be others not as yet developed. The Sunshine claim has been divided into a number of blocks, nearly all of which had been leased, and the lessees were eagerly working to develop thier several holdings. To the eastward on a neighboring hill the Gold Shore claim resembles the Sunshine, having the same rhyolite breccia and silicification, which is an accompaniment of the auriferuos ores of profitable grade everywhere in this district.

On the plateau north of High Grade is a group of claims owned by the Modoc Mines Co. A shaft had been sunk to a depth of 60 ft. at the time of my visit and some excellent ore found. The ore here is in the brecciated rhyolite. This company has built a substantial head-frame and has a well equipped steam-hoist.

There are numerous other claims scattered throughout the district, but which had so little development that no particular mention is made of them, though some of these show good prospects in gold. I observed fissures in various parts of the district, in which the rock was much kaolinized and stained by iron oxide, but all of the occurrences of this character that came to my attention were low in gold. There may be exceptions to this, but I did not see them, if there are any.

There are some striking features in the topography of this district, which are due principally to two causes, first, minor faulting, and second, climatic conditions. Naturally the first cause has left the more noticeable results as observed in the steep slopes on one side of the hills, which are probably fault scarps modified by erosion. There is undoubted evidence of the former presence of small glaciers, as indicated by the kames, moraines, small lakes, and swamp holes, in the canyons of the region. Cave lake, Lilly lake, Opal lake, and others are all of this origin. Since the glacial period erosion has progressed so far as to destroy practically all evidence of its former existence except the features above described.

Another pronounced feature in the topography is in the so-called 'rock piles.' These are generally the locus of ore disposition. All the ore of the camp, so far as I observed, is extremely silicious. The already dense rhyolites, in the zones of fracture and brecciation, have been rendered additionally hard by the infiltration of silica, and these zones being more resistant to erosion have a tendency to stand up in wall-like masses above the surface. These walls have been attacked by alternations of freezing and thawing, and the result is, as seen, a breaking down of these hard outcrops and the scattering of the fragments, large and small, over a considerable area in the immediate vicinity of each occurrence. This has made the development of the orebodies rather backward, as so much superficial work was required, and is still being done to find the gold-bearing rock in place. The prospector first finds 'float' ore in the pile of loose boulders. He then decides, as well as he can, upon the most likely point to find the orebody in place. The loose rock is often from 10 to 30 ft. in thickness and it requires considerable preliminary work to reach solid rock. In most places an adit run from some place on the mountain side would best solve the problem, but these lessees want to find their ore and stay with it, which from their point of view, is good policy. Owing to these peculiarities, the hardness of the rock, shortness of the summer season, and lack of present liberal financial aid, it will probably be another year before much more is known of the geological conditions obtaining in this district, than is indicated in this description, for the work of development will proceed slowly at first.

The metallurgical problem is not a difficult one. At present, simple amalgamation is the only treatment given these ores, but the percentage of value thus saved is sometimes discouraging. The gold is extremely fine in most of the ore, though the richest ores occasionally contain much visible gold. I believe that the cyanide process will satisfactorily solve the metallurgical difficulties. The only sulphide observed was pyrite, with a single exception, which was an occurrence of mispickel. Copper also occurs in a few places, but in small amount. Generally speaking, so far as developed, iron sulphide is far from abundant in these mines, the gold appearing to be associated rather with the secondary silica than with sulphides of the base metals. Most of the gold is accompanied by silver, some of the bullion running as low as $12 per ounce. Most of the ore affords excellent examples of that condition so interestingly described by Franz Posepny as 'crustification.'

The district is an ideal summer camp. It has the advantage of abundant timber and water, and is but 9 miles from the railroad, at New Pine Creek. Deep creek, which heads just north of High Grade will furnish abundant power which can be transmitted into the district. So, on the whole, High Grade may be said to possess the elements of success. The energetic men who are at present interested in the district, and who, by the way, are mostly from Colorado, where they do not look upon the deep snow of winter as an insurmountable obstacle, will, without doubt, make the most of the situation at High Grade and achieve the success to which they are entitled. At present there are no saloons in High Grade, and little or no gambling, nor is there either church or school, but the people of the camp are optimistic to a degree, and most of them have calloused hands, which speaks much for their faith. A portion of the district—that at the north end, is on 'school land,' section 36, which was purchased from the state. The rest of it is in the forest reserve.

It has been repeatedly stated by some of those interested, that High Grade district is "another Cripple Creek," and that it will "eclipse Goldfield." These and similar comparisons with noted mining districts have been made. Geologically it bears no resemblance to either Cripple Creek or Goldfield. The mineral deposits are only in a remote way similar to those of Goldfield, and very unlike those of Cripple Creek. Each mining district must stand or fall upon its own intrinsic merit. High Grade will, without doubt, produce some profitable mines, but how many remains to be determined by development and ore treatment. Already the newspapers are beginning to contain statements attributed to me, which I never uttered. The above description of the camp is a truthful one, and presents the district to the mining world as I saw it during my visit of a few days. The work was a reconnaissance at best, and the statements made are subject to change as development proceeds and the district becomes better known.

That every claim, or group of claims, in High Grade district will become profitable, I do not believe, but the superficial showing certainly justifies energetic prospecting, and that, too, in some places where little has as yet been done. There is a probability that the development of the surrounding country will extend southward, to Mount Vida and beyond, and some encouragement has already been given prospectors in that direction. I did not visit that locality, however, and know of it only from the description of those interested there, who showed me some ore which they said came from that locality.

STORES valued at $58,250,000 were purchased during 1911 by Rand gold mines.

SILVER produced from Transvaal gold mines amounted to 894,833 ounces.

Edison Giant Crushing Rolls

By J. F. Springer

The annual production of open-hearth steel in the United States equals that of bessemer. It is confidently expected that the near future will disclose still more favorable results. Whatever has to do with economy in this process will be of interest to those who are concerned in steel manufacture. It so happens that the character of the limestone plays an important part, and the quality of the open-hearth steel or the economy of the production of lime rock of high quality depends largely upon the freedom of the limestone from silica. The cost of production turns largely upon the price per ton of a very pure limestone delivered at the furnace. If a considerable railway haul is involved, then economies will have to be sought in the processes of mining or quarrying, of crushing, screening, and loading.

In the Martinsburg district of West Virginia are large deposits of fine limestone which outcrop on the surface. A great deal of rock is steeply tilted, so that the mining operations consist largely in the removal of the overlying soil or useless rock and a breaking of the limestone by blasting operations. The property of the National Limestone Co. consists of about 1000 acres upon which are four deposits. The one which is now being worked is two miles long and upward of 150 ft. deep. Its width averages about 200 or 250 ft. The stripping preparatory to quarrying of the limestone is a simple operation, consisting merely in the removal by hand methods of a thin layer of soil. The strata stands almost vertical. The edges are much eroded and soon become whitened upon exposure; so that a stripped area presents an appearance not unlike a mass of monster bones. The irregularity of the upper face of the limestone thus precludes the use of machines in stripping. The mining consists in throwing down parts of an appxoimately vertical wall, by drilling vertical holes back from the face and blasting. The ordinary churn-drill is employed, a gasoline engine supplying the power. The entire drill-rod, including the bit, will weigh about 1100 lb. The hole made is 6 in. diam. A row of 6-in. holes is put down 25 ft., back of the face of the quarry, and at intervals of about 20 ft. to a depth of perhaps 160 ft. The blasting is accomplished in two operations. First, about 75 lb. of 50% dynamite is exploded at the bottom of the hole to create a cavity. About 1000 lb. of dynamite is then loaded, filling the cavity and reaching up into the undamaged part of the hole. The bottom half of the dynamite is 50% strength, and the upper half 30%. When this charge is exploded, the lower portion of the wall is thrown out upon the floor of the quarry and the shattered but not displaced upper rock settles down into the position formerly occupied by the lower portion. This system of blasting can be used to advantage wherever a vertical wall is to be thrown down. It is of especial advantage at Martinsburg because of the fact that the strata are highly tilted. The foregoing details as to depths and positions of holes and sizes and strength of charges are typical.

At Martinsburg a 100-ton steam-shovel is employed to handle the product of the blasting and to load it upon special skip-cars. Steel skips are also employed. A stone which is not too large for the shovel is not too large for the crushing apparatus. Secondary blasting of particular blocks has primarily the capacity of the shovel in view. Another big shovel is to be put to work later on. The use of the largest size of the shovel, combined with the ability of the crushing apparatus to take anything handled by such shovels, leads to considerable economies. The blasting expense is greatly reduced, as is also the cost of labor. A further and considerable advantage arises from the increased independence of labor conditions. In connection with the efficient working of quarries such as those in Martinsburg, it is quite important that the arrangements for drainage be thoroughly dependable. From the point of view of economy, it is also desirable that the necessary pumping apparatus be simple and subject to the necessity of only infrequent and small repairs. At these quarries there are two standard pumps built by the A. S. Cameron Steam Pump Works, of New York City, which furnish the necessary clearance from water. The manager reports that the first pump has undergone hard service, has handled a large amount of water with ease, has been used day and night for over a year, and has cost less than $10 for repairs in that time. The second pump has been placed only recently, and has hardly had time as yet to make its record.

The rock when loaded in the special skip-cars—one skip to a truck—is drawn by locomotives to its destination in the crusher house, and dumped into the hopper bins over the rolls, whether the load consists of one or two enormous blocks or a mixture of big and little stones. Just over the rolls, a horizontal section of the opening of the hopper is a rectangle of about 7 by 10 feet.

The actual crushing is done by a pair of rolls, each 6 ft. in diameter and 7 ft. long. Their cylindrical surfaces are provided with numerous projections or knobs arranged in circumferential and longitudinal lines. All knobs are essentially alike with the exception of those in two longitudinal rows on one of the rolls. The great majority are about 2 inches in height. A circumferential row is in reality an annular rib interrupted here and there. As the rolls are given a rotational movement, the knobs have front and rear faces. These are planes inclined toward each other above. Thus the forward face is a plane extending upward and backward. The inclination to the cylindrical surface is not a steep one. The other knobs, arranged as already said in two longitudinal rows, are of superior height. Their forward faces are quite steep. These knobs arranged in two lines diametrically opposite each other are known as 'sluggers.' They are prominent if not the chief agents in shattering the rock. The two rolls are placed alongside each other, with their circumferential rows immediately opposite. The rolls rotate in opposite directions—toward each other, viewed from above. At full speed with no rock between them, the rolls have a speed of about 165 r.p.m. As the roots of the knobs are 3 ft. from the axis of rotation, they have a velocity of about 35 miles per hour. At any given point where sluggers pass, 330 blows are delivered per minute, or 5½ blows per second. As there are 8 or 10 sluggers arranged in a longitudinal row, these form a body of active sledge-hammers. Furthermore, the sluggers and other knobs operate with the accumulated energy of the heavy rotating weight of the rolls, which weigh about 50 tons each. The shattering effect breaks the rock, regardless of size, in a few seconds.

The crushing rolls are an invention of Thomas A. Edison and were furnished by the Edison Crushing Roll Co. of Stewartsville, New Jersey. Each roll rotates upon a shaft 21 inches in diameter. Next to the shaft is a mandrel having an octagonal cross-section. Upon this plane rectangular surface, the crusher-plates themselves are secured by large tap bolts. Ten bolts hold each plate. The plates themselves are 22½ in. broad at the bottom and 3½ ft. long. The maximum thickness, exclusive of knobs, is 5 in., the minimum 4 in. Sixteen such plates and 160 bolts make up the complement belonging to one roll. All tap bolts have a diameter of 2 in., except those which secure the slugger plates. These have a diameter of 2½ in. All threads are V-shaped. No nuts are employed; the bolts are simply screwed into tapped holes in the mandrel. The plates are of chilled cast iron; the mandrel is of cast iron. The shaft is reduced to 18 in. diameter at the bearings. The two shafts may be adjusted at various distances apart, so as to crush the rock to different predetermined sizes. When brought to the minimum distance apart, the product of the crushing operation will be sizes ranging from about 4 in. down. In this position the sluggers barely clear the knobs of the companion roll. The rolls may be placed as far apart as 8 ft. 8 in. between centres. The product will then be approximately 24 in. and smaller. Six-foot rolls readily take care of stones weighing 15 or more tons,

and are able to deal with cubes 7 ft. on a side and weighing 28 tons.

The energy of such a pair of rolls rotating at 165 r.p.m. is estimated in effect at about 4,000,000 ft.-lb. This accumulated energy is important. When the rock is fairly gripped, both rolls tend to rotate in unison. Because of the enormous amount of work done in such a short time, the rotative speed goes down sharply and then slowly recovers itself. The shattering of an 8-ton rock will require about 13 seconds, of which 10 seconds may be required to regain speed. The two rolls are not geared together, but are operated absolutely independently by separate motors. It is supposed that the slugger roll does the greater portion of the work, and probably in the majority of cases its speed falls off more than that of its companion. The motors fall off somewhat in speed, but the reduction in rotation velocity of the rolls is far beyond what can be accounted for thus, as the driving pulleys slip in the belts. Considering this slippage, it is not surprising to learn that the upkeep of belts is one of the chief items of maintenance. The total expense for upkeep is, however, quite moderate. At the works of the Edison Portland Cement Co., in the space of two years, four rolls crushed 1,024,409 tons of rock from sizes running up to 10 tons to a size capable of passing a ¾-in. perforation. Exclusive of labor, the repairs and replacements cost $8718.39, an average of $0.0085 per ton. The plate expense accounted for about one-half; the belt expense for about one-quarter.

At the Martinsburg plant, the rolls are driven by a pair of 200-hp. electric motors. The energy demanded at the most intense instant may rise as high as 3000 to 4000 hp., so it is very necessary to store up energy in the rolls—just as with an ordinary fly-wheel. The maximum demand continues, however, for a very short interval —perhaps half a second, and at this moment the rotational speed has been considerably reduced, so the crisis of the crushing operation is accomplished by one or perhaps two blows of the slugger knobs. Immediately before and after the single blow of a row of sluggers, the demand for energy is much less. The belts which connect motors and driving pulleys are 24 in. wide. The motor pulleys are 32 inches in diameter and those on the rolls 96 in., so that there is a speed reduction in the ratio of 3 to 1. As the rolls are operated in opposite directions, the upper side of one belt and the lower side of the other are tight. One belt has, then, a slack lower side. An idle roll is used to support this. The roll pulleys are mounted directly on the roll shafts, one on either side of the crusher. The successful use of electricity for this service is ample proof of its adaptability for work where shocks are to be expected and taken care of. These Edison rolls are successfully driven by motors totaling only 400 hp. because of the great weight and substantial character of the rotating mechanism. It is doubtful whether the shocks of a rolling-mill are proportionately equal to those experienced with these rolls. The demand for energy at the moment of crisis may be 8 or 9 times the capacity of the driving engines.

At present the capacity of the rolls at Martinsburg is about 1000 tons per hour, but the ultimate capacity is unknown. The present practice is to use the rolls for crushing to a size at least as small as 7 or 8 in. There are, of course, quantities of rock of all sizes below, including dust. It is all valuable, provided it is properly classified. So the problem subsequent to the great crushers is largely one of screening, and if a considerable percentage of the smaller sizes is desired, then supplementary crushing will be employed as part of the procedure. Edison rolls of reduced dimensions may be employed on this service. At Martinsburg the giant rolls are the only crushing apparatus in use at present. Consequently, the smallest sizes are produced in relatively small amounts, and the product is now largely confined to the sizes used in the open-hearth process of steel-making and blast-furnace production of pig iron. To these may be added the sizes used for railway ballast and road-making. It is proposed ultimately that this plant shall include additional rolls and screening apparatus in order to produce considerable amounts of the smallest sizes, which are used in the manufacture of glass and agricultural fertilizer.

Alaska Gold Mines Company

Details regarding the Alaska Perseverance mine at Juneau, now the property of the Alaska Gastineau and about to pass to the new Alaska Gold Mines Co., are given in a report by D. C. Jackling and A. F. Holden, from which the following is taken:

We have considered the probable capital requirements for a capacity of 6000 tons per day, which contemplates a hydro-electric power plant; mine development and equipment, including all the necessary living quarters, both at the Perseverance mine proper and at the mill, and driving the long adit. We believe that $4,500,000 will do this work.

Our belief is that the substantially indicated orebody is about 4500 ft. long by 70 ft. wide. The value of the 600,000 tons of ore that have been mined from this body in three different large stopes indicates that a recovery of at least $1.50 per ton can be made. We believe that there will be 75c. per ton profit in this grade of ore. The Sheep Creek adit, which will be driven on the vein as the main haulage level, will develop this orebody at an average depth of about 2200 ft. on the dip of the vein, or about 700 ft. deeper than present developments.

The character of this vein is similar in a general way to other large deposits of gold ore in the same vicinity in which the value of the ore at a vertical depth of 1600 or 2000 ft. on the dip of the vein from its apex, is practically the same today as on the surface. We visited these mines and saw their deep levels, and, if there is any inference to be drawn from the continuity of these orebodies, which are not, however, on the same vein as the Perseverance, one might be tempted to say that there is a probability of ore 2500 ft. deeper than the so-called Sheep Creek adit, which we contemplate driving, but while the probability is there of the vein and ore of value extending to great depth, there is nothing today to warrant anybody in stating that it is a fact that such will be the case.

There are substantially 50,000,000 tons in the orebody we consider definitely indicated. There is a probability of another 2000 ft. to the east of the 4500-ft. ore-zone which, from surface indications, would seem fairly certain to contain ore. Beyond this is some 1800 ft. of the vein concerning which we have no final opinion one way or the other, as we visited no workings or outcrops from which we could secure sufficient data to form accurate deductions. While we cannot at this time state that there is ore here, there are several small mines worked almost at the extreme east end of the vein on this property, which indicates that this 1800 ft. will undoubtedly produce considerable ore and perhaps large quantities. If we do not consider this in the probabilities, it is certainly well within the possibilities.

This letter is based solely on a consideration of $1.50 recoverable value as ore. If one should figure on lower values, assuming 75c. as the total cost of mining and milling, the tonnage now indicated is indefinite, but certainly enormous. We believe that sound mining business will indicate that for the plant now proposed and for operating period of, say, two years, it will be wise to confine our work to the higher-grade ore. There can be, in our opinion, little doubt that at some time in the comparatively near future a much larger plant than the one now proposed will be erected for the purpose of working a larger tonnage of the normal grade ore we now expect will be developed, or of utilizing the apparently vast quantity of lower-grade material. The indicated earnings from the installation now contemplated are approximately $1,500,000 per annum.

STAMPS and tube-mills erected at the end of 1911, in the Transvaal, totaled 10,775 and 263, respectively.

Discussion

Readers of the MINING AND SCIENTIFIC PRESS are invited to use this department for the discussion of technical and other matters pertaining to mining and metallurgy. The Editor welcomes the expression of views contrary to his own, believing that careful criticism is more valuable than casual compliment. Insertion of any contribution is determined by its probable interest to the readers of this journal.

American Institute Affairs

The Editor:

Sir—The American Institute of Mining Engineers has labored for some years under three separate difficulties: (1) Ill defined division of responsibility, in the dual control of its activities, between the Board of Directors and the Council; (2) the independence of the secretary of the Council because of his election by the Institute at large, of the body he is supposed to serve; an illogical situation; (3) the possibility afforded by the present form of constitution and by-laws of placing the management of the entire affairs of the Institute in the hands of a single individual.

The Directors are made solely responsible for the funds and property of the Institute by the incorporation laws of the state of New York. The constitution places the management of all its professional and social affairs in the hands of the Council, which may, and which has in the past, in arranging them incurred indebtedness for which the Directors are responsible; but in which they have frequently had no voice. This should be changed so that no expenditure can be incurred except on previous appropriation by the Board of Directors. The secretary has been the executive officer and has the power, under the constitution, of incurring debts in the name of the Institute, auditing the bills and paying them without consulting either of the governing bodies. As shown in the report of the Committee of Five, the Institute has for some years been short of funds. Its annual income has not sufficed to meet all of its financial obligations.

The main reasons for this condition are: (1) The expense incurred by the interest in the United Engineering Society building; (2) high salaries and inefficiency in the office work; (3) the large proportion of life members whose commutation of dues has been spent for current expenses as fast as received, while the obligations of the Institute to them are continuous; (4) the large number of delinquent members carried on the books and supplied with publications. Together, the life members and delinquents are about one-fourth of the total, so that the entire expenses are paid by about three-fourths of the membership.

It is generally admitted the constitution should be amended, and in so doing we believe the difficulties mentioned above should be borne in mind and every effort made to remove them. It is hardly possible to do away with the dual control of Directors and Council without putting the control entirely in the hands of the New York members, which they do not desire, and which would not be for the good of the Institute. The incorporation laws place the responsibility so entirely in the hands of the Directors that in order to have meetings most of them must be residents of New York or vicinity, or the power be delegated to an executive committee of such residents, which amounts to the same thing. For this reason the dual control will have to be continued.

The undue influence of the secretary of the Council should, and can be, obviated by abolishing his election by the membership at the annual meeting and by letting the Council elect its own secretary subject to its own pleasure. A one-man management can be prevented by changes in the constitution and by-laws precluding the occupancy of certain offices by the same individual.

Two policies have been in mind for the future management of the Institute. One is a continuance of the present predominating influence on the part of a single individual; the other a practical divorce of the business management and the professional activities so that they will not come in contact except at a single point. In the past the Institute has had an especially versatile and energetic secretary; but even in this case the number of those who have not agreed with his policy has increased until they now probably constitute a considerable majority of the Institute. Even if it were desired to continue what is practically a one-man management, and if an individual combining all of the necessary qualifications could be found, it is doubtful whether the Institute, with its present obligations and comparatively small membership could afford to pay sufficient to obtain him. We believe it would be better, at least for the moment, to have a business manager selected by and responsible to the Directors and have the editorial work, so far at least as the selection of material goes, performed by a committee on papers and publications, as is done by most similar societies who attempt to manage their affairs economically; the papers so selected to be turned over to an editor and the business manager, who would attend to the details of publication and distribution.

The expenses of the United Engineering Society building have been incurred and must be provided for. It is therefore either necessary to increase the income of the Institute, decrease its expenditures, or both. The former result can be obtained by making the Institute of greater value to its members, which would probably result in increasing the membership, the latter result by more efficient management at the head office and by eliminating various subsidiary activities not strictly a part of the Institute's business. We believe that the members can be largely increased, as other societies of similar aims and scope have grown largely in the past few years, while the Institute has stood still. An increase in the membership beyond the present number will increase the income much more rapidly than the expense, so that a comparatively small number of additional members would place the Institute in an easy financial position. We believe this to be a better and surer way of providing the needed funds than to increase the dues, which would undoubtedly cause enough resignations to make the financial results uncertain. When a large proportion of the members are dissatisfied and are asking themselves whether they are getting a proper return for their money, it is a bad time to ask them to pay more, unless they can be clearly shown that they are to receive an adequate return. We believe that by lopping off some unnecessary expenditures, by still closer supervision on the part of the Board of Directors, considerable economies can be effected without in any way curtailing the work which the Institute was called into existence to do.

C. R. CORNING,
GEO. C. STONE.

New York, N. Y., August 21.

Mining Reports

The Editor:

Sir—My attention has just been called to a letter signed 'C. S. Herzig,' under the heading of 'Mining Reports' in your issue of July 6.

As the late manager of the mine referred to in this letter, I trust you will allow me a little of your valuable space to reply to it. Mr. Herzig is apparently in England, and from the tone of his letter seems to believe that he has some knowledge of mining company procedure in this country. If so, he might have explained that the manager of a mine, being on the mine itself, is not responsible for the publication of any news in any paper. In this case the quotation is taken from a lengthy fortnightly report, and not a cabled one, as Mr. Herzig leads one to infer. The extract was made presumably by the board of directors, who, naturally, are responsible for whatever is published. It is kind of Mr. Herzig to acknowledge the authorship of the italics, although I must confess that I do not see his point. The phrase which he has kindly italicized is the summarized views of the mine manager, who informs his board that, from all the data which he has at hand, he believes the adit which he has been driving for a considerable distance

is nearing the reef—which it is the object of this adit to intersect.

I fail to see on what Mr. Herzig bases his cheap sarcasm. It is not usual in this country among professional men of repute to attack another man's work and management on such flimsy pretext. I can only come to the conclusion that Mr. Herzig has only written you with a view to airing some commonplaces, which, in my opinion, are certainly not in keeping with the high tone and reputation of your paper.

If Mr. Herzig believed the matter of importance, why did he not air his views in the English technical press? Was he afraid that, in view of its contents, his letter might not have been accepted as worth publication?

W. Hildred.

London, August 5.

Foreign Trade and Canal Tolls

The Editor:

Sir—Your generous polemics would stay my answering your editorial in the *Mining and Scientific Press* for August 17, but that the argument needs challenging in the interest of a closer scrutiny of our national policies. There are few who do not now regret the folly of the Hay-Pauncefote treaty. It was a work of supererogation, done vain-gloriously by a Secretary of State who sought, in the making of various unnecessary treaties, to pose as a diplomat worthy of the circle of distinguished British dukes and lords and statesmen in which he had been socially prominent through his position as ambassador before the Court of St. James, aided by the unstinted millions of his father-in-law. It was a heavy price America had to pay for social preferment. It would have been cheaper to have paid a better trained man enough to sustain the dignity of the embassy; but we are slow in appreciating the virtue of such economy.

It was a bad bargain, but I agree that we should not, for that reason, decline to fulfil our contract. Nevertheless, interpretation of a treaty in the light of previous diplomatic understandings and of diplomatic precedent, is so universally conceded that these are necessarily taken into account in the application of any convention. Great Britain did not hesitate to construe the Clayton-Bulwer treaty of 1850 in accord with the principle which holds in Common Law as well as in the *Jus Gentium* limiting obligations of a contracting party in the face of permanently continuing injury. So far did Great Britain go in her disregard of the Clayton-Bulwer treaty that two Secretaries of State informed her that they held the treaty annulled by her own acts. Such was the attitude of our Government until Mr. Hay undertook to resuscitate the question. Back of these declarations lay further precedent established by Great Britain in her interpretation of existing treaties, relating to the absorption of the province of Vera Paz from Guatemala, and to her pretensions to sovereignty in the name of her ward, the Kingdom of Mosquito, over the territory on both sides of the Rio San Juan in southern Nicaragua, which constituted the basis of tedious diplomatic correspondence when Mr. Buchanan represented our Government in England, and which was freely drawn upon by Mr. Blaine at the time when he made known to Great Britain that under any and all circumstances it was the understanding and intent of this Government to regard any trans-isthmian water-way as practically an extension of our coast-line. The drawing up of the treaty without specifically setting aside this pretension on our part would naturally make its interpretation subject to such declaration, after the precedent set by Sir Henry Bulwer in his historic note following the ratification by our Senate of the Clayton-Bulwer treaty.

Added to this exists the remarkable fact that the Hay-Pauncefote treaty lacks an essential to valid agreements, namely, a *quid pro quo*. Even the Clayton-Bulwer treaty, loose and ambiguous as it was, did not fail to set forth, as the reason for our concessions, the co-operation of England in protecting the canal in the interest of the commerce of the two countries. Therefore the violation of the Hay-Pauncefote treaty by the bill which passed the Senate cannot be conceded, and cannot be claimed until a decision of the Supreme Court covering this point shall have been handed down. It is not a question of dishonor, but one of standing firmly upon the rights appertaining to the American people.

Against the flagrant violation of both the spirit and letter of our treaties with the United States of Colombia, I made earnest protest through the columns of the *Mining and Scientific Press* and elsewhere, and the infamy of that act is a blot upon our Canal policy that must ever make honest Americans blush, but I can conceive no analogy between that case and the one now at issue.

It were to lead far afield to show, as records and statistics, voluminous enough to fill the San Francisco Public Library would amply do, that the policy of protected shipping has given Great Britain a virtual tariff wall for her trade so thick that the United States certainly has never been able to break through it, especially since that famous aftermath of the War of 1812 that tore the sails and dismantled the rigging of our merchant marine. For the first time in 85 years we stand a chance, through a wise measure, of regaining our place upon the sea. The advantage which many had foreseen from the Panama canal is not to be fully realized, but there seems no reason to expect that our inter-coast traffic will be handicapped by tolls, and the admission to American registry of foreign-built ships is a great step in the development of our foreign commerce. Then our unequal trade relations will undergo a change, and the ratio between raw materials and manufactures in our exports will alter in favor of the American wage-earner. The disproportion between the huge increase of prices of staple foods and of those of metals and metal products will be modified. The balance of exchanges will take care of itself. As a matter of fact, such are the needs and demands of different peoples, that reciprocal trade relations exist only to a limited extent. The effectuation of international exchange becomes triangular in any healthy foreign relationships. Without it periods of stagnation and disaster in the operation of a fleet of ships would be frequent.

If we are not to have free toll for all ships, both in domestic and over-sea trade, there still lies open to some diplomat the opportunity of finding the way to revive discriminating duties, which would be a fitting counterpart to the other advantages which the Panama canal is about to bring.

Courtenay De Kalb.

Tucson, Arizona, August 20.

The Editor:

Sir—May I ask what the prospects are for the employment on the editorial staff of the *Mining and Scientific Press* of a political economist? California has so many unsolved mining and metallurgical problems that it would seem that the regular editors could be kept fairly busy aiding these industries. The space occupied by such labored articles as yours on 'Foreign Trade and Canal Tolls' could be greatly reduced by a trained writer on economics, and the space saved devoted to editorial explanations of why the mining, milling, and developing costs at the Standard mine in Mono county are $15.85 per ton of ore, as against a maximum cost of $3 per ton at the Kennedy mine in Amador county, that is now working at a depth of 3600 ft. below the surface. Then, some of the space saved could be regularly devoted to a study of the work that is being done along the Mother Lode, told in such a way that the foreign engineers and business men could learn from the files of the paper the facts about the mines that are being worked in California. The *Mining and Scientific Press* often appears without a single item from the Mother Lode, and in so far as any subscriber depends upon it for a weekly history of mining in California, just to that extent will he be disappointed.

The following editorial from the *Public*, by a trained political economist, will illustrate how space may be saved and a befuddled subject clarified. It may also help

Courtenay De Kalb to get hold of the idea that service for service can be rendered without either party to the transaction being exploited. To those who care to follow this subject, the writing of the American ship-builder, Louis F. Nixon, will be illuminating. He calls attention to one of the duties imposed upon Congress by the Constitution: "To regulate commerce with foreign nations." The editorial follows:

"Something very like pettifogging is the position of the United States Government with reference to the discriminating tolls at the Panama canal. This canal is either an international enterprise managed by the American government for the general good on equal terms, or it is a national enterprise for national benefit; and that it is the latter the American government has not the face to claim. Then the American government must concede it to be the former. But if it is the former, if that canal is an international affair, the American government has no right in good conscience to impose any tolls upon the commerce of other nations which it does not impose upon our own. To insist upon doing so is in effect to claim the right to make a national monopoly of the whole carrying trade through the canal. And by charging the tolls and then refunding them nothing can be gained but a reputation for bad faith."

G. McM. Ross.

Stockton, California, August 21.

[Choice of subjects for editorial discussion in the *Mining and Scientific Press*, and method of treatment is determined by one rule only—"tell the truth and make it interesting." We think that in the matter of canal tolls we told the truth; an opinion in which we are fortified since our correspondent quotes "a trained political economist" whose opinion evidently is the same as ours. That the subject was interesting to engineers is shown by the fact that it provoked letters from Mr. Ross and Mr. De Kalb. Incidentally, the particular editorial was written only after several requests for information on the subject had reached the editor.

As to the Mother Lode, the *Mining and Scientific Press* publishes all the accurate information about that district that can be had. Unfortunately the majority of the operators refuse to give out for publication the exact facts about their properties, and we repeatedly throw into the waste-basket material sent by local correspondents and which we know to be untrue. Many Mother Lode operators keep their books so poorly that they deceive themselves as to costs; others who have reliable figures and who generously place them at our disposal for our own information, restrict our use of them. Some of the best work of which we know, taking into account all conditions, is being done on the Mother Lode, and some of the poorest. Two well conducted properties have total costs of $3.50 per ton, and at one the ore now averages $6 in value. Another property was widely reputed to contain a large amount of $5 ore, and the manager told the editor that the total operating cost was $1.60 per ton. Subsequent examination by competent engineers showed the ore reserve to average $2.80 per ton in value and that there was no possibility of making a profit out of this ore. In our judgment, fortified by that of several of the best experts who have studied the Lode in the past two years, the Mother Lode district today affords one of the best opportunities in the world for development of profitable deep gold mining, but there are unusual difficulties in getting a property in the district upon terms that will permit raising the capital necessary for deep mining. There is the ever-present threat of litigation in case anything of value is found; many properties are held by those who cannot or will not put money into a new venture and who yet require a large cash payment for what at present is worthless; other mines have been sold or bonded on rank misrepresentation; and still others have been badly mismanaged. Along the whole lode with but few exceptions, it is impossible to get accurate data *for publication*, and therefore impossible for a mining paper, however friendly, to be of much assistance. In the aggregate, we publish a great deal about the Mother Lode, more than any other mining paper. It is a district in which we believe thoroughly, and we would gladly publish more, provided it be accurate. We will welcome further facts about the district from our correspondent.—EDITOR.]

Fusing Silica

The Editor:

Sir—In proposing the following modified method for the determination of fusion silica, I believe I am offering your readers a more rapid and convenient method than the usual procedure, and one that is also very accurate. Of course, the chemist must use discrimination in the application of the method; it is not suitable for ores containing barium; and ores with lead must first have a preliminary treatment to separate the lead, but that is usually necessary with any fusion method.

The following determinations, made on a difficult ore high in alumina, will show the accuracy of the method: portion insoluble with acids, 52.4%; silica in original ore, by potassium bisulphate fusion, 37.8 and 38.0%; silica, by standard sodium carbonate fusion, 35.4 and 35.3%; silica, by sodium peroxide and sulphuric acid, 35.4 and 35.4 per cent.

Method.—Take one-half gram of ore, fuse in a nickel dish, or iron crucible, with 5 gm. of peroxide mixture (four parts sodium peroxide and one part sodium hydrate); extract with a little hot water, acidulate with sulphuric acid, add 5 c.c. of concentrated acid, and evaporate to fumes. Cool, dilute, filter off silica, dry, ignite, and weigh.

Ores with lead must first be decomposed with acids and fumed, the lead removed by ammonium acetate, and the insoluble residue then dried and fused with peroxide mixture.

ASSAYER.

Washington, August 19.

Mining Bureau Appropriations

Appropriations for the support of the United States Bureau of Mines as finally granted by Congress are:

General expenses	$ 66,100
Mine accidents investigations	320,000
Metal mine investigations	50,000
Testing coals	135,000
Alaska mine inspection	6,500
Books for library	1,500
Land for headquarters for mine-rescue cars	4,000
	$583,100

IN the Brazilian state of Minas gold has been mined from earliest times. It was about 1570 that pioneers, penetrating into the interior of Brazil from São Paulo, discovered that the streams of the south of what is now the state of Minas ran over auriferous gravels. The news spread, and soon parties were converging upon the district from north, south, and east, exploring and colonizing it, clearing ground, raising crops, building towns, and establishing a small but steady export of gold to Portugal. The Portuguese Crown promptly imposed a tax of 20% on all gold produced, creating the practice of smuggling on a large scale and driving the miners to the remoter districts where they might be free from official surveillance. The alluvial deposits were the first to be worked, and then the miners attacked the veins in the mountain side; but both were finally abandoned in favor of the newly introduced industry of coffee planting. Nevertheless, official records state that between 1700 and 1820 gold was produced to the value of £120,000,000, and it is estimated that, in addition, from six to ten million ounces was exported clandestinely. Shortly before the Independence a company was organized to work a gold deposit at Passagem, between Marianna and Ouro Preto, the then capital of Minas, and this mine is still being worked as the Ouro Preto Gold mines of Brazil. Other companies followed, mostly formed in London.

Special Correspondence

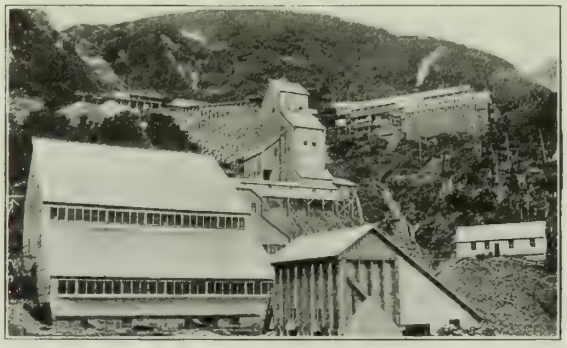
NEW YORK

AMALGAMATED PUZZLES. — ALASKA GOLD. — COPPER MINE NEWS.—MEXICAN SITUATION.—COBALT.

There has been a little lull in the metal market, though the prevailing quiet has not affected prices so far. The increase in refinery production, as shown by Producers' figures of last month, was a little bit disquieting, though such attempts as were made to manipulate the London market to lower levels were practically without avail. From the figures covering production, it is quite evident that actual conditions have not always been completely revealed during the past few months, and the skeptical attitude maintained by the public has not been without justification. The real climax for the copper situation will come within the next six or eight months, when it will be determined whether or not consumption is to keep pace with production. The copper metal market is in such exceedingly strong hands that factors which ordinarily would be of great weight must under present consideration be ignored somewhat. From the present outlook it is quite safe, apparently, to say that present prices have come to stay for at least a considerable time. Market followers are expecting to see some interesting movements in Amalgamated. Eventually, Amalgamated is slated to be absorbed by the new and enlarged Anaconda Copper Co., which will be wiped out, but before this is done it is said that the City Bank people, who originally stood sponsors for the flotation of Amalgamated, intend to make the stock sell at at least its original subscription price of $100 per share. Lawson has not been the only critic of Amalgamated's history, and if the stock can be put back to the price suggested, the original sponsors for the company will be able to wash their hands with better grace when the last chapter is written. The Anaconda dividend is expected to be increased, and Amalgamated will probably make an increase in its distribution in order to further this end.

The report of D. C. Jackling and A. F. Holden covering the Alaska Gastineau property should be studied carefully by investors who fancy shares in precious-metal mines. The existence of low-grade milling properties, turning out precious metal even as the porphyries turn out copper, is overlooked *in toto* by far the greater number of individuals who purchase mining shares. The examples of the Alaska Treadwell and the Homestake are largely lost because there is not the glamor of high grade, the romance of nuggets as in Australia, 'pockets' as in the earlier days of California, or small rich ore-shoots from which a few lessees made fortunes in Goldfield. The 'pocket' hunter cannot equip a low-grade milling property, but for the investor some study by way of comparison cannot but prove profitable. The joint report of Mr. Jackling and Mr. Holden opens with bald statement that to equip the property with a mill, a hydro-electric power-plant, living quarters for workmen, and to drive the long adit will require $4,500,000. The orebody which is to be opened is stated to be about 4500 ft. in length and 70 ft. in width and to contain 50,000,000 tons of ore. Some 600,000 tons already mined from the vein are stated to have yielded at least $1.50 per ton. Mining and milling costs are calculated at 75c. per ton, leaving a like amount as profit. The mill is to be built to have a capacity of 6000 tons per day, and is expected to earn $1,500,000 per year. It is worthy of attention that men of such wide experience, and so far from the type of mining promoter who indulges in hyperbole, should wax enthusiastic. Summing up, they say: "The possible tonnages of ore indicated in this property appear to be greater than any vein deposit we know about"; certainly as strong language as could be expected from the gentlemen signing the report. The Alaska Gold Mines Co. is to have a capital of 7,500,000 shares of $10 each, of which 614,700 shares are to be issued at this time, and the company will acquire $1,790,000 of the bonds of the Alaska Gastineau company out of a total issue of $3,500,000, and also $9,801,000 par value of the stock, being about 80% of the total stock of $12,000,000. The balance of the authorized stock of the new company is to be retained in the treasury and will be used in part to acquire the balance of the stock and bonds not under option when same can be bought advantageously. The Alaska Gastineau represents a recent consolidation of the Alaska Perseverance with the Oxford and important Sheep Creek properties, in Silver Bow basin and on Sheep creek back of Juneau, Alaska.

The controlling interests in Butte & Superior have evidently changed their minds in regard to the manner of handling the additional territory adjacent to the original property and recently acquired under options. Instead of an independent organization to be formed as recently announced, a special stockholders' meeting is to be called September 24 to vote on an increase of 100,000 shares of new stock, to be offered to the present holders at $37.50 per share on a basis of one new share for each eight shares now held; the proceeds to be used in exploring the ground now under option and acquiring same if the developments are as satisfactory as hoped. The Assets Realization Co. has taken over all of the assets of the United Copper Co. All of the Heinzes have resigned from the United board. The Realization company is to advance $1,250,000 and presumably will proceed with the gradual liquidation of the United Copper Co. What there may be



ALASKA PERSEVERANCE MINE.

in the United treasury is a matter of hazard only; excepting F. Augustus Heinze, no one has known up to the present time. The Assets Realization Co. is an outgrowth of the business of Cobe & McKinnon, of Chicago, who were originally dealers in broken-down real estate projects in and about Chicago; developing some instinct for the work of salvage, the Assets Realization Co. was formed, and under the particular guidance of John W. McKinnon has grown into an exceedingly large institution buying and converting the assets of failed banks, insurance companies, and, on the other hand, financing new enterprises. The Assets Realization Co. has played an important rôle in New York since the 1907 panic, which, by the way, displayed its first violent symptoms in the market for United Copper. Heinze's 'far-flung battle line' does not shorten much. Stewart, Ohio, United Copper, are all in snarls of litigation, reorganization, or liquidation.

The British Columbia Copper Co. is turning out copper at a better rate than ever. The New Dominion Copper Co., which is now controlled by the British Columbia, has made its report for the year ended March 31. The work done was for the most part in the way of experiment and endeavor to get on some basis that would admit of ore shipments being made to the Greenwood smelter of the British Columbia and allow some profit to each organization. Owing to the fact that during a part of the time the British Columbia, like the Granby, was forced to import Pennsylvania coke, the experiments so conducted were hardly a fair test. Under the present arrangement a smelting charge has been agreed upon as fixed by a joint committee of engineers, and on this basis the British

Columbia guarantees to the New Dominion a profit of 15c. per ton on its ores.

The melon which was to be served to the stockholders of the International Smelting & Refining Co. is apparently not to be cut as yet. The company has been active in new construction. The Tooele smelter, the lead stacks and furnaces near Chicago, the enlargement of the Raritan plant have cost several millions of dollars, and stockholders rather expected some profits in the way of subscription rights. However, as the company is earning considerably more than its 8% dividend, it has a surplus to use for its requirements and can save interest charges by borrowing 6% money in the market rather than put out additional shares on which it would have to pay 8%. Earnings are said to be running more than 15% at present.

Notwithstanding the fact that the Shattuck-Arizona property is under option to some people who are trying to place it with French capitalists, plans are proceeding for the construction of the smelter at Douglas, and bids will probably be advertised for early in September. The management of the Anaconda Copper Co. has purchased the Oro Fino gold mine, which adjoins the Southern Cross near Butte, for $250,000. The Southern Cross was purchased by the Anaconda some months ago for $500,000. Both of these properties lie in the Georgetown district, and the Anaconda people are extending the Butte, Anaconda & Pacific railroad to take care of the shipments from these mines. The sale of the Chemung Copper Co. to the Phelps-Dodge people for $1,350,000 in cash has been ratified. A final distribution will be made by the Chemung management, and the stockholders will receive about $6 per share.

The Mexican situation is rather exasperating. It was taken for granted when the Speyer loan was consummated that quiet would ensue and the development of the country proceed with added energy and vigor. Now there is but uncertainty, and it is by no means uncommon to hear mining men in New York express a wish for the hand of Diaz or another equally stern to grasp the sword and restore peace. The San Toy Mining Co. has just published its report for the half-year ended June 30, showing a net profit for the period covered of $4795. The principal item of interest is the note that while it may be possible to continue operations, no exploratory work can be undertaken until tranquillity is at least so far restored as to make it possible to employ and hold skilled laborers. During July the mill of the El Oro Mining & Railway Co. was in operation 30 days, crushing 20,190 tons of ore and treating 14,840 tons of old tailing, the recovery in bullion being worth $169,420. The working expense was $99,100; expenditure on development, $16,820; mine profit, $53,500; railway profit, $9170; and total profit, $62,670. The sum of $1770 was spent upon permanent mine improvement.

Cobalt, while absolutely without any sign of life marketwise, is experiencing something of a revival of excitement. This week the land near Haileybury, known as the Gillies Timber Limit, was thrown open to prospectors, and a Jack London midnight stampede or 'mush' was seen. One thousand men participated in the race from the line to points where recent discoveries of silver were made. Claims were staked in frantic haste, and the claimants then raced for the registry office to file claims. In Cobalt proper the work of production is exceedingly creditable. Shipments for the week of August 17 were $51,439 in bullion, and 333 tons of high-grade ore, which brings the week's shipments nearly to the high record. The fact remains, however, that the public has forsaken Cobalt issues, and apparently pays no attention to production figures. Last year was supposed to mark the 'peak of the load' which Cobalt could carry, but this year so far has seen each month do a little better than the corresponding month of last year. McKinley-Darragh made the record shipment last week, sending out one carload of 38 tons of ore, running a little better than $4000 per ton, the total value being $142,231.

BOSTON

CALUMET & HECLA DIVIDEND.—ALASKA GOLD MINES.—KUSKULANA COPPER COMPANY.

Every time there is a Calumet & Hecla dividend declared Boston rejoices, for it means the distribution of a large sum of new money among the city's 'best families.' The latest declaration of a dividend of $12 per share for the third quarter of 1912 was the biggest thing in a monetary way which has happened to State Street for many a day. It may be a coincidence worth mentioning that the quarterly dividend is precisely the amount of stock paid in per share on the company's original capitalization. Three months ago Calumet declared a dividend of $10 per share; six months before that it was $8, and a year ago the rate was only $6. So the rate has been doubled in the past year. Another declaration of $12 per share will make the payments for the year total $42, the highest total since 1907. In 1911, $24 was paid; in 1910, $29; in 1909, $27; and in 1908, $20. The highest annual dividend payment made by the company was $100 in 1899. The company is earning enough to spare $20 per share in dividends for the quarter, but has $1,000,000 in 5% notes to retire on September 1. With its subsidiaries coming into the producing and earning ranks, one by one, as the result of ample financing and excellent management, Calumet & Hecla takes on a much stronger outlook than it did a year ago, when there was so much talk about the days of the good old company being numbered. Alaska Gold Mines stock has been traded in on the Boston and New York curbs at around $7 and $8 per share. The trading is based on the stock 'when issued.' This is for stock upon which $5 has been paid, the other $5 being due next July. It is understood that there will be an over-subscription of the private offering of the stock by the bankers, Hayden, Stone & Co. Interest in Alaska is increasing. The governing board of the Boston curb has admitted to trading the 100,000 shares of the Kuskulana Copper Co. of Chitina. The company has a capitalization of 250,000 shares, par $10. George H. Morrill, of Boston, is president, with Boston, Athol, and Leominster men as officers and directors. The stock has been moderately traded in around $4 per share.

TORONTO, CANADA

RUSH TO GILLIES LIMIT.—COBALT IMPROVES.—PORCUPINE RECOVERY.—LABOR INVESTIGATION.

Cobalt is again in the limelight. Interest in the Porcupine district has for some time been declining, owing to the closing down of many once promising prospects, and the absence of any official or other reliable information as to the results of milling operations at the leading mines. 'Estimates' by professed experts of the approximate output appear from time to time, only to be adversely criticized and contradicted by others. The effect on the public mind is demonstrated by an apathetic and sagging market, principally characterized by the making of new low records. The great event of the week has been the opening to prospectors on August 20 of about 4000 acres of the Gillies Limit, lying to the south of the Cobalt area proper, followed by a rush and a fierce competition by a crowd estimated at between 1500 and 2000, struggling in a midnight scramble for 200 locations. The chance attracted prospectors from the mining districts of northern Ontario, hundreds of whom camped on the ground for days before the official opening, and had their claims picked out ready for staking at the midnight hour. Every trick and device to get there first was resorted to, some of the claimants having erected tents and set corner stakes inside, in defiance of the regulations. Then followed a rush to the recording office at Haileybury, which did not open until 8:30 on the following morning, and a wild scrimmage to secure priority in recording. So great was the excitement for several days in advance of the opening that predictions of violence and possible bloodshed were freely made, but fortunately every-

thing passed off peacefully. It now appears that all this haste and struggle was futile, as all applications for locations will be considered without regard to priority, and the claims awarded in case of dispute to the applicant who can give the best proof of actual discovery. It goes without saying that there are many contested claims, and the rush is likely to be followed by much litigation. And, after all, it is doubtful whether the lucky ones have secured anything of actual value, except perhaps to the company promoter, as before throwing it open the Limit had been examined by officials of the provincial Bureau of Mines, who failed to make any discoveries. The Government some time ago sold locations in the northern part of the Limit for upward of $400,000, and considerable development was done on the Provincial mine and the Waldman, Wyandoh, and Cleopatra locations, but operations have proved decidedly unprofitable so far. There is an increased demand for Cobalt stocks, with a slight upward tendency in this long-depressed market, and some properties which have been regarded as hopeless are looking up. The Cobalt Central, now known as the Penn-Canadian, is in active operation and has shipped 32 tons of high-grade ore, taken from the 110-ft. level. A large body of milling ore is being developed on the 305-ft. level, and the old mill, which has a capacity of 100 tons per day, is being refitted for the treatment of a large tonnage of low-grade ore now on the dump. Steady development has been for some time in progress at the Bailey, which is preparing to make a shipment. The McKinley-Darragh has made a new record for the value of a single shipment from the Cobalt camp, having recently sent out a carload of ore containing 231,270 oz. of silver valued at $142,231. The ore averaged as high as 13,000 oz. The Beaver has found good ore in the diabase underlying the Keewatin formation, which is regarded as of great importance, as showing that the productiveness of a mine is not necessarily terminated when the diabase is reached as appeared to be the case with the Timiskaming. The Curry Lorrain has been reopened and a shaft will be put down close to this property. Other South Lorrain properties, formerly closed down which are now being worked, are the Bellellen, the Alice Lorrain, and the Sharpe Lake. The British American Cobalt, a Montreal company, is being wound up, an attempt to raise funds by the issue of treasury stock having proved unsuccessful. John McLean and Frank Gilmour, the two high-graders who robbed the Nipissing mine by the ingenious method of dipping a cold steel bar into the molten metal at the refinery and withdrawing it with silver adhering to it, each received sentence of two years imprisonment. A Finlander named Johann Salas, alias John Perga, who was arrested at Niagara Falls with 40 lb. of pure silver in his possession which he admitted having obtained at Cobalt, was sentenced to six months imprisonment. George MacNaughton, formerly manager of the Trethewey, has accepted the position of manager of the St. Anthony gold mine in the Sturgeon Lake district.

Members of the Associated Boards of Trade of Ontario to the number of about 80, visited the mining districts of northern Ontario recently, leaving Toronto on August 13 accompanied by W. H. Hearst, Minister of Mines, and other officials. At Porcupine they were present at the clean-up of the Hollinger mill, which yielded gold to the value of $18,000. At the Dome the daily tonnage of ore treated is 'semi-officially' stated at about 350 tons. A body of ore directly under the big dome at the 200-ft. level has been opened up in the cross-cut and will be connected with the mill by a raise from this level. The Crown Chartered property is likely to change hands. An engineer representing Rochester, New York, stockholders, has been making an inspection of the mine with a view to their acquiring a controlling interest. A payment of $35,000 on the property has fallen due and a meeting to be held in Montreal in a few days at which the course to be taken will probably be decided upon. At the Vipond mill four additional plates are being placed, making the total number 10, which is expected to increase the percentage of recovery. The Standard, which has been closed since June, has been forced into liquidation, and its assets, comprising two claims west of the Preston East Dome, will be sold by auction.

The Ontario Government has commissioned Samuel Price, mining commissioner of the province, to make an investigation of underground labor with a view to obtaining full information as to the need and desirability of legislation providing for an eight-hour day. The question was introduced at the last session of the legislature, the proposed restrictions being strongly opposed by the mine-owners, and action was postponed pending further investigations. Mr. Price will hold meetings at the principal mining centres at which both sides will be heard, and he will also study the effect of the eight-hour law where it is in force.

LONDON

SUDBURY NICKEL MINES.—WANDERER IN RHODESIA.

The Mond Nickel company does not publish any commercial or technical details, and its yearly reports are of the baldest. All we know is that the company owns copper-nickel mines at Sudbury, Ontario, and a refining plant for the matte at Swansea; that it produces metallic nickel and copper sulphate; and uses the Mond separating process. The report for the year ended April 30 shows that its prosperity continues to increase. The net profit was £154,364, out of which £7718 has been paid as directors' remuneration, £26,666 as 7% preference dividend, £45,906 as ordinary dividend at the rate of 16¼%, and £26,131 as dividend on the deferred shares; £35,000 has been placed to various reserve funds, and £41,381 carried forward. The

WANDERER MINE, RHODESIA.

dividends are the same as the year before, but the amounts placed to reserve and carried forward are greater. During the year, £250,000 5% debentures have been issued for the purpose of completing the new smelter works at Coniston, Ontario, and for extending the works at Swansea. The chairman, in addressing the shareholders, stated that the demand for nickel expands steadily. He expressed the hope that the British Government would eventually adopt a coinage containing nickel, as a substitute for the present cumbrous coppers. The British Government makes nickel coins for use in the Crown Colonies, and supposedly backward countries like India, China, and Central Africa already have such a coinage, while the nickel coins of America and Europe are well known.

The Wanderer is a Rhodesian mine exploiting a large and soft low-grade gold-bearing lode at a low cost per ton of ore. The company was formed in 1899 to acquire the Wanderer, Ashton, and other gold properties in the banded ironstone of the Selukwe district of Rhodesia, and production started in 1902. In the summer of 1909, the company was reconstructed and additional capital raised, for the purpose of purchasing the Camperdown property nearby. The report for the year ended April 30 shows that 219,400 tons of ore was mined and treated by dry-crushing with rolls and cyanidation; of this amount 20,847 tons came from the Wanderer, 9993 tons from the Ashton, 62,794 from the Kemerton, and 125,766 tons from the Camperdown. The assay-value of the ore averaged 2.6 dwt. per ton, and of the tailing 0.6 dwt. The yield was 21,740 oz. or 2 dwt. per ton. The output of ore was 24,166 tons greater than that of the

previous year, which itself was a record. On the other hand, the assay-value of the ore and the yield per ton were less by ½ and ⅓ dwt. respectively. The amount left in the tailing was ⅙ dwt. less this year as compared with last year. The working cost was 7s. 6d. per ton as compared with 8s. The development done amounted to 8647 ft., an increase of 2318 ft. over the previous year. A large amount of overburden, 79,917 tons, was removed at the Camperdown and Kemerton mines. The revenue from the sale of gold was £92,365 and the working cost £82,631. In addition, £2092 represented London expenses, and the profit, £7902, was carried forward. The ore reserve is estimated at 350,925 tons, a decrease of approximately 70,000 tons. During the year, Percy Tarbutt & Co. have resigned as consulting engineers and were succeeded by Noel Griffin; H. Wiley is now manager in place of J. B. Little. A serious blemish in the detailed report on the development work is the frequent omission to state the width of the ore. Thus a raise "was put up 41 ft., of which 10 ft. averaged 7.37 dwt." per ton. This conveys nothing unless the stoping width is given.

SALT LAKE CITY, UTAH

Bingham Wages.—Copper Output.—Park City.

Bingham miners after September 1 will share the prosperity of the industry, due to the high price of copper. When the metal was selling at low figures, a reduction in the wage scale was made, with the promise that there would be an increase when the price of the metal justified it. This promise has been fulfilled by the Bingham Mine Operators' Association, a general increase averaging about 25c. per day having been granted. Machine men in the future will receive $3.25 per shift, helpers $3, hand steel miners $2.75 to $3, hand trammers $2.75, and mule trammers $3, other classifications of labor being paid in proportion. This is substantially the scale paid before the cut. The labor situation has been precarious at times in Bingham, but it has always been dealt with firmly, and serious trouble has been averted. The recent move of keeping faith and advancing wages, it is believed, will check smouldering discontent.

With some of the financial burden lifted from the company, and transferred to the shareholders, Ohio Copper is giving a better account of itself. It is stated unofficially that operations netted about $36,000 during July. Part of the third section of the mill is in operation, and it is declared by people connected with the management that three full sections will be working in September, treating 3000 to 3500 tons per day. The third section is expected to handle 1200 to 1500 tons, while each of the other two sections is handling about 1000 tons each per day. Since the first installment of the $1 assessment has been pretty well paid up, some of the local creditors have received their money, and the credit of the company has thus been improved. Until the second installment of the assessment has been paid, it is probable that nothing definite will be done in the way of contracting for new equipment. The production of Utah Copper is steadily increasing. July, with 11,160,034 lb. production, set a new record for the property. D. C. Jackling says the August output will be around 12,000,000. Early in September the remodeled Arthur mill should be in operation, so the goal of 150,000,000 lb. of copper per year does not appear to be far distant.

Two of the largest Park City mines—the Daly-Judge and Daly West—have decided to contract the greater portion of their development work during the coming year. James A. McIlwee & Sons, of Denver, have signed contracts to drive all drifts and cross-cuts in virgin ground. The same concern is negotiating with other mines in Park City to contract this class of work. The high price of zinc is bringing prosperity to some of the old producers in Utah. Horn-Silver of Frisco, one of the pioneer mines in the state, has recently entered into a contract to ship an initial consignment of 1000 tons of zinc ore from the dump to Bartlesville, Oklahoma, to net $17.50 per ton.

BUTTE, MONTANA

North Butte Cuts Rich Ore.—Copper Production for August.—Barnes King.—Stewart Mining Company.

One of the most important finds ever made in this city and one of the richest ever brought to light in the North Butte property was uncovered the other day when the Edith May vein was cut on the 2400-ft. level. It has a width of 25 ft. and is mineralized from wall to wall and is south and east of the shaft. The poorest assay yet made shows 4% copper and the general average is between 10 and 12%. Several months ago when the North Butte company management failed to find ore of considerable richness in the cross-cut for the Edith May vein on the 2200-ft. level there was much disappointment. After much calculating it was decided to drive on the 2400-ft. level for the vein, and after running a cross-cut it was found.

The Radersburg people, and especially the mine-owners, are much disappointed over the stoppage of work on the line from Three Forks into the district. During the summer work had progressed satisfactorily, and just as the roadbed was ready for the rails financial difficulties arose and work has ceased.

The possibilities of Butte as a great zinc-producing centre are attracting more attention every day. A few days ago W. A. Jones, of Mineral Point, Wisconsin, who is the head of one of the largest zinc manufacturing concerns in the world, stopped off in the city after a trip through the National Park. In speaking about his visit he said: "I confess that I was not prepared for what I understand is more or less common knowledge here—that your zinc industry promises to grow to tremendous proportions. I have been amazed at what I have learned here of your zinc production, both actual and prospective. I am so interested that I am coming back, and it is altogether probable that we will purchase ores from the district and may get into the mining game ourselves here. The zinc industry is growing in importance, and I question if your people right here realize the value of your zinc properties. It is certainly bound to add to the wealth of the city. Like copper, zinc is a metal the world must have, and I feel that in the production of the metal your district is destined to have an important part."

The copper production for the month of August will run about 24,700,000 lb. for this district. This is just about the same as in July. With the first section of the Washoe smelter again in operation, the September production will probably be increased by at least 2,000,000 pounds.

The Barnes-King company in its operations of the North Moccasin property will be managed by George McGee, who was in charge of the mining conducted in the Barnes-King. Mr. McGee is thoroughly familiar with the North Moccasin ground, and only a short time ago he was in the city and had a consultation with C. W. Goodale and others as to the plan of operations, and an understanding was reached as to the mode of procedure. Active mining will be started in a few days. The North Moccasin will be worked through the Barnes-King shaft, as the two properties are connected and the Santiago claim adjoins the Barnes-King at the east end.

The Butte Central Copper Co. mill will be ready for operation by the last of September. Practically all the machinery is now at the building.

F. A. Heinze has more than a two-thirds control of the stock of the Stewart company, and, according to information received here, he intends to amend the articles of incorporation so that stock of other properties, including its own stock, can be purchased. Carter, one of the directors, who is fighting Heinze and wants a receiver appointed, says that with the proposed amendment to the articles of incorporation, Heinze will be in a position to pour Stewart earnings into the treasury of the Ohio company, and thus secure a new lease of life for the Utah company. Carter further points out that Heinze will be in a position to sell his own Stewart stock, which he declares Heinze got for little or nothing.

General Mining News

ALASKA

Cordova

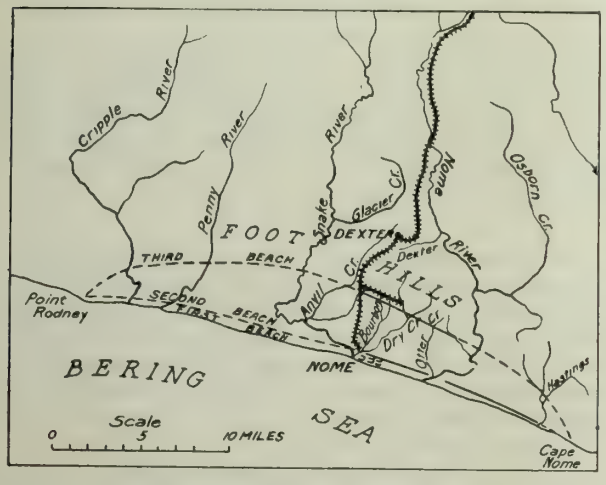
The Alaska Consolidated Copper company has 15 men working on its Kuskulana claims. A winze has been started on the lower levels of the Valdez claim, on Nugget creek, and will be sunk 250 ft. An adit will be driven 250 ft., and should cut the vein at a depth of 125 ft. Pumps and power plant have been ordered for the mine. It will take some time to open the copper country, as there are difficulties in getting supplies and machinery. About 100 men are at work in the district. Around Nugget creek gnats are large and ravenous, so all the men working around the dam have to wear gauze. Rich ore has been opened on four claims on the Tasnuna divide. A lode has been traced for 200 ft., and is 12 to 30 in. wide. It has been opened for 14 ft., and assays give $1872 per ton. Surface samples gave $164 per ton.

Juneau

During July, the 240-stamp mill of the Alaska Treadwell worked 29.64 days, and the 300-stamp mill 29.70 days, crushing a total of 81,116 tons of ore. The estimated gross value of free gold was $118,216, and that from 1650.47 tons of concentrate $102,186, a total of $220,402. The estimated realizable value is $218,198. Operating expenses were $78,349, and construction $13,967, leaving the net profit at $125,882. The yield per ton was $2.71. Development totaled 947 ft., and the stock of broken ore decreased 12,676 tons. The Alaska Treadwell company has declared dividend No. 98, of 75c.; Alaska Mexican No. 67, of 35c.; and Alaska United No. 20, of 50c. per share; all payable August 28.

Nome

A large dredge is being erected by H. Greenburg and associates, who are to work the third beach line. The dredge



MAP SHOWING THIRD BEACH LINE.

is a Bucyrus make, and will cost $175,000 and should handle over 3000 cu. yd. per day. Drilling has proved the ground worth 39c. per cubic yard. Ground on the Bessie claim will be thawed for the machine.

ARIZONA

Cochise County

Something like a boom has started at the Johnston camp. It is said that the Centurion has been acquired by the Lewisohns. It consists of 23 claims, and a good deal of 7% copper ore has been blocked out. The Bonanza Belt company is shipping 40 tons of ore per week from its Peabody mine. In four months the net smelter returns were $17,000. The main shaft of the Republic mine is down 820 ft. Ore is being broken on the 720-ft. level which averages 6% copper. About seven carloads per month is shipped. The Mammoth is also shipping ore. Johnston not only has plenty of copper ores, but is near the shipping station for either the Douglas or El Paso smelters.

Gila County

(Special Correspondence.)—Churn-drill hole No. 8 of the Southwestern Miami Development Co., whose claims lie to the southwest of and adjoining the Live Oak mine, is 860 ft. deep, in chalcocite-bearing schist. Chalcocite first appeared at a depth of 720 ft. in small quantities, and is now reported to be proved. Hole No. 7 is 805 ft. deep in mineralized schist, the sludge from drilling being heavily iron stained. Hole No. 6 is 825 ft. deep in schist. Churn-drill hole No. 3 of the South Live Oak Development Co. is 125 ft. deep in silicified schist, carrying copper in the form of silicate and oxide. The hole is on the hill near Needle mountain, at the northern end of the property, nearly a mile from the first two holes. Water for drilling is pumped 7000 ft. through a vertical distance of 700 ft. To protect itself against probable results of the recently enacted miners' lien law, the Old Dominion company has posted a notice requiring all lessees to give a bond of $5000. This will work a hardship in many cases. The law provides that a lien shall attach to a mining property for unpaid sums due for labor, or material furnished under contract, with the owner or his agents, or with a person working the property under lease, option, or contract to purchase. The construction of the spur from the Arizona Eastern railroad to the Inspiration mine has been started with a force of 50 men, which is being increased as rapidly as possible. The two Chilean mills in the first unit of the Miami concentrator are being replaced with three 8-ft. Hardinge pebble-mills. The fourth and sixth units are already equipped with the latter type of fine-grinding machinery, and Hardinge mills will eventually replace Chileans in all six units.

Globe, August 22.

Greenlee County

The new concentrating and cyanide plant of the Twin Peaks company, near York, is being erected as fast as possible, and machinery is arriving. The mine is equipped with a 160-hp. air-compressor, and steam-hoist capable of lifting from 1500-ft. depth. The new mill will cost about $35,000.

Pinal County

In explaining why part of the Ray Consolidated plant was idle, D. C. Jackling said: "At Ray our milling equipment has always been far ahead of the ability of the mine to produce the quantity of ore required by the concentrators to keep the various units operating to full capacity. This is due to the fact that, in the original development of the property, we accumulated a large stock-pile, so that when the mill was first started ore was drawn from the mine and dumps. It did not take long to exhaust the latter, and since then we have been exerting every effort to open up enough places underground, from where we could take all the ore that the mills required. To date, all of our ore has practically come from No. 1 shaft, No. 2 having been in a position to send but a small quantity to the surface; but we are rapidly remedying this situation, and before long each shaft will be able to raise 5000 tons per day if necessary. There are not sufficient openings to get the ore out yet. All the ore coming from the property still comes from above the 100-ft. level, which accounts for the ore being below 2% copper, but as soon as the main ore-levels are reached, the grade will be raised to the figures originally furnished."

CALIFORNIA

Amador County

(Special Correspondence.)—Within a few weeks the sinking of the 3800-ft. Argonaut shaft to an additional depth of 150 ft. will be under way. The total of 3950 ft. on the incline corresponds to an approximate vertical depth of 3400 ft. The Argonaut already is the deepest incline mine on the Lode. A station will be cut at the 3900-ft. level and development started. The recently installed electric hoist is giving satisfaction. The 40-stamp

mill is treating about 200 tons of ore per day. R. S. Rainsford is manager. The winze from the 1500-ft. level of the Zeila is reported to be in ore of higher grade to that showing above. The shaft at the South Jackson has gained a depth of 250 ft., and is going down to 500-ft. depth. From the latter point extensive lateral work will be done. San Francisco capital is interested. Jeffrey Schweltzer is manager. Development is still under way on the 2700 and 2800-ft. levels of the Central Eureka. About 125 men are employed. Arrangements are being made for sinking the new shaft at the Bunker Hill. In the Volcano district much activity is reported. At the Mountain King a 3-ft. shoot is receiving attention. The richer ore, occurring in narrow streaks, is alone extracted and crushed with mortar and pestle, the lower grade being stored for future milling. The vein was recently discovered by B. Pitts after the former owners had abandoned the property. At the Stud Horse promising ore is showing, but lack of water prevents milling. Prospecting is under way on several claims, but work is handicapped by lack of water.

Jackson, August 24.

Inyo County

The Emma Gulch mine has over 6000 tons of low-grade ore on its dump, assaying from $2 to $6 per ton. The mine is close to the Monster and Bunker Hill, and the three could be worked with one mill. A large orebody has been opened in Homestead canyon. On account of high freight rates, no ore under $50 per ton can be profitably shipped. Other mines in the district which require capital to work them, are the Monster, Bunker Hill, Lexington, Old Soldier, Buckhorn, and Never Sweat. They are said to have produced low-grade ore, have a fair quantity in sight, and have water. During July the Skidoo mines mill treated 1201 tons of ore for bullion worth $21,733. Development expenses were $1054, and operating, $6794, leaving net profits at $13,885. The time lost amounted to 10 5/12 days.

Sierra County

A gasoline engine has been fitted to drive an air-compressor at the Kirkpatrick mine, near Mountain House. At the Rattlesnake gravel claim it is intended to extend the adit 25 ft. before further raising. This is expected to bring it directly under the channel. Two men are driving a cross-cut from one of the adits at the York mine, below Downieville. Survey work is under way on the proposed power-line to the Telegraph mine. It is intended to reopen the 'Dutch tunnel' on White Bear ground which was driven many years ago. It is said that rich gravel, from $50 to $125 per carload, has been produced from the Bellevue mine, between Gibsonville and La Porte. A bond has been secured on the Monitor group of gravel claims adjoining the Bellevue. The purchase price is $25,000, one-half of which is payable at the end of the fourth year of the five-year term. A shaft will be sunk 400 ft. The group comprises 480 acres, and there is plenty of mining timber available.

Trinity County

(Special Correspondence.)—The Trinity Reduction & Mining Co. is driving adits and drifts in search for ore below the main deposit. Indications are reported as favorable. A large percentage of the upper deposit has been mined. At the Wagner mine, Coffee Creek district, the adit has been extended over 1000 ft., and it is expected to intersect the vein within about 125 ft. On the surface this vein shows excellent size and gold content. The adit has already cut two veins, one about nine feet wide, the other being somewhat smaller. Power drills are used in the driving, and no attempt has been made to develop the intersected veins until the completion of the adit work. The owners contemplate the erection of a 10 or 20-stamp mill. This is the property for which an offer of $250,000 was refused last year. P. A. Wagner, of Berkeley, is manager and principal owner. The Trinity Dredging Co. is about to commence operations with its large dredge near Lewiston. The ground has been thoroughly sampled and prospects are said to be exceedingly good. The Trinity Consolidated Hydraulic Mining Co. has a force of men prospecting several of the claims it holds under option in the Weaverville district. The company has opened large reserves of gravel in the Union Hill and Douglas City mines, two of the largest hydraulic properties in the county. It is again rumored that a deal is pending for the sale of La Grange, the largest producing hydraulic property in California. The Craig Mining Co. is erecting new equipment at the Globe, Chloride, and other mines of its group near Dedrick. Ore development is reported to be satisfactory. Lack of water has naturally hampered placer mining this summer, but most of the companies have placed affairs in shape for an early season this fall.

Weaverville, August 24.

COLORADO

Gilpin County

Good milling and smelting ore has been opened at the Gilpin Orion mine, on Bobtail hill. At the 250-ft. level a drift has been extended east for 37 ft., and west 27 ft., showing 24 in. of ore, yielding $9 and the 'tailing' $1.50 per ton. A 4-in. vein of smelting ore returns $65 per ton. One load of smelting ore from the Pittsburg mine yielded $1704 at the sampling works. This came from stopes on the 900-ft. level. Seventy tons is being treated at the Polar Star mill. The 900-ft. level is in about 575 ft., and pay-ore has been opened for some distance.

Lake County (Leadville)

A company has been formed to work the old Belgian mine, which is situated between the Adelaide, Frenchman, and Flagstaff mines. There is a fair showing of ore at present in the mine. Lessees have sunk the Annie shaft, on Fryer hill, to 260 ft., and have passed through six feet of iron ore, and are now working in a red flint which averages about 29 oz. of silver per ton. Sinking at the Gypsie and McRae shafts has been retarded by recent rain. The new shaft at the Columbine property, on Sheep mountain, has opened good ore. Several carloads of ore from the lode cut in July have been shipped. The face assays 25% lead and 300 oz. of silver per ton. Some high-grade lead ore is being sent out from the Ella Beeler tunnel, in Iowa gulch. The ore is friable and assays 40 to 60% lead, with a little zinc, gold, and silver. Hoists at the Blaine and Tip Top should be finished at an early date.

San Miguel County

(Special Correspondence.)—The new middling re-treatment plant at the Tomboy mine has been started and is giving good results. The whole mill has lately been extensively overhauled and many improvements made. The construction of a Trenton aerial tram will be started shortly. This will be used to convey concentrate from the mill to the railroad; and also to bring up all supplies.

Telluride, August 20.

Teller County (Cripple Creek)

According to J. Stewart, mine inspector, there are now 3300 men working in the district, this including about 250 lessees. The Portland company is erecting a change-room, 40 by 60 ft., for the ore-sorters. The Golden Cycle and Vindicator mines also have change-rooms. The Kavanagh mill has treated 2000 tons of $2.42 ore, and paid a dividend of $2500. Plans for the improvement of the district include suggestions for starting the fourth drainage tunnel, which would allow an additional drainage of 500 ft. below the present level. Rich ore is being broken over a width of four feet on the 750-ft. level of the Empire shaft, and 900-ft. level of the Lee shaft. About 80 carloads of ore will be shipped during August. The El Paso company states that during August about 120 cars would be sent out, with a value of nearly $30 per ton. At the 1000-ft. level, the drift on the main C. K. & N. shoot continues to open good ore. Development of the south vein on the 1500-ft. of the Vindicator has proved it to be as good as on the 1400-ft. level.

IDAHO

Coeur d'Alene

The Bullion mine is shipping 100 tons of copper ore to the East Helena smelter. Work has been carried on at the mine since last spring. J. Miller, of Portland, has been inspecting the Western Silver-Lead property in Government gulch, and work will be started. An air-compressor and pump have been ordered. The mine has been shut down for some years, and the shaft with workings from 400-ft. depth are full of water. During July the National Copper mine tunnel was driven 300 ft. Delay was occasioned by a large fault, which required careful timbering. After going through this, a shoot of ore 8 ft. wide was cut, with 6% copper and 1.5% lead. Later on, one 18-in. and one 15-in. vein were cut, but of low value. At a meeting of the Surprise company a vote will be taken on the scheme of taking over the Highland Chief group. The latter consists of 10 claims adjoining the former, and the vein is a continuation of the Surprise vein. Average assays show 8% lead, 16% zinc, and 6 oz. of silver. The Highland Chief also has valuable water and timber rights. The Surprise group has 9 claims and a 100-ton concentrator and other plant. The proposed capital of the new company is $1,200,000.

Idaho County

At the Mascot mine, at the mouth of Kirk's fork, the lode is about eight feet wide and has been opened by an adit to a depth of 125 ft. The St. Lawrence vein is 5 ft. wide and pay-ore has been opened for 500 ft. Foundations for the new mill are about finished. It will be driven by water-power, of which there is plenty all the year. A one-stamp mill has for some time been yielding profitable returns from the Little Butte mine, on Deadwood mountain. This mine is opened by an adit which is in about 1000 ft. The lode is 60 in. wide, the high-grade section being 14 in. wide, and the first-class ore yields about $30 per ton, and the second class about $10 per ton.

Shoshone County

During the year ended June 30 the Stewart Mining Co.'s gross profits totaled $315,355. Development expense was $62,769. The present cash on hand is about $195,000. Owing to economies effected, the cost of labor and supplies has been reduced to $2.02 from $2.24 per ton. It has not been considered wise to pay any dividends during the term, because of the threatening attitude of the Ontario Mining Co. as regards the orebodies. This company owns property contiguous to the Stewart, which it works through the Coeur d'Alene Development Co.'s tunnel. A suit has been brought against the Stewart company by Mr. Carter, a director. All other obligations have been settled, and one-third of the Development company's and 90% of the Coeur d'Alene Metal, Mining & Smelting Co.'s stock have been acquired.

MONTANA

Silverbow County

(Special Correspondence.)—While prospecting for a water-supply for W. A. Clark's proposed new zinc mill, a small flow of artesian water was encountered on the flat near Timbered Butte. This has led to considerable speculation regarding the possibilities of such a supply. The matter has been taken up by the Water Resources branch of the U. S. Geological Survey, which has agreed to send a man to investigate. However, if the Government geologists were correct in interpreting the flat, south of Butte, as the result of sub-aerial decay of the granite, the conditions hardly seem favorable for a dependable supply of artesian water. It is said that contracts have been signed by Eastern capitalists for the reopening of the famous Blue Bird property, west of town. Zinc orebodies will be sought. Activity in this section will give the district a resemblance to the olden days when the silver mines were in operation.

Butte, August 23.

NEVADA

Humboldt County

There has been quite a rush from Lovelock, Imlay, and Mill City to the new find in Inskip canyon, 14 miles from the latter place. The original discovery shows 24 in. of ore which pans from $75 to $100 per ton. The district is easy of access and there is good water obtainable.

Lincoln County

Mining at Pioche is fairly brisk just now. The Prince Consolidated is shipping 300 tons per day; the Mendha company, 50 tons from its property in the Highland district; the Day-Bristol, 100 tons from its Bristol and Jack Rabbit mines; while the Home Run Copper Co. and Highland Mary mine are also sending out a fair tonnage. Besides this ore, over 100 cars of tailing per week are going from Bullionville and Condor canyon, making in all about 200 cars per week over the Pioche branch railroad.

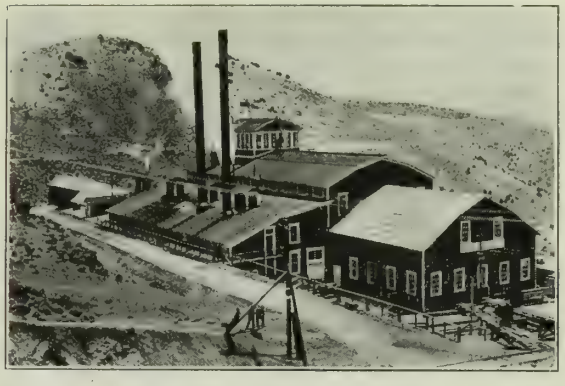
Nye County

At the Big Four rich ore has been found on the hanging wall of the glory-hole. On the 500-ft. level a raise is being made to the 400-ft. in ore which assays $15 over 5-ft. width. At 75-ft. depth in the Indian Camp property the lode is 12 ft. wide, with variable pannings. The Bath lease shaft is to be sunk from 270-ft. depth. Six feet of good-grade ore is being stoped from the 250-ft. level of the Muskett-Wittenberg lease of the Manhattan Consolidated. Assays return from $15 to $38 per ton. The White Caps company is breaking out a good deal of ore which is worth about $30 per ton from the 75-ft. level.

Storey County

A Los Angeles company is having a large dredge built in the Carson river, below the sites of the old Morgan and Mexican mills. It is intended to dredge the river channel and recover the gold and silver from the tailing washed into the river during the time the mills were working.

During the week ended August 24, the Mexican mill crushed 515 tons averaging $26.63 per ton, equal to $13,714.



WARD SHAFT ON THE COMSTOCK.

The extraction is reported to have been 92%. This ore came from 2400 and 2500-ft. levels. The new compressor for the Union shaft has arrived and will form part of the equipment for this joint shaft and will give additional air needed for work below the 2500-ft. level in Mexican, Union, and Sierra Nevada mines. During last week an attempt was made to short-circuit electric wires at the Mexican mill. A telephone wire near the mill had been cut, and a piece of the wire weighted at both ends with stones had been thrown over the high-tension wire. Fortunately the circuit-breaker in the mill worked properly, or else great damage might have been done. At the Ophir mine the southwest drift on the 2500-ft. level was advanced to 474 ft. in porphyry and quartz of low value. At the mill a tube-mill is being erected. To the Selby smelting plant 45 tons of concentrate from the Kinkead mill was shipped. Its value is estimated at $30,000. On the 2500-ft. level at the Union mine, in the main gallery, the raise was driven 14 ft. above the sill-floor, showing 24 in. of quartz. Eighteen cars of

ore were saved, averaging $8.55 per ton. At the C. & C. pumping shaft the centrifugal pump was lowered to the 2500-ft. level for temporary service. This was a big job, but was finished without any trouble. It will take a week to connect and start this pump. The Starret pump, in the Ward shaft, was brought to the surface. It is intended to only keep the water below 2100 ft. in future. This will mean a decrease of $14,000 per month in expenses.

White Pine County

One of the troubles at the McGill plant of the Steptoe Valley company, in concentrating copper ores, is the tendency of fine mineral to escape with the slime, so a small experimental plant has been fitted up to deal with this loss. The re-pumping system at the Steptoe concentrator is now sending back to the mill over 5000 gal. of water per minute. The walls of the settling ponds are now tight, and the slime will be flushed out by hydraulic pressure. The ponds will then serve their purpose of supplying clear water to the re-pumping plant. Sinking has been stopped at 725-ft. depth in the Zack shaft of the Ely Consolidated owing to hard formation being met. A station will be cut out at the 700-ft. level, then driving south will be started. An effort is being made by prospective shippers for lower freight rates on low-grade ores from the Ely district to the smelters of Salt Lake valley. The present rate on $15 ore is $3.50 per ton. From Pioche to Salt Lake smelters is much farther, yet on $7.50 ore the rate is $1.75 per ton. It is claimed that a large quantity of ore would be sent if rates were lowered. The Boston Ely is erecting a boiler and air-compressor. Fifteen claims have been located on the lead belt in Rocco-Hamilton canyon, which are to be developed by a tunnel 300 ft. long and should open the main vein at 350-ft. depth. The water of Illipah creek will be used to generate power, and 250 hp. can be secured. A two-years lease has been taken on the Cuba mine, in the Blaine district, and two carloads of rich galena will be shipped.

UTAH

Beaver County

It is said that the Utah mountains have few prospectors about now, and 'conservation' is blamed for this neglect to explore the country. The Majestic mine will ship 40 cars of ore during August, against 28 in July.

Juab County

The Eagle & Blue Bell mine is looking well. On the 1350-ft. level, 430 ft. was driven, and the face is showing first-class shipping ore. Raising is in progress from the 1350-ft. level to connect with the orebodies opened during the past several months by a series of winzes driven from the previous depth of the shaft. Ore has now been proved from 700 to 1350-ft. depth. The 700-ft. level has supplied a lot of rich ore, and production continues from winzes from the so-called 1000-ft. level. When this and the 1350-ft. level are connected, ore will be broken in a cheap way and the output increased.

Salt Lake County

The Ohio company's mill dealt with 2700 tons of copper ore in 24 hours at the beginning of last week. Mining men state that there is a shortage of men for work in the Bingham district.

The Bingham-New Haven company at present sends its ores to the Tooele smelter over the Utah Consolidated tramway, but the company now intends to connect with the No. 7 or main working level of the Utah Consolidated, through which ore will be taken instead of over the tramway. About 900 ft. will have to be driven, besides raising, cutting oreshoots and pockets, the whole to cost about $18,000. It is expected that the new method of transport will save $1.50 per ton. The Bingham company is erecting six more vanners in its mill. The Michigan-Utah company, at Alta, has cut a vein below the lower adit-level of the old City Rocks lease, which is part of the property. The lode is from 15 to 18 ft. wide, and contains copper, gold, and silver to the value of $80 per ton. Repairs to the tramway are half finished. An automatic loader has been ordered. The company shipped, on August 17, 200 tons of lease ore and 25 tons of company ore, averaging $40.65 per ton. There are about 500 tons of ore on the dump for shipment.

Summit County

The Silver King Consolidated, at Park City, will increase its capital stock from 500,000 to 700,000 shares of $1 each. Five mines at Park City shipped 1805 tons of ore for the week ended August 17. It is said that work has been started on a new tunnel on Nigger hill, to tap the Silver King Coalition at a depth of 1300 feet.

In the case of Charlotte Cassidy *v.* Silver King Coalition Mines Co., the U. S. Circuit Court of Appeals affirmed the ruling of the lower court and assessed the costs against plaintiff. The latter claimed one-fourth interest in the Capital Lodge claim, at Park City. The title is now vested in the Silver King Coalition company.

Tooele County

At the old Mercur camp, it is said that two mills will be at work very soon. That of the Franklyn leasing interests on the Geyser Mary property is working well, while the Norma mill will be finished in a short time, for that claim.

WASHINGTON

Ferry County

(Special Correspondence.)—The Spokane section of the A. I. M. E. held an official meeting at Republic, on July 26, and spent three days inspecting the mines and mills of the district. Seventeen members attended the meeting, which was the result of an invitation of the Republic Commercial Club. F. A. Thomson gave some interesting data on the resources and output of the camp. The metallurgist of the Sans Poil mill, E. C. Morse, read a paper on treatment of the Republic district ores, which covered some of the older methods used here. [Full details of the Sans Poil and North Washington Power & Reduction Co.'s mills were given in the *Mining and Scientific Press* of August 24.] He also dealt with the results of experimental work on the ore with fine-grinding and cyanidation. A banquet was given to the visitors at which 150 attended. H. W. Newton, of the North Washington company, came in for a considerable amount of praise for his metallurgical work, and said: "We have not yet completed the first clean-up, but the assays of the heads and tailing of the ore treated from July 10 to 26 show that the former averaged $7.75 per ton, and the gold extraction is 95.54%, and that of the silver 94.46%, a total extraction of the value being 95.18%." The visitors included E. Jacobs, F. A. Thomson, L. K. Armstrong, I. B. Hammond, J. H. Jones, G. M. Drollinger, W. P. White, G. S. Bailey, E. L. Jones, M. C. Osborn, J. T. Pardee, W. W. Gifford, J. B. Cook, and others.

Republic, August 16.

Spokane County

(Special Correspondence.)—Spokane men have discovered a new silver-lead camp in British Columbia, on Treasure mountain, 21 miles north of Tulameen. They report that the Canadian Goverument promises to build a wagon-road to the mine next spring. N. E. Linsley, a Spokane mining engineer, recently visited the property, while the Granby company has its chief engineer examining the district also. In order to develop oilfields near Shelby, Montana, a group of Spokane men has organized the Shelby Oil Co. with a capital of $1,000,000. The company owns 160 acres of land, 18 miles north of Shelby, and already has a well 56 ft. deep, where oil has been found. The claim will be worked this fall, as late as weather permits.

Spokane, August 23.

CANADA

British Columbia

The Granby smelter, at Grand Forks, broke this year's record lately, in treating 25,751 tons of ore in one week, making the total for the year 778,252 tons, and 13,667,500

lb. of blister copper, 395,000 lb. being sent to the refineries last week. Ore production in the Kootenay and Boundary districts was again well above the average and totaled 52,441 tons, and for the year to date is 1,524,600 tons. Smelter receipts last week were 47,161 tons, and for the year 1,372,733 tons. Metal shipments from Trail were 64 tons, valued at $53,939. The Granby company has two diamond-drills at work in the Phoenix camp. A new wage-scale has been agreed to by the British Columbia Copper Co. and the Greenwood miners' union, based on the price of copper. When the metal is between 16 and 18c. per pound, all men at the Mother Lode and Lone Star mines and the Greenwood smelter will get an advance of 25c. per day over the present scale. When copper is 18c. or more, wages will be again raised 25 cents.

Cobalt

It has been decided to reopen the Foster mine at once. The Crown Reserve company has declared its thirty-first dividend, amounting to $88,440, making $4,402,021 to date; while the McKinley-Darragh has declared one equal to $224,679, with a total of $2,830,559 to date. During the week ended August 17, nine mines shipped 334 tons of ore, and four mines 82,449 oz. of silver, 24,630 oz. of this total being from the Dominion Reduction Co., part of which came from Kerr Lake ore.

The rush to the 4000 acres of country thrown open at the Gillies Limit was full of excitement. The night before August 19 was wet, and camp fires loomed up on the hills around. At midnight the place became active, and tents that hid corner stakes which had been set days ago were torn down, unmasking what had been done in secret, in contravention of the mining laws. At two o'clock, most of the staking had been finished, and there was a race for the Haileybury recording office. Every horse, carriage, and automobile was used, even a special train was hired, but the passengers by this time were forestalled by another locator. At the office, prospectors and others had watchers at the door, and these gave place to the former as they arrived from staking out claims. It is said that the big Cobalt companies had prospectors in the district for a week, and a seam of calcite called for extra watching. The whole business of staking claims was done in orderly manner, calling for no police interference. About 2000 men were there to stake less than 200 claims, near the south end of Giroux lake. Those immediately south of A91, 92, 93, and 94, were the claims watched most. The first to reach the recording office was Ben Killoran, who arrived at Haileybury at 1:03 a.m., and at 8:20 a.m., claim A94, much coveted, was given to him, but there is likely to be litigation over it. There were 125 men trying to get into a small office. No finds have yet been announced on the new field.

At the Haileybury recording office 150 claims were recorded for the new district thrown open, this being 25 claims more than the Larder Lake rush. Five applications were filed against No. A94, five for No. 93, and four for No. 91, which had a special train hired for some of the applicants.

Porcupine

In the raise from the 100-ft. level of the McEneany mine, the lode is 4 to 6 ft. wide, and shows free gold. This lode has been driven on for 320 ft. at this level. In about 40 days the shaft will be down 400 ft. Excavation for the experimental mill is well under way. No detailed report of the trial shipment of 32 tons of ore to the McGill University has been received so far. At the McIntyre the drift on the 300-ft. level is out 300 ft. on ore about 10 ft. wide. The mill is running full time, and certain improvements are to be made.

MEXICO

Chihuahua

The Batopilas Mining Co., in a communication to the Mexican Government, gave the following particulars of its operations: It owns 867 hectares of silver-bearing properties, of which it is working on 173 hectares; and 64 hectares of gold-bearing property which is not being worked, gold contents being irregular and very low. During the past 32 years of operation, the Batopilas company has found only five important bonanzas, so it is seen that, for the exploration of this country a large outlay of capital is necessary. During the past few years, regardless of large expenditures, the company has suffered heavy losses. Since the date of the consolidation of the properties of A. R. Shepherd, the company has only paid one dividend amounting to 1¼%. Work was commenced on the former claims in 1880 by Mr. Shepherd. Silver was then double the price of the present time; and wages now are double what they were then. While Batopilas is rich in silver ores, it is not rich in native silver, as popularly believed. It has developed bonanzas, but these bodies have not been persistent as in other districts. The veins of the district are generally barren, but contain valuable pockets in certain zones. Outside of these deposits, there is little of value. There has been more money invested in the Batopilas mines than they themselves have produced. The ore reserves, as generally understood, may be considered as none. However, there is one in sight which is being mined, and considerable development has been done, and there is every reason to suppose that other valuable deposits will be found. About 350 men are employed by the company at present. The company works the San Antonio mill, which consists of 90 stamps, of 800 lb. each, worked by water-power, and its daily capacity is 150 tons. The company also has the San Miguel plant of 25 stamps of 350 lb. each, in which rich ore and concentrate is treated by amalgamation and cyanide. Annual production has varied during the past 32 years from 300,000 to 1,500,000 oz. silver. The company argues that its business is decreasing on account of increase of wages and salaries, difficulties in communication and transport, and damages suffered, and lack of confidence in the future. The Mexican Government has benefited from the operations of the Batopilas company, and so the company thinks it is entitled to consideration and protection in every way.

Jalisco

(Special Correspondence.)—During the period, March 26 to June 16, the mill at the Amparo mine worked 81.2 days, out of a possible run of 84 days, and crushed 20,976 metric tons of dry ore, equal to 258.3 tons per day. The estimated realizable value of the yield was ₱397,674. Working expenses totaled ₱197,205, and development ₱20,390, which left a surplus of ₱180,078. Construction expenses were ₱45,294, reserve of 17,250 tons broken in the mine ₱35,516, ranch improvements and planting cost ₱2889, a total of ₱83,699. There remained ₱96,379 available for distribution by the home office at Philadelphia.

Etzatlan, August 15.

Sonora

(Special Correspondence.)—The mills of the Lucky Tiger-Combination company crushed 6046 tons of dry ore during July, the cyanide plant treated 5810 tons of tailing from the mills, and 1829 from the old tailing dump. The plant was shut down for 58 hours on account of lightning breaking insulators on the power-transmission line. The estimated realizable value of bullion produced was $65,370; from concentrate $70,850, and from shipping ore $21,780, a total of $158,000. Mining, milling, general, marketing ore, and taxes totaled $86,587, leaving the net profit for the month as $71,413.

Kansas City, August 20.

The Calumet & Sonora company should soon finish raising its shaft from 525 ft. to the 400-ft. level. At present the monthly production is 300 tons of zinc and copper, and 50 tons of lead concentrate. Only the day shift is being worked at the wet and dry mills. The Cananea-Boston has started sinking a new shaft on its Siempre Viva No. 1 property, which adjoins the Norton denouncement of the Calumet & Sonora company.

The Duluth-Sonora company, which owns considerable mining property in the Cananea district, is to resume operations on October 1.

Personal

Professional men are invited to send news of their engagements and travels. Such news is interesting to friends.

LU C. TYLER is in San Francisco.

S. E. BRETHERTON has gone East.

EDMUND JUESSEN has gone to Arizona.

F. L. SIZER has returned from Arizona.

THOMAS T. READ is in British Columbia.

GELASIO CAETANI has returned from Colorado.

B. X. DAWSON is in San Francisco from High Grade.

F. P. PAUL has returned to Sydney, New South Wales.

GEORGE W. MAYNARD is examining the Harqua Hala mine.

J. W. MALCOMSON was at Keokuk and St. Louis this week.

H. M. CROSMAN is now with the Tiro General mine, at Charcas, San Luis Potosi, Mexico.

Y. TSUBOI, of the Fujita Mining Co., is visiting American copper mines and has gone to Butte.

R. S. BOTSFORD has gone from the Bogoslovsk Estate to Pavada to investigate the platinum deposits.

W. R. DOWLING has been elected president of the Chemical, Metallurgical & Mining Society of South Africa.

S. H. BALL, who has been examining the Bogoslovsk copper mine in the northern Urals, has returned to New York.

ROBERT S. LEWIS of Standford University, has been appointed associate professor of mining in the University of Utah.

WARREN SMITH addressed the Engineers' Club of San Francisco at the luncheon last Tuesday, on 'Opportunities in the Philippines.' Mr. Smith will sail for Manila, September 5.

JAMES SMITH is chief engineer at the Cerro de Pasco. Other changes are the appointment of J. T. GLIDDEN as general foreman of mills and A. E. SWANSON as general auditor, the latter succeeding F. M. LOPER who returns to New York.

Obituary

JOHN HARPER, one of the pioneer mining engineers on the Comstock Lode, died at San Francisco this week at the age of 76.

FRANCISCO ALFREDO PELLAS, mine owner and one of the active factors in the revival of the Chontales mining district of Nicaragua, died June 12 at Granada, Nicaragua. Mr. Pellas was born in Italy in 1850, and went to Nicaragua in 1874. One of his first mining ventures was the Neptune mine, which he sold to Joe Lapierre, owner of the Bonanza. He reopened the Javali mine at Santo Domingo, and was also reopening the Escandola at the time of his death. He was the organizer, manager, and principal owner of the Nicaragua Sugar Estates, Ltd., known as San Antonia, which is equipped with modern machinery and produces 5000 tons of sugar. He formerly operated the river steamboat line from Greytown to Granada which is now owned by the government. Mr. Pellas leaves a widow, two sons, and a daughter, the youngest son, Silva, being a student at present at Standford. The older son, Carlos, succeeds his father as head of the various enterprises.

Silver Prices

Silver suffered a decline of one cent per ounce in the New York market, as a result of the suspension of purchases by the Government of India. It is practically conceded on all sides that the withdrawal of the Indian Government is but a temporary move, made only for the purpose of preventing too rapid an advance in the open market, and though holders of bullion may be forced to carry stocks a little longer than is desired, higher prices are looked for within a reasonable time.

Market Reports

LOCAL METAL PRICES

San Francisco August 29.

Antimony	11—11½c	Quicksilver (flask)	42.50
Electrolytic Copper	18—18½c	Tin	50—51½c
Pig Lead	4.90—5.85c	Spelter	8—8½c

Zinc dust, 1400 lb. casks, per 100 lb., small lots $9.50—9.75; large $7.50—8.50

METAL PRICES

(By wire from New York.)

NEW YORK, August 29.—Copper is still strong and prices are advancing. There is good demand both for home trade and for export. Lead remains firm and is in good demand at higher prices. Spelter is quiet but firm.

Average daily prices for the past week, in cents per pound, based on wholesale transactions, standard brands, are given below.

Date.	Electrolytic Copper.	Lead.	Spelter.	Silver, per oz.
Aug. 22	17.50	4.50	7.10	62⅜
" 23	17.55	4.50	7.15	62½
" 24	17.59	4.50	7.15	62½
" 25	Sunday.	No market.		
" 26	17.59	4.65	7.15	62
" 27	17.59	4.65	7.15	61⅞
" 28	17.59	4.65	7.18	61⅞

LONDON QUOTATIONS

(By cable, through the courtesy of C. S. Burton & Co., New York.)

	August 29.
Camp Bird Ltd	$ 6⅞
El Oro	3⅜
Esperanza	7⅜
Oroville Dredging	1½
Santa Gertrudis	7⅜
Tomboy	6⅜

COPPER SHARES—BOSTON

(By courtesy of J. C. Wilson, Mills Building.)

	Closing prices, August 29.		Closing Prices August 29.
Adventure	$ 8⅛	Mohawk	$ 67½
Alloucz	47	North Butte	33¼
Calumet & Arizona	81¼	Old Dominion	59⅜
Calumet & Hecla	551	Osceola	117
Centennial	22½	Quincy	90
Copper Range	59¼	Shannon	16⅜
Daly West	4¼	Superior & Boston	1⅛
Franklin	11¼	Tamarack	44
Granby	57½	Trinity	6¼
Greene Cananea, ctf.	10½	Utah Con	11⅜
Isle-Royale	35½	Victoria	3
La Salle	6½	Winona	5
Mass Copper	7	Wolverine	107

NEVADA STOCKS

(By courtesy of San Francisco Stock Exchange.)

San Francisco, August 29.

Atlanta	$ .27	Mexican	$2.90
Belcher	.38	Midway	.58
Belmont	9.70	Montana-Tonopah	2.25
B. & B.	.08	Nevada Hills	2.00
Booth	.07	Ophir	.89
Chollar	.08	Pittsburg Silver Peak	.99
Combination Fraction	.13	Round Mountain	.40
Con. Virginia	.54	Savage	.08
Florence	.95	Tonopah Extension	2.90
Goldfield Con.	3.57	Tonopah Merger	1.96
Gould & Curry	.03	Tonopah of Nevada	6.60
Jim Butler	.67	Union	.73
Jumbo Extension	.43	Vernal	.13
MacNamara	.24	West End	1.72

MINING STOCK QUOTATIONS—NEW YORK

(By wire from C. S. Burton & Co., New York.)

	Closing Prices. August 29.		Closing Prices. August 29.
Amalgamated Copper	$ 87½	Miami Copper	$ 29⅜
A. S. & R. Co.	87	Mines Co. of America	3
Braden Copper	7	Nevada Con	22½
B. C. Copper Co.	5½	Nipissing	8⅛
Chino	39½	Ohio Copper	¾
First National	2	Ray Con	21⅛
Giroux	5⅞	Tenn. Copper	43⅜
Goldfield Con.	3⅛	Tonopah Belmont	9¾
Greene-Cananea	10⅛	Tonopah Ex.	8
Hollinger	12½	Tonopah Mining	7
Inspiration	18¾	Trinity	6½
Kerr Lake	3	Tuolumne Copper	2¼
La Rose	2⅜	Utah Copper	68⅛
Mason Valley	13	West End	1⅜
McKinley-Darragh	2	Yukon Gold	3½

Book Reviews

Any of the books noticed in this column are for sale by, or can be procured from, the MINING AND SCIENTIFIC PRESS.

PRACTICAL METHODS OF SEWAGE DISPOSAL. By H. N. Ogden and H. B. Cleveland. 128 pp.; ill., index. John Wiley & Sons, New York, 1912. For sale by the *Mining and Scientific Press.* Price $1.50.

This volume deals with disposal of sewage from residences, hotels, and institutions, quite apart from any connection with a city sewage system. The introduction covers the theory of sewage composition, and a summing up of methods of treatment, in an easy style. The problem of sewage treatment consists in removing, on the average, a small quantity of organic matter from a large amount of water, in such a way that no odors are made by the process, and the cost of treatment be reasonable. It is convenient to divide sewage purification into two processes, the preliminary, in which the most common system is sedimentation, by which the larger solids in suspension are allowed to settle in tanks, so that filter beds used later are relieved from the accumulation of that matter; and the finishing process, whereby the tank effluent is discharged into a system of agricultural drains laid just below the surface of the ground for sub-surface irrigation. The settling tanks being of importance, a good deal of space is devoted to their various designs and accessories, while the final disposal of the sewage is dealt with in a practical manner, as irrigation of land by such matter produces effective results. Chapter VII gives estimates of the cost of such installations.

CENTENARY CELEBRATION OF THE FIRST COMMERCIAL GAS COMPANY. 174 pp.; Ill. Edited and published by the American Gas Institute, New York, 1912. For sale by the *Mining and Scientific Press.* Price $2.

This interesting volume contains the papers read at the Franklin Institute, Philadelphia, on April 18 and 19 of this year, it being the occasion of the hundredth anniversary of the introduction of the use of gas as an illuminant. The celebration was given under the auspices of the American Philosophical Society, Franklin Institute, American Chemical Society, and the American Gas Institute.

A chronology of the early development of gas lighting is given, from 1450 B.C., when 'fire-pans' were in use, to the recent lighting of modern cities by that illuminant. Five different gas companies in America lent a large number of pictures and models relating to gas generally, which is called the Historic Loan Exhibition. One framed paper of 1833 is no less than a 'Remonstrance against Gas in Philadelphia.' C. E. Munroe delivered a lecture at the above meeting, on 'By-products in Gas Manufacture.' On such an important subject, the author did well, and the 38 pages covering the matter are crammed full of the chemistry and details of apparatus in recovering such products as tar, ammonia, and cyanogen compounds. The paper is written in an easy style, with no complex chemical formula. 'Commercial and Financial Aspects of the Gas Industry,' was a paper read by G. B. Cortelyou, and should be studied by those people who say electricity will oust gas entirely in time. The U. S. Census shows an increase of 21% in the use of gas in the decade from 1900 to 1910. From 1905 to 1908 sales increased from 117,866,000,000 cu. ft. to 156,909,000,000 cu. ft. A. E. Forstall gave a lecture on the 'Technique of Gas Manufacture,' which must be understood by every gas works superintendent. 'Gas as an Illuminant' was covered by V. R. Lansingh, who dealt with burners used in early times to the revolution in the gas-lighting industry by the invention of Auer von Welsbach in 1885, and the burners now in use with high-pressure systems. In these days, when gas is used so much for heating and cooking, the paper on 'The Use of Gas for Heat and Power; The Testing of Gas,' by E. B. Rosa. is of much interest and value.

Concentrates

Most of these are in reply to questions received by mail. Our readers are invited to ask questions and give information dealing with the practice of mining, milling, and smelting.

NICKEL coins are to replace the present bronze currency in France, and a company with $800,000 capital has been formed in Belgium, by French people, to erect works for nickel production.

COPPER mines near Huelva, in Spain, where the Rio Tinto is situated, employ about 10,000 laborers, and in 1911 the output was over 1,000,000 tons of pyrite and 17,657 tons of copper ingots.

SHOVELING contests at the Continental zinc mine, at Joplin, resulted in the winner filling 235 cars, each holding 2700 lb., in five and a half days, equal to 317 tons. Eighteen cents per car is paid for this work.

CAM-SHAFTS, only two in all, have been broken at the City Deep mill on the Rand, this small number being due to the Laschinger patented cam supports, in which the shafts have a bearing between each cam.

A PLATE-HOUSE at the Consolidated Langlaagte contains 40 copper plates, each 63 by 48 in., four to each tube-mill. From the tube-mill and the clean-up rooms there is only one entrance for each into the plate-house.

CLASSIFYING diaphragm cones, nine in all, have been erected at the new mill of the Consolidated Langlaagte mine on the Rand, and it is estimated that, after a series of classifiers and tube-mills, the mill-pulp will produce 60% slime and 40% sand.

STAMPS at the Consolidated Langlaagte will weigh 1900 lb. each, and one motor drives two 5-stamp cam-shafts. The cam-shaft floor has an iron grating similar to floors in an engine-room of a steamer, in front of the cam-shafts. This should let light on to the lower floor, and allow of easy lifting of spares from floor to floor.

WAREHOUSE trucks can be used to advantage by prospectors to wheel buckets of ore or waste to the bottom of a shaft, and have been so employed by William Chalmers at Mazuma, Nevada. They are considered to be better than wheelbarrows, as workings may be narrower, and the buckets are brought right up to the heaps to be loaded. The truck is also easier to handle than a barrow. The ground in a cross-cut or drive would have to be dry for this type of conveyance.

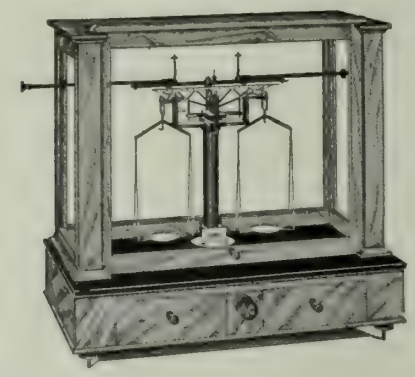
THE IRON PILLAR at Delhi, India, is of much interest. It was made about 413 A.D. and moved to its present site in 1052. It is of solid wrought iron and is 23 ft. high, 16 in. diameter at its base and 12 in. at the top, and weighs 6 tons. Samples procured by R. Hadfield, of Sheffield, England, showed the pillar to be of the following analysis: C, 0.080%; Si, 0.046; S, 0.006; P, 0.114; and Fe, 99.720, equal to 99.966%. Its specific gravity is 7.81. Probably charcoal was used as fuel in the manufacture of the iron, while the absence of manganese is noticeable.

TRANSPORT of calcium-cyanamide and ferro-silicon involves danger. As the result of an explosion of the former compound on a Norwegian steamer recently, new rules have been issued for its carriage on Norwegian ships. Where the material contains over 0.10% carbide it must, until further notice, be transported in water-tight containers of galvanized iron, of a thickness of at least 0.6 mm. Special precautions are to be taken against dampness while being stowed. Holds must be well ventilated, and only safety lamps used. Calcium-cyanamide containing less than 0.10% carbide is dealt with under other rules.

Keller Analytical Balance

For about a generation precision balances for assay and analytical purposes were made practically without changes in design or relative fineness until G. P. Keller converted the assay balance into what is known as the 'Keller type assay balance,' which is being much imitated by balance manufacturers in this country. In recent years Mr. Keller devoted much time to designing an analytical high-grade balance that should not lack any of the good points embodied in his assay balance, and stimulated by an enquiry from the U. S. Bureau of Weights and Measures for just such an instrument, continued the efforts that resulted in the analytical balance illustrated in the accompanying figure. The tests made with this new type surpassed all expectation; the first one completed was accepted by the bureau at Washington, and it is claimed there is not an analytical balance on the market its equal for accuracy, speed, convenience in manipulation, and perfect freedom from jarring of the beam (commonly called 'kicking').

The points of superiority claimed for the Keller analytical balance are: (1) The beam is mounted on its support by a new method; each end of centre edge being provided with a screw inserted vertically, one resting on a



V-post, the other on a conically apertured post. This fixes the beam on its support with no lost motion, and whenever necessary it can be readjusted by the operator simply turning one of the screws until the edge resumes its parallel position with its bearings. (2) The release of the beam without any 'kicking' constitutes a saving of time to the operator. The Keller flat stone stirrup balances were the first balances made that placed hangers on the beam before releasing the same, thereby eliminating all jars caused by the hangers. Stirrups, beam, and hanger supports are operated by one knob in front. (3) The Keller stirrups are made mechanically so accurate as to be completely interchangeable. These interchangeable stirrups make possible eight tests on bearing surface of stirrups and keenness of end edges, to determine fractional resistance. If bearing stones and end edges are absolutely correct, the beam will show no variations on pointer scale. (4) Hangers are of a new type, weighing about two-thirds less than any other hanger in use, when sufficiently strong for a load of 500 grams, adding to the rapidity of the balance's action. (5) Hanger supports are of a new style, well appreciated by all users of the balance; they will turn up against the column when it is desired to clean the black plate sub-base and are easily adjusted to keep hangers from swinging. (6) Construction is such that the entire instrument can be thoroughly cleaned, even by inexperienced hands, without suffering the loss of any adjustment, parts being easily and quickly removable and as readily replaced. (7) The superior methods used in producing and assembling parts, resulting from 18 years experience in designing and adjusting precision balances exclusively, all of which tend to prolong the life and delicacy of the finished product. The development of such methods involves the construction of many special machines, superseding the old-time mechanic peculiar to this line, and has brought the art of balance building to the plane of a profession as intricate in mechanical methods as those of the modern watch or typewriter factory. Formerly a balance-maker drilled holes into glass with a hand brace and steel drill, often spending a whole day on a few holes in one plate, only to break this before completion of the job—and this not more than twenty years ago. This work is now done with diamond tools much more accurately; but these tools had to be evolved for the purpose. Agates were formerly imported from Europe cut 'close to size,' and the metal worked to match the stones; now agates are cut and ground at the Keller Mfg. Co., of Salt Lake City, Utah, to exact size with diamond tools, to fit places provided for them, and plenty of agates are found at home to make good knife edges and bearings. Numerous comparisons between old and modern methods may be cited, of equal moment to the user and the builder of a fine balance—ultimate excellence.

A Test of Lubricants

One of the most difficult things to buy is a lubricant. The greatest part of the difficulty, however, is caused by the statements of the various concerns engaged in selling lubricants. They all claim their lubricant possesses no bad features—that it is perfect. Every one of them will say that the other fellow's lubricant is full of impurities. The main thing to secure in any lubricant is the greatest amount of lubrication at the lowest cost. A simple but good and practical test is suggested by Adam Cook's Sons, of New York, makers of Albany grease.

Securing an 'Albany Grease' spindle cup, place it on the engine, shafting, or machinery upon which the test is to be conducted, but be sure the cup is thoroughly cleaned before it is used in the test. Fill the cup with a known quantity of Albany grease, then place it in operation. The first thing that will be noted is the small quantity that will be used each day. The reason for this is that Albany grease has a low melting point and runs only when it is needed. The spindle of the grease cup is made of soft copper and rests on the shaft. As the shaft revolves, the conductivity of the copper spindle causes the Albany grease that is packed around it to flow. When the shaft is not in motion the spindle is not heated and naturally the grease does not soften and flow. This condition produces the maximum amount of economy.

There is another way to learn its great economy, and more than anything else its fine lubricating qualities. After the cup has been in service for some time it will be noticed that there is nothing left in it. The Albany grease has all been used and no residue is left. Where there is no waste it means that everything bought can be used, and used with good results. Albany grease is all lubricant—no waste. There are no acids, resin, resinous oils, talc, lime soaps, or foreign substances that eat the bearings, gum up, clog, and create friction instead of reducing it. This can easily be determined by the appearance of the cup and the bearings. They show up as fine as the day they were made.

Commercial Paragraphs

The Dodge Manufacturing Co., Mishawaka, Indiana, has just received an order from the American Boston Mining Co., Clowry, Michigan, for twelve line-shafts equipped with chain oiling ball and socket pillow blocks.

The G. P. Keller Mfg. Co., Salt Lake City, Utah, maker of the 'Keller' assay and analytical balances, has opened a department for the repair and adjustment of engineers' instruments, transits, and levels, in charge of Gustav Warkentin, head of the firm of Warkentin & Krause, Leipzig, Germany, an expert in this line.

Salaries and wages earned at Transvaal mines in 1911 totaled $71,350,000.

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EDITORIAL

REPORTS indicate that the fall meeting of the Lake Superior Mining Institute was fully up to expectations in attendance and interest. We will present later some of the papers read.

CRIPPLE CREEK operators are so well pleased with the results of the Roosevelt deep drainage adit that a movement is already being organized for the driving of a still deeper adit. Since it is estimated that five years will be needed to complete the work economically, it will be well to begin promptly.

CAMP BIRD has again come to the front, this time with the discovery of an 11-foot vein, 60 feet from the shaft on the 500-foot level. The vein contains lead sulphide, and samples are said to assay as high as 5 ounces to the ton. Sinking is to be resumed and an effort will be made to reach the vein on the 600-foot level.

GUADALAJARA, one of the most beautiful and interesting cities in Mexico, has been repeatedly injured by earthquakes. Now the announcement is made that the city must be abandoned, as it is built on the site of an impending volcano. The evidence upon which this prediction is based is not at hand, and all lovers of the old city will hope that when thoroughly examined it may not point to any such fatality as now predicted.

PUBLIC opinion is all powerful in the United States when brought into play, and as *Harper's Weekly* points out, modification of the Panama canal bill in conference so as to permit all ships in foreign trade equal rights, was a distinct triumph of the best public opinion. In the *Century* for September American sentiment is reflected in an article on 'Can a Nation be a Gentleman?' The sentiments that "the greatest service our rulers at Washington can do the country is to see that its honor is kept as untarnished as that of the most scrupulous gentleman," and "the way to make a people love their country is to make sure that its reputation is maintained as a source of love and pride," will meet universal approbation.

WESTERN AUSTRALIA is about to join her sister states in opening a university. Among the members of the Senate of the new institution is Mr. G. M. Roberts, the accomplished general manager for the Associated Northern Blocks (W. A.), Ltd. Thanks largely to his foresight and energy, mining will be appropriately provided for in the new school. Aside from the chair of agriculture, which is separately endowed, it has been resolved that there shall be chairs of mathematics and physics, mining and engineering, history and economics, English, chemistry, and geology. As there are already adequate facilities for secondary instruction, the university is to give only advanced courses. The professors are each to receive $4000 per year, with an allowance of $500 for house rent, and there will be the usual complement of lecturers, demonstrators, and assistants. The new school will open its doors at Perth in March 1913 and would seem to be assured of every success.

IMPORTANT changes in the mining laws as applicable to Alaska are summarized this week in our department of 'Decisions Relating to Mining.' Another notable change made by the last Congress was the granting of local government to the Territory and the establishment of a Railway Commission to report upon routes suitable for building. Upon the latter commission is to be placed, among others, an officer from the Geological Survey. No final action regarding the coal lands was taken.

ILLINOIS geologists keep up their good work of furnishing prompt information to the oil men concerning the geological structure of the state, and the oil men reciprocate by giving the geologists free access to all records. This co-operation has already resulted in discovery of several outlying fields and is sure to greatly simplify the problem of finding the deeply buried sands. Bulletin No. 20 of the State Geological Survey, prepared by Messrs. E. W. Shaw and Fred H. Kay in coöperation with the United States Geological Survey, treats the Carlyle and Carlinville fields and is an excellent illustration of how an official survey can help private industry.

FEW recent decisions of the General Land Office have created as much discussion among mining men as has that in the East Tintic case. We are especially glad, therefore, to present this week a full review of it. From the letter of Mr. Samuel C. Adams, it is evident that the Department rested its finding on the facts in the case; namely, that the defendant did not in fact make a discovery on the ground in question that would warrant a reasonably prudent man spending money for development. This is the old rule, and is very different from a requirement that commercial ore be found as a prerequisite to patent. It was the same rule laid down by the courts, in that case to the loss of the Government, that land could not be held to be coal land, and therefore entry as agricultural land did not constitute fraud, except when an actual discovery of coal had been made on the ground. This we have always believed to be foolish. In other words, we believe that the evidence of geological structure may be quite as reliable as the stripping of a thin bed of bituminous matter, such as has often been held to constitute a discovery of coal. In the East Tintic case the land was desired because of the presumable presence under it of an extension of an orebody outcropping on adjacent ground. Without knowing the details of the case, one may still be safe in affirming that such evidence might well be strong enough to warrant a prudent man investing money. The land was not, however, claimed upon this ground, but upon the presence of an admittedly worthless vein. We believe the decision was sound. The remedy was for the claimant to sink or otherwise expose the ore of real or probable value, unless extralateral rights prevented his claiming it. If so, under present law, he should not have been given the land. Back of it all, however, we hold that the requirement of a discovery should be stricken out of the law. In the days when only ore outcropping at the surface entered into calculations, the requirement was reasonable. Now it is not. Every practical miner knows of excellent orebodies that do not outcrop, and the development of geologic science has been such that the old rule regarding discovery has become a farce. In our opinion it is better to meet such issues squarely and to amend the law than to abuse officials for not making a 'liberal construction.' The trouble with liberal constructions is that they make the courts legislative instead of judicial in character. The sounder practice is to amend the law.

Mexico and Nicaragua

New interest has been given the Monroe doctrine by recent events in more than one quarter of America. Señor Don Perez Triana, editor of *Hispana*, has proposed to the several Latin American republics a radical extension of the doctrine, one of particular import just now. It will be remembered that the Monroe doctrine was designed to prevent European intervention in America for purposes of oppression or the "controlling in any other manner" of the destiny of an American republic. While European nations have never recognized the doctrine they have respected it. Señor Triana now proposes that "the exclusion of conquest of territory, as a fundamental principle of international life on the American continent should be solemnly proclaimed by all the American nations; they should all pledge themselves to maintain it." This would practically promise international maintenance of the present status, which in the future might or might not, prove wise.

Mr. F. B. Loomis, replying for the United States, observes that "as the United States does not covet an inch of foreign territory in the new world, I see no reason why this country should not subscribe to the proposed declaration." Mr. Loomis undoubtedly correctly reflects American opinion in the first part of this statement, whether or not all would endorse the conclusion. There are many people familiar with the affairs in Central America for example, who think it inevitable that the United States will in time exercise larger control over affairs in Latin America; but even these, so far as we know them, dread the contingency. Nothing would please thoughtful citizens of the United States more than to see every American republic enjoy strong and stable government. Unfortunately, in the case of certain communities, that seems now far away. The United States has troubles enough without annexing more, and extension of our territories is far from being an American ambition now, whatever may have been true in the past. With a large share of the white man's burden already on our shoulders, the glory of raising the flag on foreign shores makes but scant appeal. The rôle rather of helpful, sympathetic, elder brother is the one that is in the public mind. A firm declaration that the United States has no ambitions in the line of conquest, would be propitious, and would but put into words the present thought of the people.

All this, however, does not mean that we have no duties and are to cling fatuously to a policy of non-interference. The United States has repeatedly interfered in Central America to prevent useless sacrifice of right and property. The people of any country are entitled to what government they wish, but they are not entitled to destroy the lives and property of the 'innocent bystander' save in the gravest emergency. American marines are now in control in Nicaragua and regular troops may be sent there at any time. The right to intervene in such a situation as obtains there is merely the right to protect life and property when the local government fails. Whether one party or the other to the contest in progress wins is no concern of ours. The position of our troops may incidentally help or hinder one side; that is unfortunate but unavoidable. Except in the size of the expedition, the action of the Government in landing the marines in Nicaragua is not unusual. It would call for no special comment were it not for the present critical condition of affairs in several of the states of Mexico. From the first we have maintained that it was for the Mexicans to settle their own difficulties, and that so long as organized civil war was being conducted we must patiently await the outcome. The situation has now taken on another phase, and we believe the time has come for the

United States Government to quit talking and to act. There is nothing in the situation justifying sending American marines to Managua that will not also justify protecting El Tigre and Cananea from robbery by bandits. It is a mere accident of geography that a land rather than water boundary separates Sonora and Arizona, and this should not influence a question of right. There is little doubt that if necessary the United States could and would land marines to protect Guaymas if seriously threatened by Orozco and his men. There is also little doubt that indirectly, by making its possession valueless, the United States forced the evacuation of Juarez by the rebels. It appears to us that too much attention is devoted to technical position and too little to facts.

When some years ago the Apaches were ravaging the border, Mexico and the United States quickly came to an agreement permitting the troops of either to follow the enemy into the territory of the other; and whether one be killed by an Apache or a drunken Mexican rebel makes little difference in the end. The rebels are now hopelessly defeated in open warfare. All they can do is to needlessly prolong a guerrilla campaign that has already descended to brigandage and been stained by practical savagery. For the United States to permit large and prosperous towns and works, owned and operated by her own citizens, to be held up and ravaged by roving bands of brigands is disgraceful. We cannot believe that intervention in such a case, which is radically different from mixing into a family quarrel, or attempting the conquest of a state, would be other than welcome to Mexico and the Mexicans.

American Mining Congress

The official call for the fifteenth annual session of the American Mining Congress, to be held at Spokane, Washington, November 25 to 28, inclusive, has been issued. It is a document well worth reading, and, whether we agree or disagree with the viewpoint of the committee issuing it, there can be little question that the topics proposed for discussion are of direct interest to mining men. The Congress takes as its watchword, safety, efficiency, and conservation; and it recognizes coöperation as the means necessary to accomplishment. It proposes thorough discussion and deliberation as the best means of bringing about a better coöperation in production and distribution, and it has been successful in the Eastern and Middle Western states in securing the support of both operators and men. In the West support comes mainly from the operators of the smaller mines, though a number of the chiefs of large enterprises have been enlisted. The gulf between the leading operators and organized labor in Western metal mines has proved too wide to be bridged, and in part because of the lack of a common forum for discussion, there are sharper differences in opinion, even among mine operators, in the West than in the East. The Mining Congress, for example, is committed to the doctrine of workingmen's compensation for accidents, and has exerted powerful influence toward its enactment into law in several Eastern states. The chairman of its committee on this subject is one of the leading coal operators in Pennsylvania and among the members of the committee are several powerful in the councils of the United Mine Workers of America. The official call speaks of employers' liability as "barbarous." Western sentiment regarding this matter is still profoundly divided, and if there are arguments that appear sound at once to the hard-headed operator in a competitive industry, and to the radical labor leader, if a law can be framed that is satisfactory to both, evidently the West needs enlightenment. No one sees another suffer hardship except with regret, and if the Mining Congress has found a better way to distribute the burden of sorrow incident to mining, its message will be welcomed by its early friends throughout the West.

Control of trusts, regulation of competition, and amendment of the Sherman law, are subjects of interest not alone to mining men, though in the coal industry the need of change is peculiarly acute. The appropriate committee of the Congress has proposed an Interstate Trade Commission, and this is in line with much of the best thought on the subject. Public opinion has not fully endorsed this plan, and a full presentation of its advantages and drawbacks will be of great service. As to conservation, the official call points out that this is a fundamental question affecting not alone Alaska or the public-land states, but the whole country. Increased safety is bound to come as fast as engineers provide the means and public attention is focused upon the need, but diminution of waste is another matter. Gradual improvement is to be expected, but whether the present generation will support drastic legislation which, while preserving material from waste, increases present costs, is not so certain. As to the public lands, the call indicates strong leanings toward state control, and here again opinion is divided and full frank discussion is essential to any right decision. Mine taxation, another problem proposed for discussion, is one that is well worthy of attention. It will come as a surprise to many to know that in many Western states the taxes upon a mine are based upon the total amount that it may reasonably be expected to produce during its lifetime, plus an acreage tax. Into the intricacies of mine assessment and taxation few have penetrated. Most men are content merely to secure some reduction or not to pay more than some neighbor. How the assessment on a mine compares with that on a farm, a bank, or a railroad, is rarely discussed. Taxes in any one year form but a minor item in the accounts of any successful mining company, and it is apt to be forgotten that output, in the case of mines, is division of principal as well as profit.

In Alaskan matters the American Mining Congress has been particularly active, and at the Spokane meeting Alaskan problems are expected to be especially prominent. Indeed, the meeting was set late in the year so as to assure a large attendance from the Far North. Under the guidance of an able committee, the Mining Congress has formulated and urged upon Congress at Washington bills providing for railway construction and the opening of the coal lands. Neither bill was passed, but there can be no doubt that much progress was made in the direction of agreement and the framing of a law that may be expected ultimately to be enacted. Abandoning useless opposition to the policy of the present Administration, fortified as it is in these particulars by a strong public sentiment in the East, the Alaskan committee wisely devoted itself to the details of the proposed bills and to shaping them as nearly as possible in agreement with sentiment at home. We have already discussed the proposed measures, and, recognizing that any legislation on such disputed matters must be a compromise, we heartily endorse them. If the meeting at Spokane does nothing more than to bring to bear such public sentiment as will assure their prompt passage, it will have accomplished more to open Alaska than any other one thing. On the whole, an excellent program has been laid out, and with such men as Messrs. S. A. Taylor, D. W. Brunton, Carl Scholz, James Douglas, and E. A. Colburn, and the hard-working secretary, Mr. J. F. Callbreath, and with an active local committee, in control, a profoundly useful meeting seems certain.

Steel Sets in Inclined Shafts

By Walter Lyman Brown

In the Tarquah district of the Gold Coast, of South Africa, steel has of late almost entirely supplanted timber for shaft sets, main stations, and loading bins as well as for practically all important surface constructions. This is due to the excessive deterioration of timber caused by the hot moist climate, which is further accentuated on the surface by the ravages of the white ants. Certain of the native timbers, especially *kako*, have a fairly long lfie, but they are heavy and hard, difficult to shape and frame, and are short grained. They sustain compressor loads well, but offer practically no resistance to bending, and are therefore of little avail for caps, though they can be used for posts and sills. *Kako* makes excellent blocking and wedges, and is largely used with steel for this purpose. Mahogany is a lighter wood, more easily worked, and is used a good deal for flooring, but has very little strength. Imported timber from Oregon and Norway was mainly used when the shafts were first sunk, but was found to have such a short life that its use was discontinued by most of the mines, and steel sets were substituted with excellent results. In some cases imported timber which have been in shafts for not to exceed two or three years could be almost torn apart with a candle-stick.

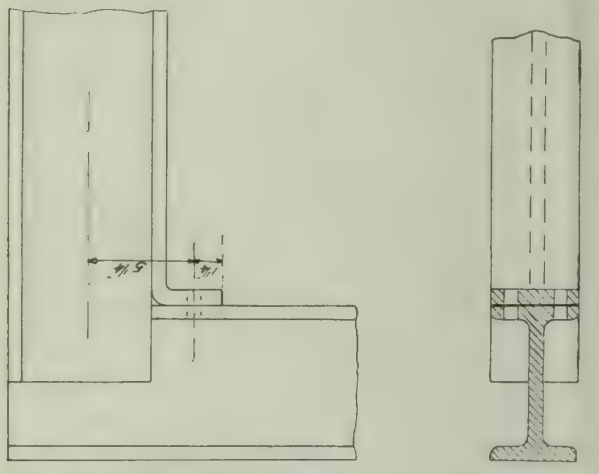


Fig. 1. Detail of Abbontiakoon framing.

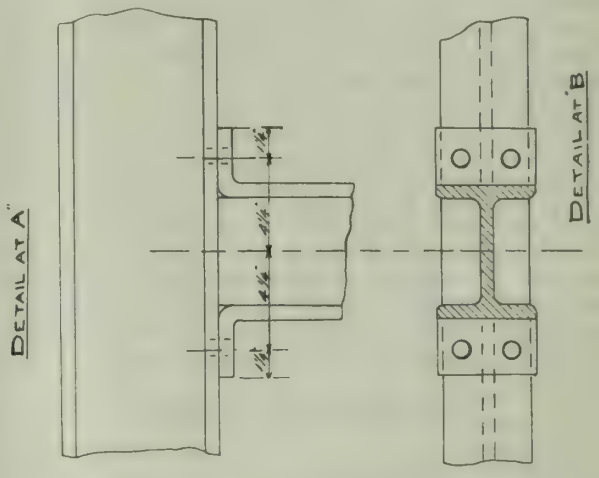


Fig. 2. Detail of Abbontiakoon framing.

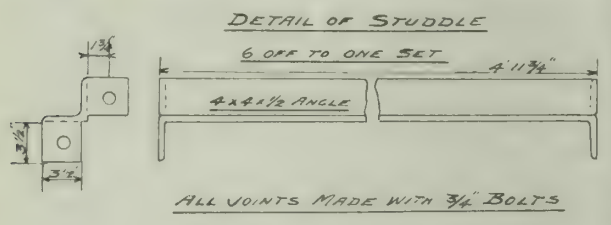


Fig. 3. Detail of struddle.

Fig. 1 to 8 illustrate types of shaft-sets used, figures 1 to 7 show that of the Abbontiakoon mines, and Fig. 8 of the Fanti mines. These are both subsidiary companies of the Fanti Consolidated group. These figures show the shapes and dimensions of girders used and the method of framing and of joining the members of the sets. All joints are made with bolts, so that they can easily be put together underground. These sets on the whole are satisfactory. Their life is practically indefinite, and they withstand all ordinary strains thrown on them very well. In inclined shafts, however, the pressure from the hanging wall is resisted by forces acting in two planes; one at right angles to the shaft, carrying the weight through the dividers and end plates to the sill and foot-wall of the shaft, and the other along the line of the shaft, through the studdles or distance pieces to the bearers. The latter becomes especially prominent when the hanging is very heavy and loose, and to resist this component of the weight I consider the cap to be of too high and narrow a section. A girder of the same weight, but with an approximately square section, would resist this force better and would offer very little resistance to downward pressure. The tendency of this force acting along the line of the shaft, is to bend the caps between the studdles along this line, and to cause a slight 'creep' of the lagging on the caps which causes them to bend on the web. In the Abbontiakoon main shaft, where, in replacing timber sets with steel, a section of ground was gone through that had a very heavy hanging wall, requiring false sets and driving of the lagging, in several instances caps were bent in the web through arcs of at least 30°. This could, to a certain extent at least, be improved by using caps of a squarer section and shorter and thicker web.

All sets are put in with a batter up the shaft of approximately 6 in., that is, the cap is some 6 in. farther up the shaft than the sill, measured from a line at right angles to the incline of the shaft. All sets, where there is any weight on them, tent to 'ride' down the shaft, this tendency being resisted by the bearers. Putting in the sets looking up the shaft, partly counteracts this 'ride,' as the caps swing through an arc whose radius is the height of the sets, and whose centre is the bottom of the sill, which is in a fixed position. Sets thus placed, therefore, in order to ride, must first force up the weight of the hanging wall supported by them. Sets put in at right angles to the incline are only kept from riding by the bearers, and in practice these are usually not entirely effective, and when a set has passed the right angle and is looking down the shaft, even to a very slight degree, its value as a support to the hanging is greatly lessened.

Blocking is done in the manner customary with timber sets, namely; at the four corners, both top, sides, and bottom, and above and below each divider. The native timber *kako*, is largely used for this purpose. Sills are often placed on small concrete pillars, the sills being imbedded to about half their depth in the concrete. This is done more especially near the surface, where the ground is apt not to be as hard and firm as it is at greater depths. In one instance, sets are carried for some distance on three continuous concrete piers, running up and down the shaft.

Rails are bolted to the sills, through holes drilled in the

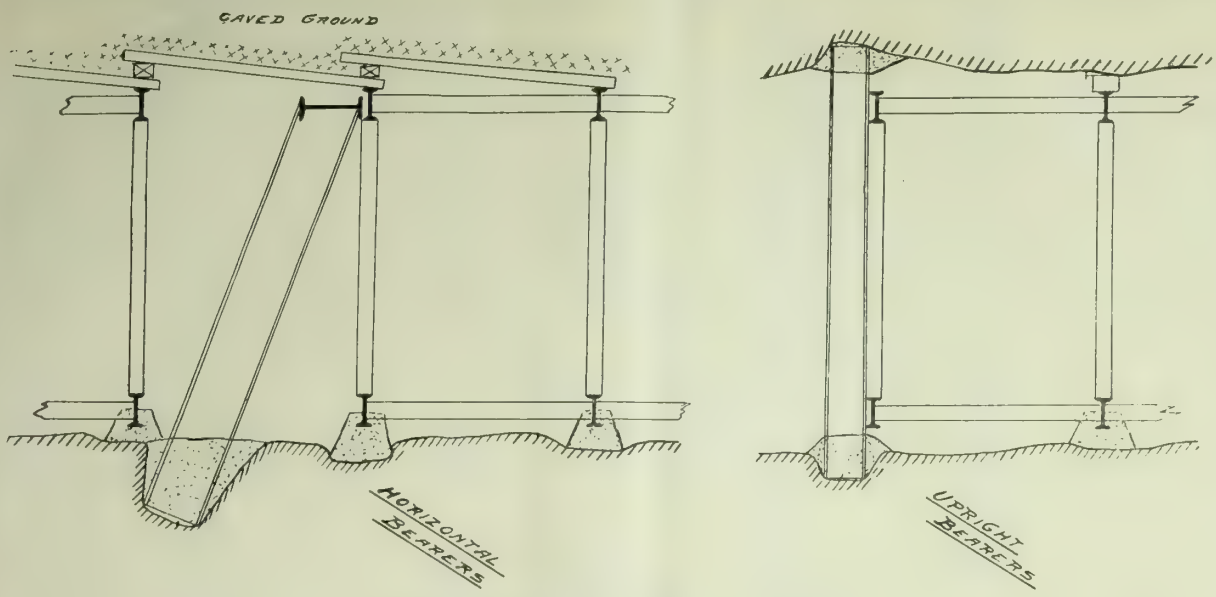


FIG. 4. GENERAL ARRANGEMENT OF FRAMING.

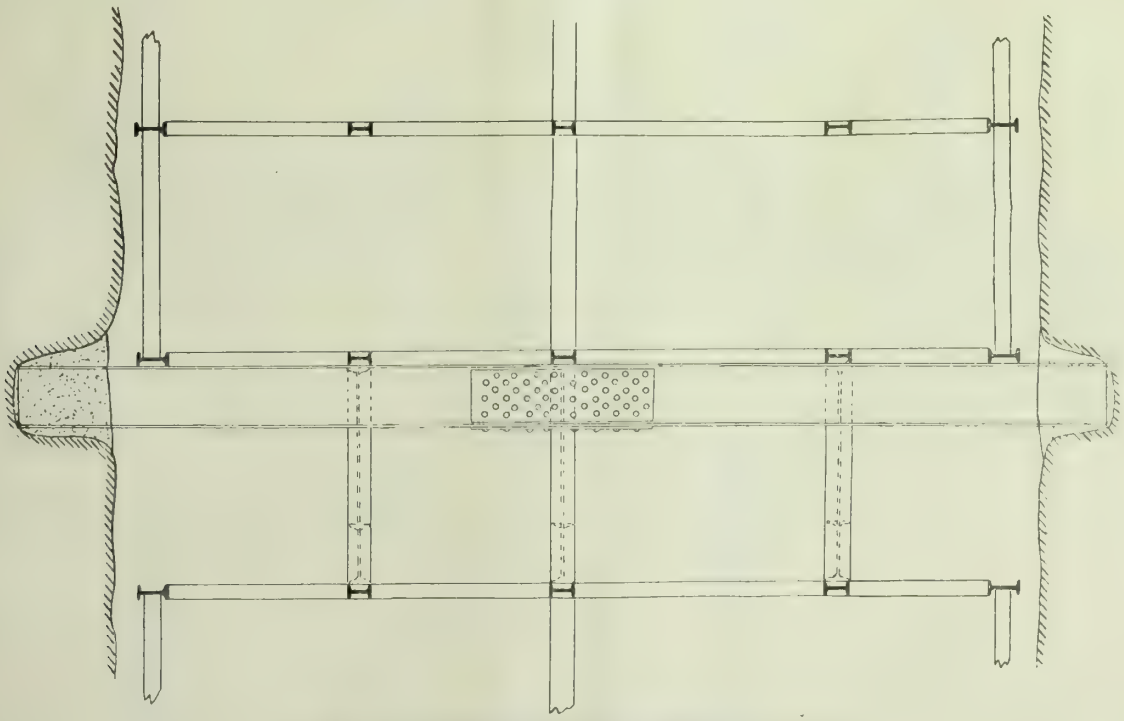


FIG. 5. HORIZONTAL BEARER AT ABBONTIAKOON MINE.

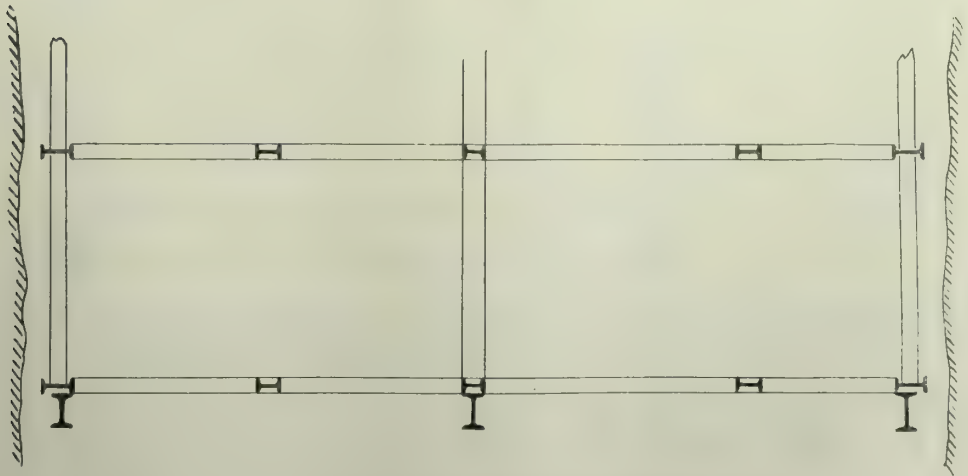


FIG. 6. UPRIGHT BEARERS, ABBONTIAKOON MINE.

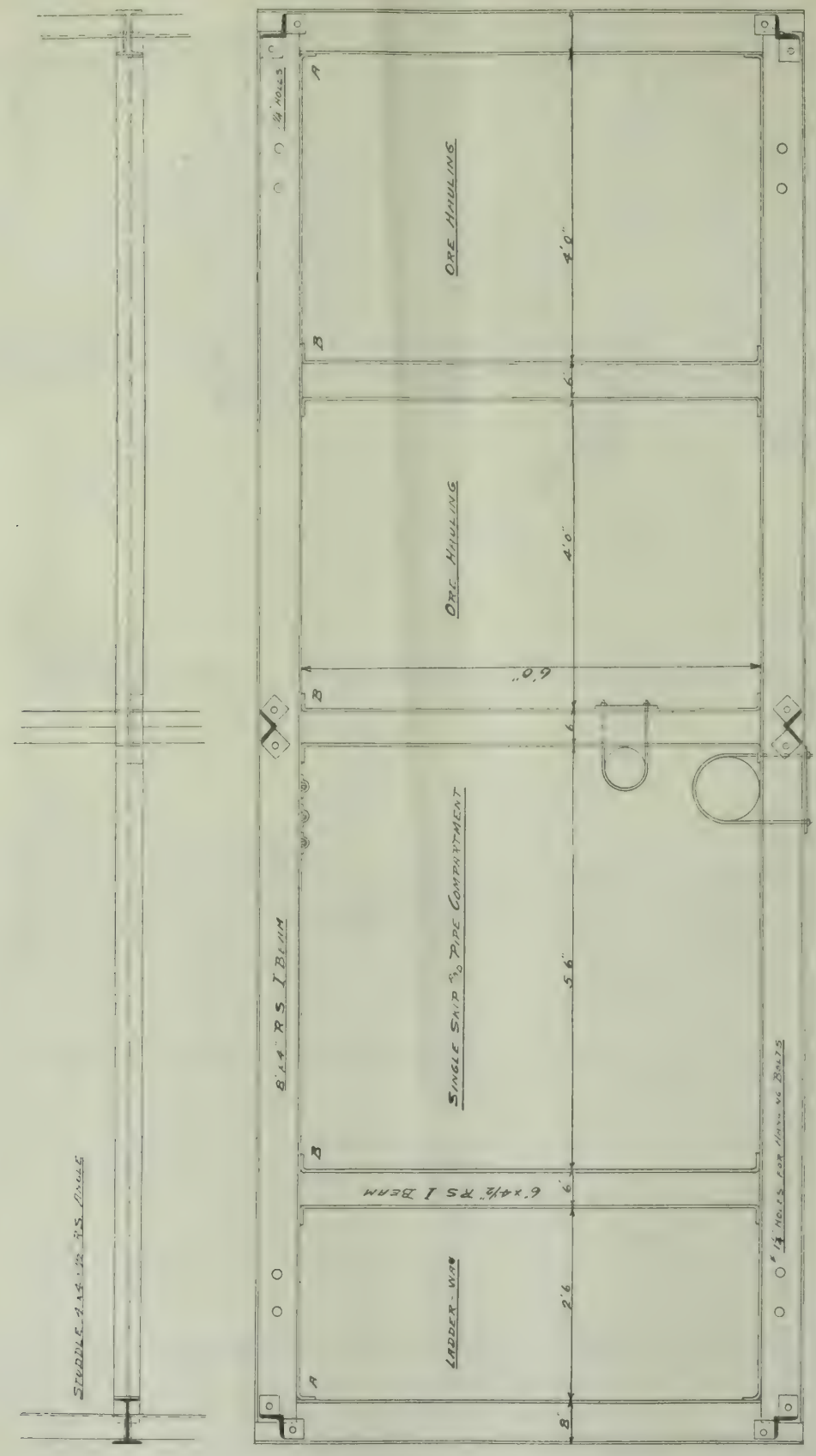


FIG. 7. GENERAL PLAN OF ABBONTIAKOON FRAMING.

flanges of each. The sills are drilled to template in the shops and the rails are drilled in position in the shaft with hand ratchets or pneumatic drills. This gives excellent results, insuring rigidity, and entirely prevents any slipping of the rails which so often happens in inclined shafts. Bell and power cables are also bolted by means of clips to the sets.

Bearers are put in at varying intervals, depending on the ground, of 50 to 100 ft., though 60 to 80 ft. is the most common distance. In the heavy ground in the Abbontiakoon shaft, previously referred to, they have been put in as close as 30 ft. apart, but this was an exceptional case. The class of bearer used also depends on the nature of the rock. In ground with a firm or fairly firm hanging wall the ordinary 'upright' bearer, so called in distinction to the horizontal or longitudinal bearer, is used. This is the type commonly used in all shafts, well hitched into both foot and hanging, with the lead into the upper side of the hanging

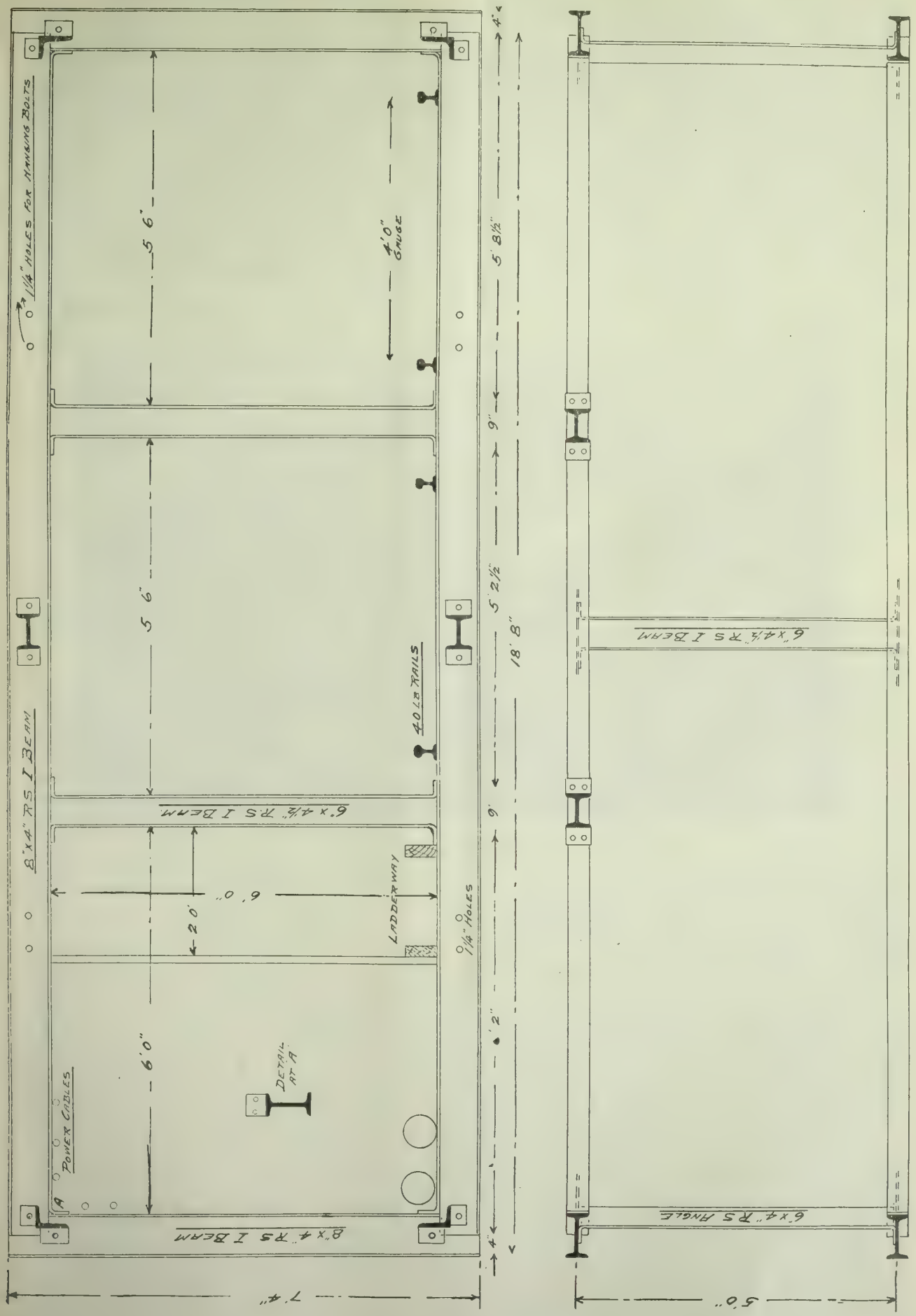


FIG. 8. STEEL-FRAMING AT THE FANTI MINE.

wall hitch, and with the bearer firmly concreted into its place. Usually three bearers are put in to each set, one below each end-plate and one below the centre divider, and they are usually I-beams of about 6 by 10-in. section.

Where the hanging wall is not sufficiently firm to afford a secure hold for upright bearers, horizontal bearers must be used. These, as used in the Abbontiakoon shaft are 6 by 16-in. steel I-beams (see Fig. 5), spliced in the centre. Splicing is necessary, as, from the nature of the ground, the sets must be kept close to the face, allowing no room for leading the bearers into hitches. A lap-joint is used, with plates on each flange and on both sides of the web of the girder, all being drilled to template in the shops and put together in the shaft with bolts. Hitches are cut deep with bearers of this class, as the ground is apt to be weak, and they are firmly concreted into position. In addition, braces of 6 by 16-in. I-beams are put in as shown in Fig. 5, these being cut at the top to the shape of the bearer and firmly hitched and concreted into the foot-wall. In spite of the strong girders used, both as bearers and braces, in one shaft with heavy hanging wall, it is not uncommon to see the bearers bent several inches down the shaft by the riding due to the vertical component of the weight, previously referred to. Horizontal bearers are not allowed to take any down weight, as they are set the wrong way and are not supported to withstand it. All bearers are so placed as to give the sets the batter up the shaft previously mentioned. Corrugated steel sheets have been used with good results as top lagging, where driving is not required. They are held in position by S-shaped clips hooked over the caps. They are not very satisfactory for side lagging.

Testing Roasted Ore

The aim in roasting is to obtain a product having a minimum quantity of oxygen-absorbing salts, such as soluble sulphites and sulphides occurring as calcium sulphite and ferrous sulphide (FeS), respectively. This reducing effect is estimated by titrating a caustic soda extract of the ore with N/100 iodine solution, and as a rough quantitative test for purposes of daily comparison it is found to be extremely valuable. The method of testing, using the following standard solutions, (*a*) water solution of NaOH containing 60 gm. to the Winchester gallon, and (*b*) N/100 iodine, is as follows: Twenty grams of each of the roasts to be tested are weighed into a like number of 8-oz. conical beakers. A sufficient quantity of the NaOH solution is brought to boiling in a separate vessel, and 100 c.c. of this boiling solution is measured off into each beaker. The assays are placed on a hot sand-bath, brought again to a boil, and kept boiling for a minute. They are then removed, allowed to settle, and 50 c.c. of clear solution pipetted off. Phenolphthalein and starch solution are added as indicators; the assays are acidified with dilute H_2SO_4 and titrated to a faint blue with N/100 iodine.

In the case of estimating reducing agents other than sulphides, a few cubic centimetres of ammoniacal zinc chloride solution are added to the NaOH solution before beginning the test. This solution is then boiled, 100 c.c. measured off, and the test performed exactly as before. Any ZnS precipitated by the $ZnCl_2$ in ammoniacal solution is carried down by the ore, and the clear solution pipetted off contains no sulphides. Experience with Kalgoorlie ore has shown that, when the test does not much exceed 4 to 5 c.c. of N/100 iodine, the result is generally a good extraction of the gold, with a normal consumption of cyanide. Calcium sulphide is the chief reducing agent, but when the test is more than 4.5 c.c., it is usually indicative of the presense of ferrous sulphide also. This may be detected by adding an emulsion of $PbCO_3$ to a NaOH extract of the ore, when a brownish precipitate of PbS will be formed. The occasional presence of ferrous sulphide does not affect extraction materially; but, when excessive in quantity and persistent, the strength of the cyanide drops greatly, and the residue rises in value to an appreciable extent.

Mining on the Gold Coast

An interesting report on the mining industry of the Gold Coast for the year 1911 has been issued by the Government, from which it appears that the value of gold produced was nearly £1,079,024, being an increase of £298,626 as compared with the value of the gold produced during 1910, and is the largest production since the year 1908. In the Gold Coast Colonoy the increase amounted to £171,048, and in Ashanti the increase was £127,578. The increase in the Gold Coast Colony was due to the Prestea Block A and the Broomassie Mines restarting to produce gold, and the increase in Ashanti is totally due to the enlarged production by the Ashanti Goldfields Corporation. The total number of ounces of fine gold obtained was 253,977, of which 238,571 oz. was by mining and 15,406 oz. by dredging operations in the Ankobra, Fura, and Offin rivers.

From the conglomerate mines 91,802 tons of 2000 lb. was crushed and treated, producing 44,233 oz. of fine gold, being an extraction of 9.64 dwt. per ton crushed; while from the quartz mines 359,990 tons was treated, producing 194,289 oz., giving an extraction of 10.79 dwt. per ton treated. By sluicing, 49 oz. was obtained. The various dredging companies treated 2,545,173 cu. yd. of alluvium, with a production of 15,405 oz. of fine gold, being an extraction of 2.90 gr. per cubic yard treated. The only other mineral prospected for besides gold was mineral oil, near Bonyere, in the Western Province, where the Société Française de Pétrole (a British company) was engaged in boring. The average daily amount of labor employed by the mining and dredging companies throughout the year was 19,153, as compared with 19,138 employed in 1910. There was no apparent shortage of labor in the mining districts; but toward the end of the year several mining companies started to introduce labor from other colonies to meet the anticipated requirements for the year 1912.

YEARLY OUTPUT OF GOLD FROM 1892 TO 1911.

Year.	Oz. fine gold.	Estimated value.	Year.	Oz. fine gold.	Estimated value.
1892..	23,259.401	£98,806	1902..	22,806.050	£96,880
1893..	18,620.290	79,099	1903..	59,978.810	254,790
1894..	18,078.150	76,796	1904..	89,096.186	378,480
1895..	21,538.840	91,497	1905..	153,912.600	653,820
1896..	20,288.600	86,186	1906..	210,049.435	892,291
1897..	19,961.630	84,797	1907..	273,898.178	1,163,516
1898..	15,027.777	63,838	1908..	281,257.206	1,194,743
1899..	12,076.270	51,300	1909..	230,494.317	979,073
1900..	8,947.050	38,007	1910..	188,691.379	780,398
1901..	5,222.920	22,187	1911..	253,977.204	1,079,023

Uses of Feldspar

The principal use of feldspar is in the manufacture of pottery, enamelware, enamel brick, and electrical ware. Of these the most important is its use in the body and glaze of pottery and vitrified sanitary ware, in which it constitutes 10 to 35%. Its value in pottery lies in the fact that it melts at a lower point than the other ingredients and serves as a flux, binding the clay and quartz particles together. In glazes the percentage of feldspar used is higher than in the body and runs 30 to 50%. Other uses of feldspar, which do not require the high grade demanded by the pottery trade, are in the manufacture of emery and corundum wheels, where it serves as a flux; in the manufacture of opalescent glass; as a poultry grit; as a constituent of roofing material; and as ballast. Smal lquantities of the purest grades of potash feldspar are used in the manufacture of artificial teeth. For this purpose it brings the highest prices—$6 to $8 per barrel of 350 pounds. It is also used in the manufacture of scouring soaps and window wash. The use of feldspar of the lower grades for poultry grit, roofing, etc., seems to be on the increase, and in 1911 a small quantity was used as railroad ballast, according to Jefferson Middleton, of the U. S. Geological Survey.

New Work at Aspen

By An Occasional Correspondent

The prospect for a revival of mining at Aspen, Pitkin county, Colorado, rests mainly with the success of two enterprises now under way, namely, the Smuggler Leasing Co. and the Hope Mining, Milling & Leasing Co. Both are large in their conception, apparently sound in their premises, and hold out promise of great reward for those directly interested. In addition to this, it is not beyond reason to expect that their success will stimulate legitimate mining to such an extent that Aspen will again take a place as one of the principal mining centres of Colorado. It may be that the revival will not be characterized by the discovery of such rich silver deposits as marked the early days of the famous Mollie Gibson, Smuggler, Aspen, and Durant mines, but it seems certain that, if successful at all, it will result in the development of a large area of patented ground along the mineral belt which either has been idle for many years or has never been touched. It seldom happens that the second era of success in a mining district is characterized by either the rich ore or the spectacular features of the boom days; but, on the other hand, whatever it may lack in this respect, it usually supplies in the form of sound judgment, careful operation, and scientific investigation. Such has been the history of Leadville, Cripple Creek, Butte, and many other districts, and such is the prospect for Aspen.

The key-note of the two enterprises mentioned is co-operation. Both of them have been initiated and fostered by local interests; the first by capitalists who formerly made their fortunes in the silver mines of Aspen, and the second by miners, merchants, and professional men whose existence there depends on the success of the mining industry. It speaks well for the possibilities of the district when these men back their spirit of confidence by pouring cash into what had long since been regarded by ousiders as a forlorn hope. Nor is their confidence without reason; it is based on authoritative knowledge. Every man in the district is a disciple of J. E. Spurr, and is conversant with the geological work done by him and published in Monograph No. 31, U. S. Geological Survey. In pleasing contrast to the attitude sometimes taken by miners toward the work of a scientist, these men of Aspen place their reliance in Mr. Spurr's work, follow its precepts, and base their hope of success upon it.

The mineral belt in the Aspen district is comparatively narrow and well defined. Its general trend is northwest and southeast. Its richest ore came from the mines on two hills, Smuggler and Aspen mountains. Before the work done on the earliest locations could be logically extended to the north and south, there was a decline in mining owing to the slump in silver following the panic of 1893, and comparatively little work has been done since that time. The continued depression has not been due to a belief that the mines were exhausted, for it was known that many favorable locations had not been worked at all, and others but slightly. Some mines were producing when they were closed, and known bodies of ore still exist in them below the water which was allowed to flood the workings. Owing to the comparatively large sums of money required to reopen the old mines and develop the new ones, combined with the low price of silver, it has been difficult to interest outsiders in mining in Aspen. Hence, by way of showing their confidence in their own mines, and partly to protect their own interests, the citizens of Aspen have undertaken two large enterprises, one on the northern and the other on the southern end of the mineral belt.

ASPEN AND WEST ASPEN MOUNTAIN.

The Smuggler Leasing Co. is the larger of the two as regards area of ground controlled and amount of money expended. The work of this company was begun several years ago when D. M. Hyman and others who had profited by former operations in Aspen, took a lease on practically all the important old mines of the district, covering Smuggler and Aspen mountains, and including Smuggler, Mollie Gibson, Della S., Bushwhacker, A. J., Durant, Compromise, and others.

The first important piece of work undertaken was the unwatering of the Free Silver shaft, which had been filled to the ninth level for fourteen years. This was accomplished, after overcoming many difficulties, and development was then commenced north of the old workings of the Smuggler and Mollie Gibson. This is the only mining work that is under the immediate direction of the leasing company; all other mining operations in this territory being conducted by sub-lessees, mainly on Aspen mountain.

The problem confronting the Smuggler Leasing Co. was the economical mining of low-grade lead-silver ore. The

new orebodies were at considerable distance from the Mollie Gibson shaft, about 3400 ft.; water had to be handled in large volume, approximating 2000 gal. per 24 hours, and lifted 1125 ft. These two items of transportation and pumping constituted the principal expense and offered the most serious obstacle to successful mining of the low-grade ore. After unwatering the Free Silver shaft, and thereby draining the workings of the Mollie Gibson and Smuggler mines, the next step was to provide adequate pumping facilities. Until evidence is adduced to the contrary, Aspen's claim to the largest and finest underground electric pumping station and machinery must be allowed. Harry Rogers, at that time foreman and now assistant superintendent for the Smuggler Leasing Co., made special effort to provide a station that would be a credit to the mine and worthy to house the fine pumping equipment that had been decided upon.

The pumping machinery which handles all the water from the mines on Smuggler mountain is placed on the twelfth level of the Free Silver shaft. The station is 91 ft. long, 21 ft. high, and 20 ft. wide. The sump is 6 ft. deep and 4 ft. wide, and extends longitudinally through the centre of the station floor. It is lined with cement. The station will accommodate five Aldrich vertical quintuplex pumps, but at present only four are in place. When the station was first cut there was room for but three of these pumps, but later it was decided to increase the capacity of the plant, and the station was extended without interfering for a minute with the operation of three pumps then in use. To accomplish this, Mr. Rogers first constructed a bulkhead of 12 by 12-in. timbers lagged on each side with 3-in. planks, between the pumps and the end of the station. This permitted drilling and blasting operations to be continued without interfering with pumping.

The Aldrich pumps are electrically driven, each pump being geared directly to two 125-hp. motors. Each pump delivers 10 gal. of water per revolution, and has a capacity of 700 gal. per minute when running at full speed. Thus the full capacity of the pumps is 2800 gal. per minute, but they are required to handle only from 1800 to 2000 gal. In the early part of July when surface water was excessive, the daily duty reached approximately 3,000,000 gal. per 24 hours, but at the last of the month it had dropped to about 2,775,000 gal. Water is lifted 1125 ft. and discharged through the old Smuggler adit. The pressure gauge at the pumps shows a weight of about 500 lb. per square inch on the pistons. It would be possible to stop these pumps for about an hour without seriously affecting mining operations, but in the event of a longer shut-down it would be necessary to use the old Jeanesville steam pumps which are held in reserve.

The pumping plant in the A. J. adit on Aspen mountain consists of a single Aldrich horizontal quintuplex pump, geared to one 90-hp. motor. This pump raises about 550 gal. per minute against a head of 620 ft., and relieves the main pumping plant of just this amount of water which otherwise would drain from Aspen to Smuggler mountain.

Owing to the low grade of the ore it was necessary to mine and treat a large tonnage, and with the old transportation equipment it was impossible to get the requisite tonnage out of the mines. Electric haulage was adopted on the thirteenth level, where all ore is collected and hauled to the Mollie Gibson shaft, where it is hoisted. Mining in the Smuggler mountain area is now being carried on in the Della S. and Bushwhacker claims, and development is being continued to the north. The Della S. is yielding low-grade mill ore containing about 10% lead and 1 to 2 oz. silver per ton, or what is locally known as '11 point' or '12 point' ore. This is concentrated by jigs and tables to about '25 point' ore containing, say, 20% lead and 5 oz. silver per ton. Fourteen 'points' is regarded as the dividing line between concentrating and smelting ore, the profit on this grade being about the same with or without concentration. The ore from the Bushwhacker is higher grade and is shipped directly to the smelter. It contains an average of 15% lead and 2 to 3 oz. silver per ton.

Hydro-electric power for the mines of Aspen is generated by the Roaring Fork Electric Light & Power Co., which has a station on Castle Creek just below the town of Aspen. Water is brought through pipe-lines from Castle, Marroon, and Hunter creeks. The principal load carried is the Smuggler pumps and hoists. This power is believed to be the cheapest hydro-electric power sold in Colorado, due to the fact that the mines require cheap power in order to operate at all, and the power company is dependent on the mines for a market.

The second important mining enterprise referred to is the Hope Mining, Milling & Leasing Co. It is a home company and reflects a spirit of coöperation and confidence that commends itself to any mining company that is temporarily depressed. The company was organized to secure a lease and bond on the most favorable properties in the district. It was capitalized for $50,000, divided into shares of $1 each. Provision was made for subscriptions as small as $12, payable $1 each month, and no work was to be undertaken until the sum of $12,500 had been subscribed, payable within a year. No salaries are paid to any officers and no expense is incurred for any other than necessary and legitimate mining operations. In some instances labor and supplies have been given, wholly or in part, for stock. Monthly reports of receipts and expenditures are published in the local newspapers, and everyone is advised regarding the progress of the work. Ten-year leases with bonds have been secured on the Little Annie group of eight claims, the Little Annie adit and concentrating mill, the Famous adit, Slide group of five claims, the Atlanta, One-Half, and Calaveras group of five claims. All of this territory lies on the southern end of the mineral belt. The Little Annie had some reputation years ago as a good producer of silver-lead ore, but was allowed to lapse into unproductiveness after 1893. It was worked by shaft and adit, but no work of importance was done below the adit-level.

The important and promising feature of the Hope company lies in the extension of the Famous adit, which will be driven under the Little Annie to a depth of 1500 ft. below the old level. Several important faults will be cut in its course, and the prospects of finding ore is good. The other groups mentioned can be developed through the Famous adit, and it is likely that the drainage of the Little Annie adit will be accomplished as the lower level is advanced. This will make it possible to mine immediately in the Little Annie orebodies. About 150 Aspen merchants, miners, and professional men have interested themselves in this venture in amounts ranging from $12 to $500. The developments of the next year will reveal what can be done, and it is expected that the results will warrant continued operation. At present the company has a steam-driven compressor, but the position of the adit is such that water-power can be easily developed on Castle Creek. Mining operations are under the direction of Henry J. Turley, and the business of the company is in the hands of a board of directors consisting of Charles O'Kane, J. W. Hetherly, Harold W. Clark, John B. Stitzer, Alphonse Peterson, and H. J. Turley.

In addition to these resources in metallic minerals, Aspen has non-metallic mineral deposits of potential value. Farther up Roaring Fork above the town are the granite quarries of the Roaring Fork Granite Co. Five hundred acres of granite are ready for development, and ample water power is at hand for all purposes. On Marroon creek, west of Aspen, are deposits of marble said to be of good quality, and offering opportunity for development.

QUARTZ PRODUCTION in 1911, according to the U. S. Geological Survey, was 86,823 short tons, valued at $151,122, an increase in quantity of 23,246 tons and in value of $42,635 over 1910. The increase in quantity was entirely in the crude quartz, the ground material decreasing in both quantity and value. The production of the quartz in 1911 was the largest during the past five years except that of 1909, when the output was 121,459 short tons, valued at $131,334.

The Miners' Side of the East Tintic Decision

By F. J. H. Merrill

Few decisions of the Department of the Interior interpreting the mining laws have excited as much interest and aroused as strong a protest as that in the matter of the East Tintic Consolidated location. The Salt Lake Stock & Mining Exchange and the Salt Lake Commercial Club have passed resolutions of protest, of similar import, the first of which has been communicated to the Secretary of the Interior, and the latter has replied at some length, stating in detail the position of the Department. The questions raised are of very general interest, and the communications, which have come into my hands through the Los Angeles Chamber of Mines & Oil, are here given, with some comments from the miner's point of view.

Resolution Adopted by the Salt Lake Stock Mining Exchange, May 8, 1912

Whereas, recent decisions of the Department of the Interior and the Land Office have tended to place new construction upon the mining statutes, making it in some cases difficult and in other cases impossible to secure patents to claims covering valuable mining property located in demonstrated mineral districts; and,

Whereas, in many cases where it is desired to locate only a small fraction of ground, and in other cases where the depth of the mineral deposits is so great that the cost of making actual discovery on each and every claim is prohibitive and tends to a waste of money in useless work that, after patent, serves no purpose in developing the claim; and,

Whereas, the Department of the Interior, by these decisions revolutionary in their effect, has announced that it is no longer sufficient for the locator of a lode-mining claim before securing patent to discover mineral-bearing rock in place, but that such locator must prove that ore of commercial value exists within the limits of each and every claim before the Department will pass such claims to patent; and,

Whereas, the mining industry of the West is being retarded and hampered in some cases by the deficiencies in existing laws, and in other cases by the new and strained construction of the law; now, therefore, be it

Resolved, by the Salt Lake Stock & Mining Exchange, that it would be greatly to the advantage and benefit of the mining industry of the Western states if legislation along the following lines were enacted: That, to correct the recent ruling of the Department of the Interior, requiring that the existence of mineral value be discoverd on each and every claim as a prerequisite to patent, Congress should enact legislation so as to make it plain that in all cases where mining claims are situated in a recognized mineral district and the land embraced therein has no value for its timber, power sites, water sources, or for agricultural purposes, but is valuable only for its mineral resources, it shall be sufficient in the case of lode claims to discover mineral-bearing rock in place or to geologically demonstrate the same without actual discovery of the presence of mineral, and in the case of placer claims, in like circumstances, to either discover mineral or to geologically demonstrate without actual discovery the existence of mineral within the limits of the claim, and that any discovery or indications of mineral upon which a reasonably prudent man would be justified in expending his time and money in the development of such claims in the hope of ultimate success, should be sufficient to satisfy the Land Department.

And be it further

Resolved, that a copy of this resolution, together with such endorsements as may be secured, be forwarded to the Utah Congressional delegation, with the request that they use their influence and put forth their efforts to secure such legislation.

This resolution, which is similar to the one passed by the Commercial Club of Salt Lake City, was communicated to the Department of the Interior by Joseph Howell, Representative at large for Utah, and the following letter was received by him in reply:

Hon. Joseph Howell,
House of Representatives.

Dear Sir—Referring to a copy of resolution adopted by the Salt Lake Stock & Mining Exchange relative to proposed amendments of the statutes regulating the disposition of the mineral lands of the United States, personally presented by you; the third resolution reads as follows:

Whereas, the Department of the Interior by these decisions, revolutionary in their effect, has announced that it is no longer sufficient for the locator of a lode-mining claim before securing patent to discover mineral-bearing rock in place, but that such locator must prove that ore of commercial value exists within the limits of each and every claim before the Department will pass such claims to patent;

This, it is believed, misconstrues the recent decision of the Department in the case of the East Tintic Consolidated Mining Claim (40 L. D., 271), decided September 11, 1911.

Section 2318, Revised Statutes, reserves from sale, except as otherwise expressly directed by law, all "lands valuable for mineral." Section 2319, Revised Statutes, declares that "all valuable mineral deposits" are free and open to exploration and purchase. Section 2320 provides:

Mining claims upon veins or lodes of quartz or other rock in place bearing gold, silver, cinnabar, lead, tin, copper, or other valuable deposits, heretofore located, shall be governed as to length along the vein or lode by the customs, regulations, and laws in force at the date of their location. A mining claim located after the tenth day of May, eighteen hundred and seventy-two, whether located by one or more persons, may equal, but shall not exceed, one thousand five hundred feet in length along the vein or lode; but no location of a mining claim shall be made until the discovery of the vein or lode within the limits of the claim located.

Under the above provisions it is clear that there must be a discovery of a vein or lode containing a valuable mineral deposit.

In East Tintic Consolidated Mining Claim, the Department held, at page 273:

By the term 'vein or lode', as used in the foregoing, the Department is not to be understood as having in mind merely a typical fissure or contact vein, but, rather, any fairly well defined zone or belt of mineral-bearing rock in place.

It is evident from the record before the Department that the deposits alleged to have been exposed on these claims are regarded by the applicant as possessing practically no economic value, but that on the other hand title to the claims is sought essentially on account of their possible value for certain unexposed deposits supposed to exist at considerable depth beneath the surface, and having no connection, so far as shown, with any deposits appearing on the surface. The exposure, however, of substantially worthless deposits on the surface of a claim; the finding of mere surface indications of mineral within its limits; the discovery of valuable mineral deposits outside the claim; or deductions from established geological facts relating to it; one or all of which matters may reasonably give rise to a hope or belief, however strong it may be, that a valuable mineral deposit exists within the claim, will neither suffice as a discovery thereon, nor be entitled to be accepted as the equivalent thereof. To constitute a valid discovery upon a claim for which patent is sought there must be actually and physically exposed within the limits thereof a vein or lode of mineral-bearing rock in place, possessing in and of itself a present or prospective value for mining purposes; and before patent can be properly issued or entry allowed thereof, that fact must be shown in the manner above stated.

This is not a holding that there must be a discovery of ore of commercial value. The conditions present were, as found by the Department, that upon the surface there were slight indications of mineral such as would not warrant a reasonably prudent man in spending his time and money in an effort to extract mineral, but the geological conditions were such as to induce the belief that at a greater depth there was a valuable deposit of mineral. Such a belief, it was held, could not be accepted as a discovery. The decision was not revolutionary, but was an evolution from the prior decisions and regulations of the Department. It is proper to say that a motion for rehearing in this case has been filed, and that there are other cases also pending involving like questions.

In the case of the Silver Jennie Lode (7 L. D., 6) it appeared that there was a vein or lode upon adjoining ground which the applicant for patent believed to extend

into the Silver Jennie claim, but it had not been actually disclosed and could not be disclosed without a great deal of additional development, entailing a large expenditure. The Department, however, was of the opinion that this was insufficient as evidence of discovery, and held:

Evidence as to the discovery of the alleged vein or lode should be furnished showing the place where, and when the discovery was made, the general direction of the lode or vein, and all the material facts in relation thereto; and such evidence should be clear and positive, and based on actual knowledge and the witnesses' means of information be clearly set forth.

The case of Castle *v.* Womble (19 L. D., 455) laid down a rule which has since been followed by the Department, and has been quoted with approval by the courts. Its syllabus reads:

A mineral discovery, sufficient to warrant the location of a mining claim, and the evidence shows that a person of ordinary prudence would be justified in the further expenditure of his labor and means, with a reasonable prospect of success in developing a valuable mine.

The Department has consistently held that a mere belief is not equivalent to a discovery; also the fact that land is returned as mineral does not obviate the necessity of a discovery. (Reims *v.* Murray, 22 L. D., 409.)

In Henderson *et al. v.* Fulton (35 L. D., 652) the Department considered a definition of the word vein or lode. At page 656 it quoted Justice Field's language in Eureka Consolidated Mining Co. *v.* Richmond Mining Co. (4 Sawyer, 302):

The miners made the definition first. As used by the miners, before being defined by any authority, the term lode simply meant that formation by which the miner could be led or guided; it is an alteration of the word lead; and whatever the miner could follow, expecting to find ore, was his lode.

The difficulty in the East Tintic case was, as found by the Department, that the formation disclosed was not such as to lead the miner to find, or expect to find, any deposit of ore therein, but that the only real indication of a valuable mineral deposit being found in the land was his belief founded upon the geologic conditions and mining development of the district.

Paragraph 41 of the mining regulations adopted March 29, 1909:

The vein or lode must be fully described, the description to include as to the kind and character of mineral, the content thereof, whether ore has been extracted and of what amount and value, and such other facts as will support the applicant's allegation that the claim contains a valuable mineral deposit.

Prior to the adoption and enforcement of this regulation, the evidence of the existence of a vein or lode was, in the greatest percentage of cases, the *ex parte* showing of the applicant for a patent, which frequently was perfunctory in character. The acceptance of such showings by the Land Office undoubtedly led to the issuance of patents for mining claims upon which no discovery of a vein or lode had in fact been made. It is rather the enforcement of the existing law requiring the discovery of a vein or lode, than any change in the Department's regulations thereof which has caused the difficulties which give rise to the adoption of the resolutions by the mining exchange.

The Department is of the opinion that legislation, supplemental to the present mining statutes, is advisable. There are areas of public lands in which mineral deposits are believed to be contained, but which, if there, lie at great depth, and upon which discoveries cannot be made without large expenditures, while under the existing law a valid location cannot be made until a discovery has been accomplished and the prospector is therefore not fully protected. The Department believes that legislation should be enacted authorizing it to grant a permit giving an individual, or individuals, the exclusive right to prospect a certain tract of public land for the mineral it is thought to contain, for a limited period of time. Such legislation should contain provisions requiring a certain amount of annual development work as an earnest of good faith, restricting the area and the number of claims that could be held under such a permit, and requiring within a limited period of time the purchase or lease from the United States of the mineral deposits, retaining the fee of the land in the United States, which could then dispose of the surface as conditions might warrant. This legislation would also well supplement Senate Bill No. 6194, now pending before the Senate, which in brief, as to future locations, abolishes extralateral rights, requires notices of location to be also filed for record with the Register and Receiver of the proper Land Office, and also requires final entry and payment to be made in seven years from the date of the location.

Very respectfully,

(Signed) SAMUEL C. ADAMS,
First Assistant Secretary.

In general consideration of this subject it may be said that, as a rule, the prospector and miner do not so much object to strict interpretation and enforcement of existing laws as to radical and abrupt changes in their interpretation. Those having a right to locate mining claims have also the right to ask that changes in the laws and rules governing locations and patents shall not be made without due notice, for in law-making bodies, regard is usually paid to business necessities, and due notice is given of contemplated changes in legislation. While there is a technical distinction between the Federal statutes on mineral lands and the decisions of the Department of the Interior interpreting these statutes, these decisions are virtually law for those transacting business under them.

The position taken in the foregoing letter appears chiefly to be that public welfare requires a more literal interpretation of existing statutes than has hitherto been customary. On general principles this might be desirable, but, in this particular instance, it is difficult to see how a stricter enforcement of the law will benefit the nation.

The view expressed would be more appropriate if locations on outcrops of metallic ore, necessarily involved the transfer of valuable mineral land from the Government to some individual or group of individuals. What proportion of mineral locations pass to patent is not known, but my observation leads to the opinion that not more than one prospect in one thousand proves of value when developed. Surely this matter should be considered in framing the mining laws and in their enforcement. If land does not clearly show mineral of value, and is not valuable for agricultural or other purposes, how does it benefit the nation to withhold it from location, or even from patent? Is it a public duty to prevent the miner from paying his money to the nation for land which is valueless? Seemingly the nation would be more benefited by accepting cash for land which otherwise would not be sold.

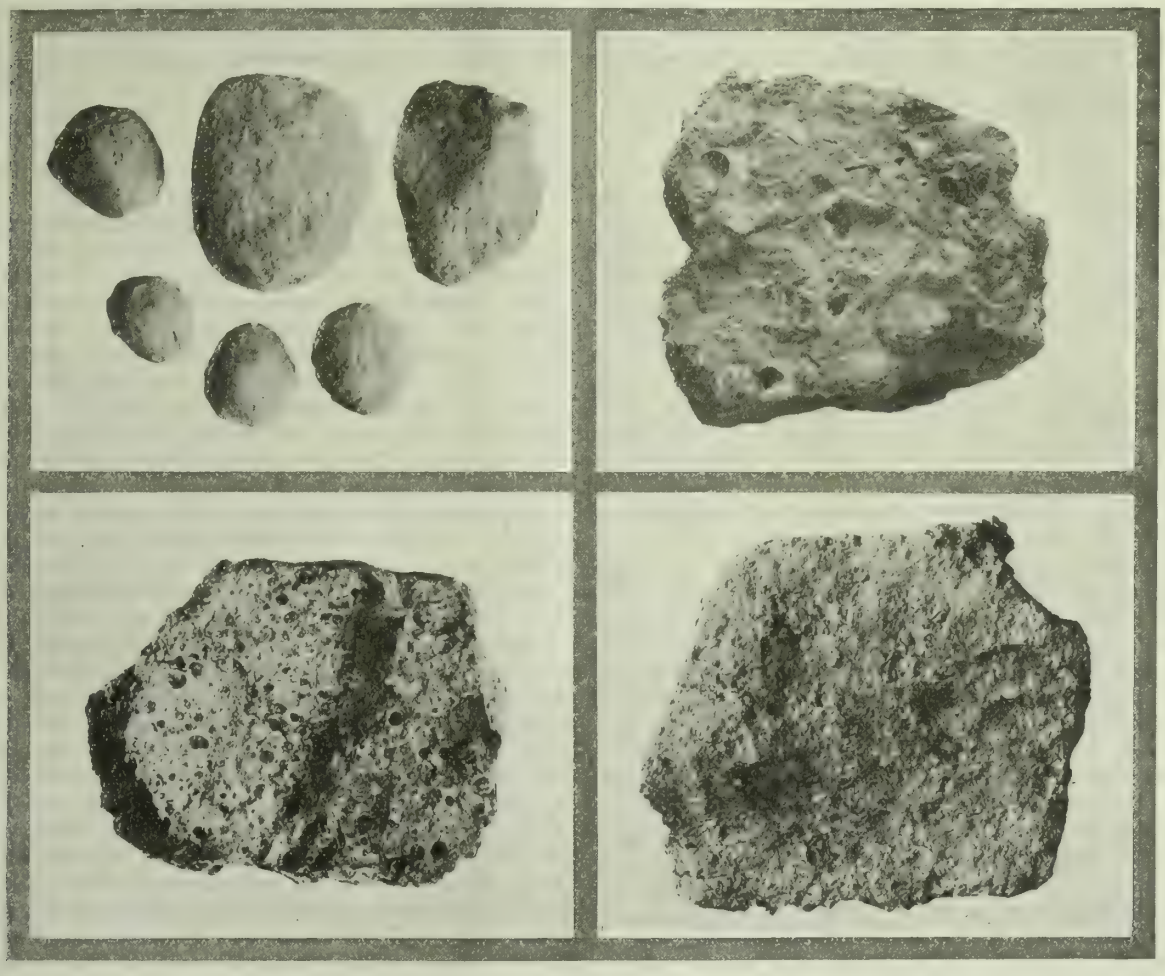
In the revision of the mining laws, now contemplated, there have been in view two principal points which have molded opinion regarding needed changes: (*A*) revision in the light of more complete knowledge of facts and conditions in mining; (*B*) protecting or conservation of the public domain in the interest of the people.

A fact often overlooked in discussing this subject is that the mining industry was founded on mineral deposits exposed at the earth's surface. The processes of ore deposition, however, are separate and distinct from those of erosion, and the fact that an ore deposit exists beneath a given area does not necessarily involve the progress of erosion to the point of exposing any part of that deposit or in any way revealing its existence. As time passes and the mining industry advances, the discovery of ore deposits becomes a more complex and costly matter than it formerly was. For, in the better known areas, most of the valuable orebodies which were well exposed and easy to find, were found some time ago. It is obvious that, in the near future, we shall come more and more frequently to seek for orebodies of which there is no suggestion at the surface. Therefore, any adequate system of mining laws must provide for and protect such exploration work as may be necessary to determine the presence or absence of mineral deposits without surface outcrop.

Prospecting for Bauxite-Aluminum Ore

By W. C. Phalen

**Introduction.*—Though experiments have been made and are still in progress on the extraction of metallic aluminum from clay or silicates containing it in considerable amount, it still remains a fact that the mineral bauxite is the only commercial source of metallic aluminum. When it is considered that the price of the metal has varied between 24c. per lb. as a maximum and 18½c. as a minimum during the two years 1910 and 1911, prospecting for the raw material—the source of the metal—becomes a matter of some importance, particularly when the additional facts are considered: (1) that the metal is with us to stay; (2) that it is finding a constantly enlarging field of usefulness, and (3) that more than 23,000 short tons was consumed in the United States during 1911.



PEBBLES FROM 'PEBBLE ORE.' TYPICAL OOLITE ORE.

PISOLITIC ORE VERGING TO PEBBLE ORE. TYPICAL OOLITE ORE.

Properties.—Bauxite is a mineral which can readily be recognized in the field, even by the inexperienced. Its most striking and common characteristic is its oölitic or pisolitic structure. The oölitic and pisolitic grains are small approximately round bodies varying from the size of a pea up to an inch in diameter. In some places the ore has the appearance of gravel, the oölites separating readily from the matrix, which resembles clay. In some occurrences the matrix and oölites are firmly cemented, forming compact ore. Rather rarely the mineral resembles ordinary grayish or yellow clay so closely that its nature may be entirely unsuspected, especially when such an occurrence is somewhat isolated. In such a case, recourse must be had to quantitative analysis in order to determine the true nature of the substance. In color, bauxite varies from white or gray through the shades of yellow and brown to red. It is not a heavy mineral, its specific gravity being 2.5. In composition it is a hydrated aluminum oxide with the symbol $Al_2O_3.2H_2O$, containing alumina (Al_2O_3) 73.9% and water (H_2O) 26.1%. The pure mineral is of rare occurrence, the commercial grades carrying varying amounts of impurities, among which the chief are silica, ferric oxide, lime, magnesia, and titanium oxide. Ore containing as low as 45% alumina is of value, particularly if situated favorably as to markets or places where it may be worked up cheaply.

Tests.—A few simple characteristics by which the mineral may be determined in the field are: (1) It is infusible or difficultly fusible; (2) it is insoluble in or but slightly acted upon by hydrochloric acid; (3) it is soft and can be readily scratched with a knife; (4) when treated with cobalt nitrate it assumes a blue color before the blow-pipe; and (5) when heated in a closed tube, water is given off. Other minerals like kaolinite and others of the kaolinite group, together with gibbsite, give the simple reactions indicated above. The peculiar concretionary structure of bauxite then serves as a distinguishing characteristic and when absent, as already mentioned, a quantitative analysis should be made.

Occurrences.—The known occurrences of bauxite are

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really the only guide in searching for new sources of the mineral. As, however, it is known to occur under widely different conditions, and as it may be expected to occur under still other and at present unsuspected conditions, the prospector must be on the alert and not rely too implicitly on the assumption that the mineral will be found only under conditions already known. As a concrete example of this statement may be mentioned the last important find of bauxite, namely, that in central Georgia, where the mineral occurs in an entirely different manner from what it does in the northwestern part of the same state, and where in turn the geological occurrence of the mineral is quite different from that in Arkansas. In the same type of country, geologically speaking, it is reasonable to assume a uniformity of conditions of occurrence.

Foreign Sources.—The best known foreign occurrences of bauxite are in the departments of Hérault, Bouches-du-Rhone, and Var, in southeastern France near the Italian border. The first valuable beds of ore were discovered in the vicinity of Les Baux in the department of Bouches-du-Rhone, northwest of Marseilles—which accounts for the name of the mineral bauxite—pronounced in French as if it were 'bo'zit', but more commonly known here as 'box'ite.' The bauxite of Baux occurs in highly tilted beds associated with limestones, sandstones, clays, or in pockets and cavities in limestone. Other deposits in the south of France either rest upon or are associated with limestone. Such deposits are thought to have resulted from hot spring or geyser action. Other French deposits, for example those of Puy de Dome, rest on gneiss and are partly covered by basalt and have no connection whatever with limestone. Certain of the German and Irish occurrences have been shown to have been derived from basalt.

In the United States bauxite occurs in commercial quantity and is worked in Arkansas, Georgia, Alabama, and Tennessee. An important deposit is known in Botetourt county, Virginia.

Arkansas Deposits.—In Arkansas the beds of bauxite are situated in Saline and Pulaski counties. The great bulk of the mineral produced in this State in 1911 was mined near the town of Bauxite, on the Chicago, Rock Island & Pacific railway, about five miles east of Benton, the county seat of Saline county, and 22 miles southwest of Little Rock, the state capital. In Arkansas the bauxite beds rest directly on kaolinized syenite and occur in undulating layers corresponding to the surface of the syenite. The ore covers many of the hills completely, occurring on their sides as well as their tops. It tapers out rather abruptly approaching the ravines and is absent in many of them. In thickness it varies from a knife edge to a possible maximum of 30 ft. The Arkansas ore occurs in at least three forms—the granitic, pistolitic, and the compact or clay-like form. Where the bed has been so opened as to show the underlying syenite, its lower part next to the syenite consists of the granitic ore—that is, the ore is pseudomorphous after syenite. The second and the third forms occurring in this state have already been mentioned.

Various theories have been propounded as to the origin of the Arkansas bauxite. All seem to agree that it is genetically related to the syenite. Though important deposits of bauxite in connection with igneous rocks are not known in other parts of the United States, occurrences of rock composition similar to the Arkansas syenite are not rare.[1]

Georgia-Alabama Deposits.—The deposits of bauxite in northwest Georgia and northeast Alabama are comprised in one bauxite field in which the geologic and structural relations of the ore deposits apparently are the same. The district as a whole extends along the Coosa valley from the vicinity of Summersville or Adairsville, Georgia, to Jacksonville, Alabama. It lies chiefly in Bartow and Floyd counties, Georgia, and Cherokee county, Alabama. Not the whole of the district, or even a large part of it, has been prospected, and it is more than likely that new deposits of bauxite may be discovered from time to time.

Most of the bauxite mines in this field and near Chattanooga, Tennessee, consist simply of rounded or ellipsoidal deposits a few hundred feet in diameter at the surface and tapering roughly to a point as they descend. None of them are more than a few hundred feet deep at the most. The deposits in the Georgia and Alabama field occur in the residual clay derived from the weathering of dolomite or limestone. The calcareous rocks overlie a great mass of shale, and numerous faults intersect the rocks. According to C. W. Hayes,[2] who has studied the deposits, it is believed that surface waters reached the shale and, oxidizing their pyrite content, set free sulphuric acid. This, reacting with the alumina of the shales, formed sulphate of aluminum. Ascending currents carried the sulphates in solution upward toward the surface, where in contact with the limestone during their upward passage, they were decomposed and aluminum hydrate formed. Whatever the origin of the deposits may be, the almost constant association of limonite or iron ore and kaolin is worthy of mention and may furnish an important clue in finding future deposits.

Tennessee Deposits.—The deposits in Tennessee are situated on the southeastern slope of Missionary ridge near Chattanooga. They are of the same nature as those farther south in the Georgia-Alabama field just described, and indeed they may be considered as a northern continuation of the deposits of the older and better known field. The ore is found in the Knox dolomite near a fault line along which the Knox has been overthrust from the southeast upon the Chickamauga and Clinton formations lying to the northwest. These geological and structural conditions are essentially identical with those farther south in Georgia and Alabama. The extension of such deposits to an area far north of that already known, emphasizes the value of a close study of the structure in the Cambrian and the Ordovician rocks in the southern Appalachian region in all future attempts to extend the bauxite-bearing areas.

Central Georgia.—Bauxite occurs in Wilkinson county, central Georgia. The deposits are in no way connected with those in the northwestern part of the state, either geographically or geologically. They are 150 miles away near the northern margin of the coastal plain, the nearest city being Macon, 30 miles to the west. The bauxite apparently occurs near the contact between the Lower Cretaceous and the Claiborne group (Eocene), which are chiefly made up of unconsolidated sands and clays lying flat and having no pronounced structural features. The bauxite occurs in the form of beds either resting directly upon the Cretaceous clays or disseminated as nodules through them. Beds 10 ft. in thickness have been observed. The ore is generally either pisolitic or concretionary, but is all amorphous. In color it varies from almost white or cream to a bright red. It is generally hard, but clay-like varieties have been discovered. The tentative opinion has been offered that the bauxite is an alteration product of a bed of white clay or kaolin and has resulted from it by desilication.

The points at which the bauxite is most likely to occur may be approximately determined by finding the white clay beds, locally known as the 'chalk' beds; as the bauxite has been found contiguous to the clay near its contact with the overlying red sands and impure clays. The geologic conditions prevailing in Wilkinson county are also found in Twiggs, Washington, Glascock, McDuffy, and Richmond counties, and bauxite may be found in any or all of these.

Uses of Bauxite.—The chief uses of bauxite are: (1) as raw material in the production of metallic aluminum; (2) in the manufacture of aluminum salts; (3) in the manufacture of bauxite bricks, and (4) in the manufacture

[1]U. S. Geol. Survey, Prof. Paper No. 14, 1903, pp. 198-199.

[2]Twenty-first Ann. Rept. U. S. Geol. Survey, Pt. 3, 1901, p. 461.

of alundum (fused alumina) for use as an abrasive. The use of bauxite in the manufacture of calcium aluminate to give a quick set to plaster composition should be added, as well as the extended use which alundum is finding in the refractory industries.

The use of bauxite in the production of metallic aluminum is by far the most important of those enumerated above. A large part of the entire output of Arkansas is used in the metallic aluminum industry, and the figures of production from that state have shown phenomenal growth during recent years. A large part of the French product is also used in the manufacture of metallic aluminum. Only the purer bauxite is used in the manufacture of chemicals, such as alum, aluminum sulphate, and aluminum salts in general. Freedom from oxide of iron is essential in the material to be used in chemical manufactures. Bauxite is used on a large scale in the manufacture of the artificial abrasive alundum at Niagara Falls. This abrasive is made in an electric furnace by fusing calcined bauxite. It is high in crystalline oxide, and virtually amounts to a form of artificial corundum. Its quality is under complete control and hence it can be duplicated with ease in the various abrasive products, a factor of great importance in the success of the abrasive industry.

Other Possible Sources of Alumina.—In a report I prepared a few years ago the statement was made, which still holds good, that the expiration of the aluminum process patents, and the great increase in output of metallic aluminum, have given rise to many scientific researches and commercial inquiries regarding new methods of producing metallic aluminum. These inquiries are appropriate in view of the fact that bauxite is found in comparatively few places, must be transported long distances, and contains so much silica as to require costly chemical operations to purify it for the manufacture of metallic aluminum. Aluminum silicates, on the other hand, are found almost everywhere, and the separation of the silica from them may at some future time not cost more than to counterbalance the scarcity, inaccessibility, and impurities of the bauxite deposits.

Attention has recently been called to the mineral alunite, having the formula $K_2O.3Al_2O_3.4SO_3.6H_2O$, as a source of alumina, and hence of metallic aluminum. Experiments performed in the laboratory of the United States Geological Survey have showed that on igniting powdered alunite all of the water and three-fourths of the sulphuric acid are volatilized. On leaching the residue with water the potassium sulphate is dissolved, leaving the insoluble aluminum oxide behind. The average amount of potassium sulphate leached from the ignited mineral powder is 17.9% of the original material used. As the coarsely crystallized alunite was found to contain 19.4% of potassium sulphate, 92% of the total potash present was obtained by simple ignition and subsequent leaching. According to the laboratory experiments which were carried out by W. T. Schaller, 32.7% of the ignited alunite consists of available potassium sulphate which can be extracted by simple water leaching and evaporation. The remaining 67.3% consists of nearly pure aluminum oxide. The alunite used in the experiments just alluded to, came from near Marysvale, Utah, where is situated what seems to be the largest known deposit in the United States. Beside the Utah deposit, the mineral alunite is known to occur in the Rosita hills, in the Rico mountains, at Silverton and Cripple Creek, Colorado. Other important occurrences in the Western states are at Goldfield, Nevada, Tres Cerritos, California, in the Clifton-Morenci district, Arizona, and in Beaver county, Utah.

Another Universe

Spiral nebulae are discussed entertainingly by Edward Arthur Fath in the September *Century*. One result of his work has been the discovery of 14 absorption lines in the spectrum of the Andromeda nebula which corresponded, line for line, with absorption lines in the solar spectrum. A photograph of the spectrum of the sun taken with the same instrument looks precisely like that of this particular nebula. This implies that the Andromeda nebula has the physical characteristics of the sun. The nebula is four times the apparent diameter of the sun. Its distance is not known, but a conservative estimate would place it among the nearer stars. If this assumption be correct, it places the nebula at least ten million times as far away as the sun is from the earth. Consequently its real dimensions are at least forty million times those of the sun. Since the diameter of the latter is 866,000 miles this gives nearly 35,000,000,000,000 miles as the diameter of the nebula. This great body gives a solar spectrum, and the simplest assumption seems to be that it is a vast assemblage of suns so far from us that no telescope has been able to show the suns separately. If this be true, it is not among the stars, for these can be seen separately in the telescopes, but beyond the stars. This would make it another universe.

Goldfield Consolidated Report

By J. F. Thorn

During the month of July 1912 the total production of the Goldfield Consolidated company was 31,907 tons, containing $474,955.84, or an average of $14.89 per ton, of which 29,000 tons was milled with an average extraction of 91.05%, and 2907 tons was shipped of an average value of $16.42 per ton, the net recovery from all ore being $13.69 per ton. The total net realization was $238,278.70 or $7.47 per ton. Development during the month amounted to 2923 ft. The total cost of mining, development, transportation, milling, office, and general expense was $6.41 per ton, distributed as follows:

Mining (including stoping and developing)	$3.18
Transportation	0.08
Milling	1.97
Marketing	0.05
General expenses	0.40
Bullion tax	0.05
Marketing ore shipped	0.66
Construction	0.07
Total cost of operation	$6.46
Miscellaneous earnings	0.05
Net cost per ton	$6.41

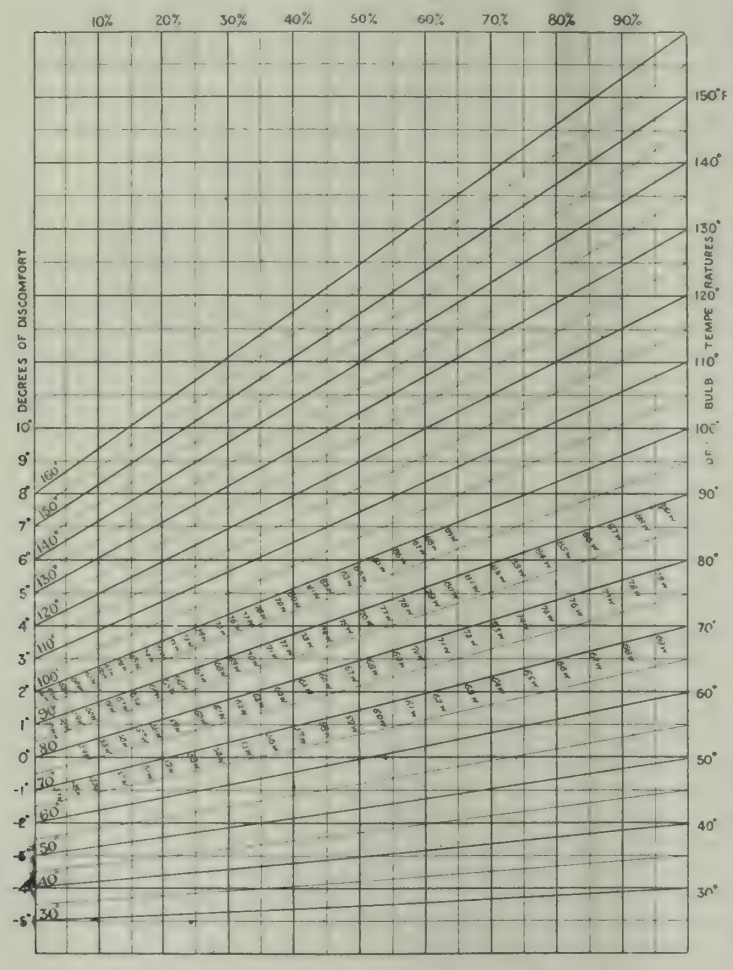
In the Combination mine the 402-G stope, 300 ft. north of the shaft between the fifth and sixth levels, produced 399 tons of $30 ore, this being the deepest point in the mine at which ore has been found. A new stope on the second level, 80 ft. east of the 136 stope, produced 275 tons of average $17 ore.

In the Mohawk the 3-J sill, north of the 3-E stope in the old Sheets-Ish workings, produced 279 tons of average $28 ore. The 170-J stope on the 250-ft. level or the downward extension of the old Sheets-Ish stope produced 69 tons of $58 ore. The 202 stope, which is being carried through the old Frances-Mohawk workings, produced 68 tons of $40 ore. A new raise at the south end of the 348 stope, between the 450 and 350-ft. levels, has entered a body of ore assaying $40 per ton. An important development was made on the intermediate level between the 450 and 600-ft. levels, about 700 ft. north of the shaft. The 426-X cut penetrated a body of ore, and the 490-I sill, which is being cut in the ore, produced 755 tons of $40.80 ore.

In the Clermont the 571 drift on the downward extension of the 510 orebody, between the 750 and 900-ft. levels, produced 55 tons of $40 ore. In the Grizzly Bear 250 tons of ore averaging $30 per ton was shipped from development on the 1300-ft. level. Work on this level has advanced slowly on account of being carried on in conjunction with sinking the shaft. The 1400-ft. level of the shaft will be reached during the coming month, and lateral work from both levels can be carried on more rapidly.

Miners' Phthisis in Western Australia

Four important commissions have made reports in Western Australia, on questions connected with the health of miners. These are: (1) 'Ventilation and Sanitation of Mines,' by A. Montgomery, in 1905; (2) 'Pulmonary Diseases Among Miners,' by J. H. L. Cumpston, in 1910; (3) 'Composition of Gases Caused by Blasting in Mines,' by E. A. Mann, in 1911; and (4) the recently issued 'Report of the Royal Commission on Miners' Lung Diseases.' The investigations by Dr. Cumpston were primarily to see if phthisis, or fibrosis, as he better calls such lung troubles, was present among miners. As he proved it to be, the business of the last commission was to inquire further, and make suggestions for legislation on the subject. Mr. Mann's excellent work was to prove the quality of explosives used, and their general effect on mine air.



LAMB'S CURVES OF DISCOMFORT REVISED.

Abstracts of the proceedings, and summings up of the last commission, have been commented upon already in the *Mining and Scientific Press*, yet a few points in the last report may still be of interest. In the commission's report there are 269 sections or summaries on the various questions at issue. At the different mining centres visited in Western Australia, 7195 questions were asked and answers given by managers, miners, doctors, insurance people, and others. There are in addition appendices to the report on meteorology and on state of air in many mines; the latter under the heads of locality, carbon dioxide present, dry bulb temperatures, percentage of saturation, and degrees of discomfort, as read from Lamb's chart in his paper, 'Curves of Comfort,' published in the *Mining and Scientific Press*, August 27, 1910. The commission considered this chart especially valuable, and reproduced it on a large scale, with additions, the result of investigation. We reproduce the amended chart herewith. The report also gives details of underground work in many mines, their temperature, amount of air used, analysis of ores, carbon dioxide in mines after blasting, and notes from dry-crushing plants. Numerous letters and tables are also given, besides 'Notes and Measures Taken for the Prevention of Dust in Johannesburg,' by R. N. Kotze, the acting mining engineer for the Transvaal Government.

Appendix 34 of the report is of value, as it is on the 'Nature and Constitution of the Dust in the Kalgoorlie Mines,' by C. O. G. Larcombe, of the local School of Mines. This was a rather difficult investigation, and needed great care and study. Mr. Larcombe personally collected dust from various Kalgoorlie mines, on both sides of slides by means of a coating of Canada balsam. Miners also wore respirators for certain times under varying conditions, and the dust from them was collected, centrifuged, dried, weighed, and microscopically examined, with the following results:

1. It was found that the physical character of the dust has an important bearing on the subject. The Kalgoorlie dust contains under 50% of free quartz. Any dust made up largely of quartz, which breaks with a shell-like fracture, and, when in a fine state of division, tends to become splintery, must be dangerous. The dust from the mines of the Golden Mile is made up of a number of minerals, whose hardness range from 2 to 7, and in specific gravity from 2.65 to 5.1.

2. An analysis of collected dust shows it to contain silica, carbonates of lime and magnesia, sericite, pyrite, and apatite. The constituents, besides quartz and pyrite, are relatively soft. Excepting the carbonates and apatite, the remainder are insoluble in hydrochloric acid.

3. Three sizes of dust were collected and examined. The impalpable dust, consisting of rounded and granular particles from 1/2500 in. long and wide, and same thickness, to particles 1/8000 and 1/10,000 of an inch. The medium-grained dust ranged from 1/500 to 1/2500 in. long by 1/1500 in. thick. The coarse dust is as big as 1/33 in. wide 1/16 in. long, and 1/100 in. thick. When boring dry holes underground, in a drift 7 by 5 ft., 3,000,000 particles of dust per square inch collected near the face, but when boring wet, only 194,500 particles were found at the same place.

Some interesting diagrams and microphotos are reproduced, showing the relative amounts of dust collected under these conditions. Mr. Larcombe concludes by saying that the dust in the mine atmosphere at Kalgoorlie compares most favorably with the dust from any other centres, and is less dangerous than that at Bendigo or on the Rand. The whole report is a valuable addition to the existing literature on the subject.

TWO ADDITIONAL RULES have been lately added to the Mines Regulation Act of Western Australia: (1) When so directed by an inspector, the manager shall have gates securely fixed upon cages, during such time as they are employed at the change of shifts for lowering and raising men; and (2), where, in the opinion of the inspector, the dust from tailing dumps, or any other heaps of waste rock or mill residue in a mine is a nuisance to persons employed on them, or in their vicinity, and detrimental to their health, he shall give notice in writing to that effect; and the manager shall thereupon provide, and cause to be constantly used, such spraying appliances as will effectively lay the dust.

Electric Smelting of Iron Ore

By E. F. Burchard

*The direct reduction of iron ore by means of an electric current is a problem that has engaged the attention of certain electro-metallurgists for the past ten or twelve years. According to J. B. C. Kershaw, in the *Iron Trade Review* for January 4, 1912, the first experiments were made by Captain Stassano, an Italian, at Rome, in 1899–1901, and later at Darfo, in northern Italy, where cheaper electric power was available. Stassano's furnace was of a revolving arc type with 3-phase current and water-cooled electrodes, and this type of furnace is still employed by Stassano for refining steel by electricity. Stassano's experiments proved that good iron could be produced in this way direct from the ore. The iron ore was first ground, and after mixing with lime and coke, was briquetted before being charged into the furnace—an expensive preliminary treatment. The power required in this process was estimated to be 2866 kilowatt-hours per ton, costing $18.60, and when the cost of materials and labor were added to the already exorbitant power cost the impracticability of the process, from a financial standpoint, was readily apparent. Keller, a French electro-metallurgist, carried on extended experiments in his own electric furnace at Kerrouse and Livet, France, from 1901 to 1905. In the Keller process, the ore, coke, and limestone were coarsely crushed and mixed before charging into the furnace, which had two shafts, connected below by a canal which collected the molten iron. A reduction in power and costs was accomplished by the Keller process, which is estimated to have required 2292 kilowatt-hours of power for a ton of 2000 lb., at a cost of $12.05.

In America, Heroult, another French electro-metallurgist, made a trial of a shaft type of furnace at Saut Ste. Marie, Canada, in 1905-6, under the auspices of the Canadian Government. This early Heroult furnace was of the square-shaft type, and was much simpler than those of Stassano and Keller, and by its use it was estimated that the consumption of power for a large plant would approximate 1490 kilowatt-hours per ton of pig iron, at a cost of only $2.43. The estimated cost of native magnetite iron ore was $1.50 per ton; of charcoal, which was used instead of coke, $6 per ton of iron; and of labor about 76c.; a total cost of $10.69 for labor, ore, and power supply requisite for a ton of pig iron. These costs were not, however, attained by actual practice, and the project of establishing an electric iron smelting industry on the Canadian side of the Great Lakes was temporarily, at least, abandoned. In 1906 to 1910 three Swedish engineers, Gronwall, Lindblad, and Stalhane, carried on extensive experimental work on the problem, building with the assistance of a number of iron manufacturers in Sweden two electric furnaces at Domnarfvet, and a third at Trollhättan. The design of the Gronwall electric furnace is similar to that of a miniature blast-furnace with the tuyeres replaced by electrodes. E. Haanel, director of the mines branch of the Canada Department of Mines, made a series of test trials with the Gronwall furnace at Domnarfvet in 1908, using Grangesberg magnetite. Based on the yield under favorable conditions, it has been estimated that the power consumption might be reduced to less than 2000 kilowatt-hours per ton of pig iron, and that for a furnace producing 8000 to 10,000 tons of pig iron per annum, the cost of charcoal, power, labor, electrodes, and repairs should total about $8.56 per ton of iron, to which must be added for cost of ore, interest on capital, depreciation of plant, machinery, etc., about $5 per ton, making the total cost of a ton of pig iron $13.56. At Trollhättan, where there is abundant water-power, a much larger plant has been erected than at Domnarfvet. This plant was completed late in 1910 and has made a considerable quantity of pig iron said to be of exceptionally good quality, containing only small percentages of sulphur and phosphorus. Since this furnace has been operating the weekly production of pig iron has been increased, the electrode and charcoal consumption has been decreased, and the power consumption has been reduced to an equivalent of only 1735 kilowatt-hours per ton of 2204 lb. of pig iron, at a cost of $13 for the power. It is expected that the year 1912 will witness an extension of the Scandinavian electric smelting industry, four large electric pig iron furnaces of the Gronwall type having been planned for erection at Domnarfvet and Hagfors, Sweden, and at Tyassaa, Norway. Thus it seems that the future of the electric iron smelting industry in Scandinavia is fairly well assured. This is due mainly to the favorable conditions that prevail there. High-grade iron ore, carrying between 60 and 65% of metallic iron, is abundant, and electric power, developed from large waterfalls, is relatively cheap. There are no coal beds, and charcoal must be used for iron making. Charcoal is produced from the abundant timber, but the possibility of replacing two-thirds of the quantity required in iron making by electric power is a very important factor.

In the United States the only locality in which electric iron smelting has been attempted is in northern California. Here the physical conditions resemble in many ways those in Scandinavia, just described. No coking coal beds are near at hand, but timber for making charcoal is plentiful. Electric power is produced in excess of the demand from industries outside of iron smelting, but the water-supply is limited in summer and autumn. The pig iron market in San Francisco is favorable to a small local iron industry, since heretofore supplies have had to be shipped mainly from Illinois and Colorado, or imported from abroad. A Heroult furnace was erected in Shasta county for the Noble Electric Steel Co., and placed in operation in July 1907. This furnace is described by R. L. Phelps in the *Mining and Scientific Press*, July 20, 1907. It was designed to utilize 1500 kilowatts in the form of 3-phase current at 50 volts. The charge consisted of charcoal, limestone, and magnetite. The heat for smelting the ore resulted from the resistance of the slag, and charge to the current as it passed from the electrodes to the neutral point at the bottom of the furnace. At the start the electrodes were in slight contact with the neutral bottom of the furnace, but as the charge became heated the electrodes were drawn out of the molten iron and remained in the slag and charge. It did not fulfill expectations, however, the output never exceeding 11 tons of pig iron per day, and a second furnace, designed by Dorsey Lyon, was erected. This furnace was smaller than the first, being of 160 kilowatt capacity, and was designed to run with 4000 amperes at 35 volts, single-phase current. It differed considerably in design from the first one erected, and was started early in 1908, and made an experimental run for 46 days. The lowest power consumption reported to have been attained was 3066 kilowatt-hours per ton of pig iron. The output of the furnace was 2400 lb. of iron in 24 hours. In order to reduce this power consumption a larger furnace capable of continuous runs was next erected. This third furnace is built on the same general lines as the second, but has a capacity of 1500-kilowatts and employs 3-phase current. The charge is dried in a pre-heater which utilizes stack gases, and the charging is done mechanically. There are six electrodes arranged equidistantly around the furnace, and the current passing through the ore lying between them in the crucible melts the charge. The molten metal and the slag are drawn off as in ordinary blast-furnace practice. Charcoal for this plant is supplied by a wood carbonizing plant which has been erected near the furnace, and such by-products as wood alcohol, acetic acid, tar, and creosote oils are obtained. J. B. C. Kershaw gives a tabular summary of comparative costs of electrically produced pig iron, which follows, with the addition of dates.

With regard to the future of electric smelting of pig iron, there are certain controlling factors that will doubtless limit it to localities like Trollhättan and Heroult where all physical and commercial conditions are favorable to its development. The main point seems to be that the saving in coke

*From Advance Chapter from 'Mineral Resources of the United States, 1911.' U. S. Geological Survey.

COMPARATIVE COSTS OF ELECTRICALLY PRODUCED PIG IRON.

Date.	Type of furnace.	Location.	Power, kw-hr.	Estimated cost (2204 lb.)	Notes.
1903....	Stassano	Darfo, Italy	2,866	$18.60	Power at $9 per electric hp-yr.
1904....	Keller	Livet, France	2,589	13.27	
1906....	Heroult	Sault Ste. Marie, Canada.....	1,642	11.77	Power at $10.71 per electric hp-yr.; ore $1.50 per ton.
1908....	Gronwall	Trollhättan, Sweden	1,957	13.56	Estimate based on early trials.
1910....	"	" "	1,735	13.00	Actual results obtained at Trollhättan, Sept. 3, 1911.
1910....	Heroult	Heroult, California	....	15.00	Power at $12 per electric hp-yr.; ore $1.50 per ton.

effected by the use of electric heating is so small that electric power must be produced or sold at a cost of $8 to $10 per electrical horse-power-year, a figure far below the possibilities of the great majority of hydro-electric power stations at present. The electric process is also further handicapped by the cost of carbon electrodes, an expense which the ordinary blast-furnace does not have to bear. These conclusions, it should be noted, have no bearing on the refining of steel in the electric furnace, a practice which is already established, and is rapidly expanding in Europe and America.

Rubies and Ruby Mining

About a year ago some particulars extracted from a paper by Noel Heaton describing the method of making artificial rubies and sapphires by fusing alumina in the oxyhydrogen blowpipe were printed. It was stated then that the difficulty of differentiating between such a product and the natural stone was great. The Burma Ruby Mines company, the largest producer of the real article, commissioned Mr. Heaton to tabulate the points of difference. This chart is now being circulated by the company. The differences relate to variations of color, included bubbles, striations, inclusion of foreign matter, and 'silk'. As regards color, the natural stone often exhibits variations in different parts, the bands being either parallel or irregular; where as in the artificial stone the color is generally uniform, but when varied the bands are curved in outline. The bubbles contained in the natural stone are irregular in shape, often elongated and frequently angular; in the artificial stone they are generally perfectly round, rarely elongated, and never angular. Striations in the natural stone are perfectly straight or rectangular in outline; in the artificial stone they consist of a series of concentric curves. Inclusions of foreign matter in the natural stone consist of particles of various size arranged in an irregular manner; in the artificial stone they are small particles generally arranged in curves following the lines of striation. As regards 'silk,' this is a characteristic of the real ruby never reproduced in the artificial stone; it is due to a series of minute parallel canals arranged in three definite directions, giving a silky sheen by reflected light. The chart gives a number of beautiful colored illustrations based on microphotographs.

The Burma Ruby Mines Co. is once more on the list of dividend payers. It was floated 23 years ago by the Rothschilds to consolidate the ruby and sapphire mines at Mogok, Burma. The expectations of big profits were never realized, and not only have the dividends been small, but the capital has been reduced. Much larger amounts of money were required in order to bring the cost to a practicable level, and moreover the terms and conditions imposed by the Indian Government have been decidedly oppressive. During recent years the market for this class of stone has diminished, the diamond carrying all before it. The sapphire is not popular, as it is ineffective at night, and to the uninformed the best quality of garnet seems as satisfactory as the ruby. Moreover, the artificial ruby and sapphire have made inroads into the trade in the genuine article, and have penetrated even to the East. During the financial year ended February 29, the amount of gravel washed was maintained, 1,479,854 loads being treated at a cost of 7½d. per load, as compared with 1,466,136 loads the previous year. The sales in London were £10,236, and in Burma £48,551. In addition, £12,069 was received from tributers. The sum of £10,862 was paid to the Indian Government as royalty, and also £2378 as share of the profits. The profit available for shareholders was £5256, and, adding £16,764 brought forward from the previous year, the disposal balance was £22,021. Out of this, £7475 has been paid as dividend, being at the rate of 2½%. The company has recently received a favor from the Government in connection with the item of £19,228 of arrears of royalty and rent. The payment of this sum is postponed until the net profits available for shareholders exceed 10% on the capital in any one year; in this case half the surplus is to be employed toward liquidating the debt. This lenient attitude was assumed by the Government because the company intimated a desire to develop additional ground at Kathie, six miles from Mogok. This work has now been commenced and is estimated to cost £20,000.

Appropriations for the U. S. Geological Survey

LEGISLATIVE, EXECUTIVE, AND JUDICIAL ACT APPROVED AUGUST 23, 1912

Rents	$37,400

SUNDRY CIVIL ACT APPROVED AUGUST 24, 1912

Salaries, office of director	35,340
Salaries, scientific assistants	29,900
Skilled laborers and various temporary employees	20,000
Topographic surveys	350,000
Geologic surveys	300,000
Mineral resources of Alaska	90,000
Chemical and physical researches	40,000
Preparation of illustrations	18,280
Mineral resources of the United States	75,000
Gaging streams, etc.	150,000
Books for the library	2,000
Geological maps of the United States	110,000
Surveying national forests	75,000
Engraving, printing, and binding monographs	145,000
Total appropriation	$1,477,920

Depth of Kalgoorlie Mines

The Chamber of Mines at Kalgoorlie has compiled an interesting table showing the depths of the large gold mines in the state, as the following will show:

	Feet.
Associated	2,286
Chaffers (Main Reef)	2,274
Golden Horse Shoe	2,390
Great Boulder	2,845
Great Boulder (Edwards)	2,879
Great Boulder Perseverance	2,200
Great Fingall (vertical and underlay)	*2,516
Ivanhoe	2,660
Kalgurli	1,900
Lake View Consols	2,017
Sons of Gwalia (underlay)	2,720
South Kalgurli	1,818

*Depth of surface to bottom of winze from level 13.

Discussion

Readers of the MINING AND SCIENTIFIC PRESS are invited to use this department for the discussion of technical and other matters pertaining to mining and metallurgy. The Editor welcomes the expression of views contrary to his own, believing that careful criticism is more valuable than casual compliment. Insertion of any contribution is determined by its probable interest to the readers of this journal.

Persistence of Ore in Depth

The Editor:

Sir—T. A. Rickard's interesting discussion of the subject of 'Persistence of Ore in Depth' presents certain facts now generally accepted by the geologist and the engineer, but not always admitted by the prospector and the promoter. It is with some hesitation that I have accepted the invitation of the editor to discuss the subject from the viewpoint of the economic geologist, because W. Lindgren has covered the subject in an early number of *Economic Geology* as far as the present state of knowledge permits, and the value of going over the subject in an incomplete and informal manner is not apparent. I shall attempt, however, to review a few of what seem to me the most important points bearing on this subject, and suggest the depth limits of a few of the most important groups of ore deposits. The discussion is largely theoretical, and I beg to suggest to those who want facts and not theories, that theory deduced from accurate observation has made it possible for the mining geologist to draw conclusions of decided practical value.

Probably the most fertile cause of inaccurate analysis of ore deposits is the lumping of all deposits together and attempting to apply the conclusions drawn from one type of ore deposit to an example of a second type different in origin and kind. The number of geological processes affecting ore deposition is large, and since any combination of these may modify a given deposit, the number of given results is increased in a geometric proportion.

At the outset, emphasis may be laid on a factor of importance bearing on the depth to which an individual ore deposit may extend. The outcrop of the deposit may be at what was originally the top of the deposit, or the present surface may cut the roots of the deposit. I have noted areas in Arizona and Sonora where the outer ore-bearing zone of a granite mass has been entirely removed by erosion, the original gold content being deposited in flanking detrital deposits. On the other hand, in the vicinity of the Gold Roads mine, Mohave county, Arizona, erosion has but cut the tops of the deposits, and there we may expect the maximum depth for the ore that is reached by deposits of its special type.

Theory again, but theory founded on established laws of physics, and checked up by the examination of rocks that have suffered alteration at some depth below the surface, limits the depth to which rock will sustain open fractures. Doubtless the strongest rock may be fractured to a depth greater than will be attained by mining operations, and, further, solutions under great pressure may open fractures that otherwise would be closed or would not exist, yet it is certain that the weaker, more pliable rocks, such as shale, etc., may form an effective bar to the passage of ore solutions. In the Oro Blanco district, Arizona, the ore-bearing andesitic rocks rest on shale, and the veins do not continue into this underlying formation. More important, however, is the fact that fractures become less numerous even at depths commonly reached in mining. Even in the Mother Lode district, where metallization has probably taken place at considerably greater depths than have as yet been reached by mining, there is no possibility that the orebodies are as numerous in the deeper levels as nearer the surface. At Cripple Creek, where decrease in tenor of ore at depths yet reached is denied by some, decrease in the number of orebodies is maintained by Lindgren and Ransome.

The theory of not so very long ago that ore solutions originate somewhere and somehow at great but unknown depths, and rise along fissures that extend down indefinitely toward the earth's centre, incited the miner's imagination until he believed that the 'true fissure vein' had no bottom at all. However, more definite notions regarding the origin of various types of deposits suggest the grouping of certain of these in a broad way so as to bring out the limits as to depth to which a deposit of any group may be expected to extend under favorable conditions.

A great group of veins, examples of which have been found to attain unusual depth the world over, is the gold-bearing quartz group of lodes in granite or metamorphic rocks, including the Mother Lode type of veins in granite, between granite and slate, and in slate, greenstone, etc., the Alaska Treadwell type of breccia zones cemented by means of quartz veinlets, and the saddle reefs and veins in the Paleozoic slates of Australia, the quartz lodes and domes in the granite in Canada, probably the quartz reefs of the Rand, the Champion and neighboring lodes of India, etc. The theory is now held by many geologists that most, if not all, of these deposits were formed by mineralizing waters driven out by the crystallization of granitic magma. Field evidence suggests that the highly heated vapors given off while the intrusive is still molten do not develop ore deposits of this type, although they may metamorphose intensely the adjacent rocks. However, the 'liquid extract' driven off during the final stages of solidification is often immensely rich in gold content, and in extreme cases may cause a concentration in the rich gold-quartz which compared with the gold content of the parent granitic rock is represented by the ratio of 100,000 to 1. While this crystallization water may be excluded at considerable depths, forming bunches and lenses of ore, it could hardly get together in volume except in the zone of fracture, so that the bottom of the lode could not be formed at more than a few miles below the surface. The mineral constitution of the lodes is remarkably constant, and suggests that the ore shown in the outcrop, as well as that in the deepest levels, was originally formed under great pressure, so that probably erosion cut off from one to three miles before reaching the outcrops. These and other theoretical conclusions would fix the maximum depth of these deepest of veins at probably less than two miles, with the further probability that workable deposits more than a mile deep would be unusual. (Lindgren concludes that the range of these gold-quartz veins reaches 6000 to 7000 feet.)

While the highly heated vapors immediately accompanying the intrusive are not usually rich in gold, they form tin deposits, and contact deposits often carrying copper. First thought might suggest that tin veins formed at high temperatures and great pressures should be formed throughout a wide range of depth, but field evidence shows that when the tin deposits occur in the granite itself, the ore is found only in the upper and outer margin. This tin-bearing zone does not probably extend on the average over 1000 ft. within the granite mass. Where structural features are favorable for a concentrated flow of solutions, such as along contact between the granite and slate, or up into an overlying steeply dipping slate, greater depths may be attained, but not equal to those of the gold-quartz type.

Contact copper deposits without enrichment are not of sufficient value to be considered here, and while contact deposits may occur at any depths where calcareous rocks adjoin acid igneous masses, yet it is doubtful if those formed at higher temperatures are as rich in copper as those formed at lower temperatures and pressures.

The richest gold and gold-silver ores, as well as valuable gold-silver-lead deposits, are found in Tertiary lavas. A list of examples would include the greatest gold and silver mines of Colorado, Nevada, Arizona, Mexico, New Zealand, Transylvania, Hungary, etc. Without reviewing the evidence which topography, structure, mineral composition, and relation to superficial volcanic phenomena suggest, it may be stated that these deposits are far more superficial than the first class mentioned. Many highly productive mines of this class have 'petered out' at less

than a thousand feet, and it is unusual to have orebodies of this type extend to depths of 2000 feet.

The above discussion mentions only a few of the many types of ore deposits, and has had to do only with primary ores. Recent interest in secondary enrichment has overshadowed the fact that much of the rich gold and silver ore mined today has not been secondarily enriched. The importance of secondary enrichment in the concentration of copper, however, is so well known that it is only necessary to mention here that the zone of secondary sulphides varies greatly in different regions. It extends only a few feet below the water-level in some of the deposits of the Eastern United States. It varies between 50 and 200 ft. in the porous porphyry and schist of Arizona, but reaches down 600 to 1000 ft. where structural features assist downward percolation, and reaches a remarkable thickness of 2000 ft. and perhaps more at Butte.

It is hoped that the above brief paragraphs will indicate the change that has taken place with the scientific investigation of ore deposits, and instead of unlimited depth there are fairly definite zones of moderate depth beyond which ore deposition does not take place. The depths suggested are the maximum ones to which only the most important deposits attain. Each ore deposit is a problem in itself, and faulting, change in formation, evidences of a feeble rather than a strong widespread mineralization, etc., will be eagerly sought by the careful appraiser of the future possibilities of the mine.

C. F. Tolman, Jr.

Stanford University, August 30.

A Few Words About Colombia

The Editor:

Sir—The chances for investment are wonderful in South America. I believe that Colombia will develop much quicker than anyone has any idea of at this time. The Panama canal, when finished, will help the great resources and bring to the notice of the world the vast wealth which is still undeveloped along the rivers, hills, and mountains. Colombia has an area of 450,000 sq. mi. and a population of between 4,000,000 and 5,000,000, of which 85% is made up of the working class or peons. Wages range from 60c. to $2.50 per day, according to locality and climate; in the Zaragoza country wages are 50% higher than at Medellin. Naturally the peon expects more wages and does less work in the malaria district.

The Magdalena river, which runs north and south for a distance of about 1000 miles, and is navigable for 600 miles, is almost the only transportation route. One of the greatest drawbacks at this time is the high charge for freight. Another is the unreasonable duties imposed on imports; in fact the only thing that is cheap in Colombia is peon labor. The average American makes many mistakes in dealing with the native of South America. First, he should try and master the language, but still more important, he should study the character of the people. They are as sensitive as children, and should be treated as such. It is hardly reasonable to swear at them in English and at the same time ask them to do for you what they consider a favor. If they do not understand any other English, you may be sure they know all the American swear-words. In dealing with them, thank them, be kind, polite, but firm. Above all be patient, and you will be surprised what you can accomplish in much less time and for much less money than by pushing, swearing, and impatience. Never demand anything from a Colombian official, but ask for what you wish in a polite way, putting it on the basis of being a favor, and ten chances to one you will get what you wish. Do not be hurried in bargaining with the native and never pay him the first price he asks. After you have struck a bargain with him you can feel very sure he will carry out his part. Always keep your word exactly, and you will be surprised to see how anxious you will find the native to help you. Also, remember that your American dollar will not go as far in Colombia or buy as much as it will in the United States; that at the present value the *peso* is only another name for a cent, or 100 pesos equal $1. A five pesos piece looks very much like our five-cent nickel and has the same purchasing value in Colombia.

Among the things in which there is opportunity for investment in Colombia may be mentioned platinum, gold, silver, copper, salt, lime, asphaltum, oil, coal, emeralds, mahogany, cedar, ivory-nuts, bananas, cacao, coffee, sugar, rubber, corn, and cattle. Thousands of acres of land can be secured at low prices, both for agricultural or mining purposes. Quartz mining is still in its infancy, with the exception of three large mines which have been working and paying for years. The banking business is attractive, with loans at from 1½ to 3% per month. Capital is also invested by foreigners in Colombian railroads.

The climate is trying on the average foreigner. At the mouth of the rivers and lowlands, mosquitoes and, consequently, malaria are found. As to the cities, Bogata is too cold and Barranquilla too warm. The most desirable climate is at Medellin in the state of Antioquia. In all three cities the sanitary conditions are poor and danger of typhoid is great. Some of the richest dredging ground is situated in the malaria districts. The title to property should be carefully examined before purchasing, and only trustworthy and conscientious men should be sent to do business in Colombia. Nearly all the failures are due to mismanagement, extravagant engineers, and lying promoters. The state of Antioquia is rich in alluvial areas. Gold-bearing gravel is found adjacent to its many rivers. Those that have studied the mining possibilities of Colombia are impressed with the vast undeveloped wealth of its placers, and conservative capital is taking notice of the dredging ground as a business enterprise.

With the proper management, great care in regard to titles, strict compliance with the laws of the country, and above all—patience—remember it takes one year to do the work in Colombia that could be done in the United States in three months. I believe that any of the business chances in Colombia will prove profitable to the investor in the course of time.

L. M. Ludovici.

Barranquilla, Colombia, June 9.

Peruvian Mining Regulations

Attention is called by the *West Coast Leader* to a circular letter sent out by the Department of Fomento, calling attention to the fact that the new code of civil procedure became effective on July 28, and that it affects the operation of the mining code to a certain extent. All who are concerned in pending litigation over mining property, or are, in fact, in any way connected with the denouncement or holding of mines, should secure a copy of the new law, and read article 1344, which nullifies paragraphs 2 and 3 of article 42 and chapter 16, with the exception of articles 198, 199, and 200, of the mining code, and any other stipulations which may be in disagreement with the new civil code. The paragraphs cited refer to the duties and powers of the mining deputations in lawsuits.

Fluorspar Production

Last year the total quantity of domestic fluospar reported to the United States Geological Survey as marketed in the United States was 87,048 short tons, valued at $611,447, compared with 69,427 short tons, valued at $430,196, in 1910, an increase in quantity of 17,621 short tons and in value of $181,251. The production in 1911 was the largest ever recorded, 69,825 short tons of domestic gravel spar, valued at $420,932, being marketed, against 52,013 short tons, valued at $282,561, in 1910. The highly satisfactory condition of the fluorspar industry in 1911 was due largely to the ability of American producers to meet the demand more nearly than heretofore and to produce a better and more uniform grade of gravel spar than can be obtained by importation.—*U. S. Geological Survey.*

Special Correspondence

NEW YORK

VACATION DAYS ENDING.—COPPER SITUATION.—DOME AND NIPISSING.—BUTTE & SUPERIOR.—BRADEN AND MINERALS SEPARATION.—TOMBOY.

New York is making the most of the last few days of the vacation season. There is no day in all the calendar that is now more universally observed than Labor Day. It has come to stand as the close of the summer holidays. The ocean-side resorts and the hotels of the lake and mountain regions which depend upon New York for patronage go into winter storage right after Labor Day, and the city in turn takes up its normal life of activity. The present week has been very much of a holiday period. Trading has been as nearly at a standstill as it can be. The metal markets are strong, but it is so nearly impossible to interest capital in new enterprises that, in spite of advanced prices, there are almost no new issues of any importance being offered to the public. The flotation of the Alaska Gold Mine Co. is an exception. This issue could not be classed as an appeal to the public for development funds. There has been a little trading in the stock in the outside market at a small premium above the subscription price. While copper is enjoying so much activity, and holders of copper securities are beginning to share in the prosperity in the way of resumption and increase of dividends, there is almost nothing doing in the way of new coppers. Whether there are no regions unprospected, or a lack of funds for grubstakes may be an open question, it takes new fields and untried possibilities to arouse public interest. The copper producers are, to all appearances, in stronger position than at any time since they got the market in hand. It is plain that the market is pegged around 17¾c., and several of the largest sellers, including A. S. & R., the United Metals Selling, Phelps-Dodge, and others, report all September copper sold. There has been no marked activity on the part of buyers since June, but on the other hand there has been no selling pressure and no 'umbrella to hold.' Amalgamated is much of a market leader, and the predictions as to the company's future are many and varied. An increase in the dividend rate is expected. Anaconda is expected to declare a dividend at the rate of $3 in September. If this income is in turn distributed to Amalgamated shareholders it will put Amalgamated on a 6% basis, as there are two shares of Anaconda held by Amalgamated for each share of Amalgamated outstanding. The idea that the latter is to be liquidated is not forgotten, but there are some things to be done. Cash and cash assets in Amalgamated's treasury are estimated as equal to some $14 per share. At the time of the last report there was some $15,681,000 cash on hand, against which there were outstanding the $12,500,000 notes and some $5,000,000 current accounts. Amalgamated, however, is a heavy holder of Greene-Cananea, and also of I. S. & R., both of which holdings now show a considerable profit.

The most interesting story regarding probable developments in the near future deals with the possible absorption of Greene-Cananea, North Butte, and Calumet & Arizona, all known as Cole-Ryan properties, and the Inspiration. The last named property has been developed to its present stage by W. B. Thompson, and while John D. Ryan is a member of the Board, it has hardly been classed in the Amalgamated group. The Inspiration board is one of immense financial strength and importance, and it would be a matter of great surprise if the property went into a merger as any kind of a tail-ender. Undoubtedly there are to be developments in Amalgamated, but No. 26 Broadway is always secretive, and more than apt to profit by the outsiders' hazard as to what may happen if the said outsider takes any market position to back up his belief in the course of events. One fact of importance stands out above all others; the circle of the copper people with whom actual control rests is smaller than ever it has been heretofore, and while it is said, and is undoubtedly true, that there is no understanding as to prices, the same result is achieved by the elimination of competition. There is now no struggle between the Guggenheims and the Standard Oil crowd in copper. The Lake interests no longer hold themselves aloof. Interlocking boards of directors have worked wonders, with the result that the situation in copper is much as it is in railroads. No new developments of importance can be financed without the consent of the inner circle. The financial situation is so controlled that it is safe to say no unwelcome independent could carry through the development of a large new porphyry. No banker would extend aid to an outsider known to have the disapproval of the inside circle in copper for fear that his so doing might be construed as an unfriendly act. Copper is in a way to do big things when the legal path is cleared, but there is no longer any place for newcomers. There are independents such as Clark and Haggin, but these will find themselves without successors as they go. They are of an older generation, and achieved their present position before the science of combination was brought to its present state of perfection.

THE TOMBOY MINE, COLORADO.

The Dome Mines, Ltd., the leading property in Porcupine, is stated to be earning at the rate of 20% on its share capital. Some of the most influential of New York financiers are interested in the Dome, notwithstanding which the shares were recently offered in the open market at $20 per share and there was no bid. There has been a recent considerable advance in Nipissing, and there is some talk of a possible increase in the dividend rate. The company is just completing a mill to handle its low-grade ore, and after November 6 it is expected that all shipments will consist of fine silver bullion. The new mill is to be paid for out of earnings, and it is rather doubtful whether the dividend will be increased as expected.

Ambitious plans are being mapped out for the Butte & Superior. The company is now being referred to as the largest single zinc producer in the world, and with the addition of the new territory, which is to be taken on by the company, it is claimed that Butte & Superior will, within the year, be turning out one-half as many pounds of zinc per annum as Anaconda now turns out of copper. A much larger hoist is to be erected within the next two months. There is enough ore at the dumps to keep the mill going during most of the shut-down. When the new hoist is working, it is expected that the mill will be treating 150 tons of ore per day. It is a sign of improvement

in mining finance that, notwithstanding the sudden increase in value of the options secured by the Butte & Superior people, the options are being turned over to the company at cost, although they could be sold in the open market at a handsome profit.

The Minerals Separation Co., Ltd., is announcing the fact that the test work which it has carried on at the Braden Copper Co.'s property in Chile, South America, has proved so successful that the Braden people have decided to erect a plant to treat 3600 tons per day. The cost of the plant is estimated at $15,000, and to put the plant on a 6000-ton basis would require only a nominal amount in addition. It is estimated that a plant such as is in general use would cost the Braden something over $200,000, as compared with the cost of a plant using the treatment of the Minerals Separation Co. the cost of the latter is comparatively nominal.

The Barnes-King company has finally made arrangements to take over the ground of the North Moccasin at Kendall, Montana. The Barnes-King was at one time quite active in the New York market; later it was compelled to practically suspend operations, but having a considerable sum in its treasury, the directors have for some months been endeavoring to find a property that could be worked at a profit. The price agreed upon for the North Moccasin is $150,000. A small payment is being made and the balance is to be paid by turning over 25% of the net earnings. The Tomboy is one of the American issues handled in London which has shown steady improvement during the past few months. The company is about to build a tramway from the Ophir tunnel to the railroad station. Surveys are completed, and work will begin as soon as bids from equipment builders are all in and contracts can be closed.

BOSTON

ALASKA GOLD MINES OVERSUBSCRIBED. — COPPER MERGER TALK.—MARKET HOLIDAYS.—BUTTE REVIVAL.

The offering of Alaska Gold Mines stock by Haden, Stone & Co. here resulted in an oversubscription reported to be about tenfold. In Boston alone the stock was four times oversubscribed. The prestige of Hayden, Stone & Co. with porphyry coppers and Butte & Superior has availed the firm tremendously in bringing out this new Alaska low-grade gold issue. Charles Hayden, in this instance, for the first time in his successful banking-mining career, lends his name as president to a mining company. The stock has been listed on the New York Curb and will be traded in on the Curb here preliminary to applying for listing on the Stock Exchange. The trading in the stock on the Curb here pending the office subscription offering has been of considerable volume, in anticipation of the oversubscription which resulted.

The second instalment of 25c. per share on the stock of the Portsmouth Coal Mining Co., Henry M. Whitney's old Rhode Island Coal Co., is payable September 16. All stock which fails to pay will after 30 days be sold at public auction. On account of the criticism of the old management, which was charged with not having disclosed the tonnage which was claimed for the property, the Whitney interests are actively opening the property. This work will probably continue until next year. When the coal stock was first listed on the Boston Curb it was handled in a sensational market way and great expectations were raised. Since then the company encountered bad weather on the stock market, and now it is the Whitney policy to place the property in actual shape for big development before special attention is paid to the market end. Mr. Whitney's son is on the property at Narragansett, R. I., superintending operations.

In Boston there is a revival of the talk about the billion-dollar copper merger which was halted in 1909. It is said that the Morgan interests will underwrite the big combination and will formulate it precisely along the lines of the United States Steel Corporation. The talk is that Anaconda will become the vehicle for carrying the merger through; that Amalgamated will be dissolved, and North Butte, Greene-Cananea, Calumet & Arizona, and Inspiration Consolidated will go into the concern. It is estimated that the Anaconda merger will control the production and sale of over 500,000,000 lb. of copper, one-third of the country's production. It is said that the Morgan interests, allied with Amalgamated and Standard Oil, have so developed their smelting and refining capacity, together with their selling channels, that they are now independent of the Guggenheims, who blocked the first merger plans. It is said that this group, through the Morgan house, which has also underwritten Alaskan Copper and railroad enterprises for the Guggenheims, will be able to dictate the terms of consolidation so as to gain the acquiescence of the Guggenheims. The merger will have its major interests in Butte, but will also be strongly entrenched in Bisbee, Globe, and Cananea, Mexico. It is believed here that J. P. Morgan & Co. can launch a copper merger which will successfully run the gauntlet of the Sherman anti-trust law. One feature of the move will be the passing of Amalgamated, of malodorous memory. Only the United States Steel Corporation investigation now remains in the way. Let the Steel Corporation get a certificate of good character and the copper merger will follow quickly. As the result of foreshadowing this immense consolidation, the speculative copper leaders are already showing great market strength. Practically all of the porphyries have reached high record prices and Amalgamated is selling around its high price of 1910 and considerably above that of last year.

Boston has more market holidays, perhaps, than any other Stock Exchange city in the Western Hemisphere. Perhaps London may rival the 'Hub' in the number of its holidays. For Labor Day the Boston stock market closed on the Saturday before as well. Boston observes all of the New York Stock Exchange holidays, and still others during the year which are not legal elsewhere. There are a number of men and events in New England which require canonization and anniversaries, and Boston honors these in the observance rather than the breach. An Eastern visitor to Butte last spring said he met a number of local traders in the board room of Paine, Webber & Co. who inquired the reason of so many holidays in the Hub at that season of the year. They could keep track of the national legal holidays on the calendar, but were unable to do so with reference to all of the days which Boston observes. When they saw the bulletin marked up on the blackboard, 'Market holiday in Boston,' at times it was as foreign to them as the announcement of holidays which are local to London.

The interest in Butte has reached a high pitch in Boston. A gentleman of the cloth, who has recently returned from Butte, describes the district as having a 'rebirth.' In addition to Butte & Superior, the probability that North Butte has again opened the Edith May vein on the 2400-ft. level, and the opening up at depth of copper ore by the Davis-Daly and Butte Central, point to Butte becoming a far bigger camp than its fondest friends have ever dreamed. A prominent financial paper in the East points out that Butte mines, being in the granite formation, may be likened to the famous Rio Tinto, whose history can be traced back in a semi-authenticated manner to the eleventh century. There has been a great upsetting of opinion in Boston as to the possibilities of Butte and even essential revisions of the technical findings announced in early geological reports. The time was when the Speculator mine of the North Butte was considered to be the *Ultima Thule* of the district's mineralization, but now active prospecting is going on 2½ miles north of the Speculator. Another recent visitor to Butte states that no shaft has been sunk 1500 ft. in the district without going into a property worth anywhere from $1,000,000 to $50,000,000. The names of old wild-cats and abandoned silver mines are paraded in print again, and the strange part of it all is that they

are now being acquired by men of heavy capital. The expansion of Butte in width and depth of mineralization, and the various metamorphoses going on there in the personnel of interested capital, are phenomena of the most sensational character in mining annals.

There is nothing but praise here for the method finally adopted of increasing Butte & Superior capitalization to take up the options on property to the north which were tied up by Butte & Superior principals. At first the idea was to create an independent company to take over these outlying prospects and give Butte & Superior stockholders an opportunity to subscribe at ground-floor figures. But the point was made that all Butte & Superior stockholders, regardless of further subscriptions, would become the beneficiaries of information gained through the exploitation of Butte & Superior, and that the formation of a new company would be unfair to them. So the interests in charge chose the better plan of enlarging Butte & Superior capitalization to meet the situation.

BLACK HILLS, SOUTH DAKOTA

BLACK HILLS STANDARD MINING CO.—RUBY M. CO.—HOMESTAKE COMPANY BUYS THE HIDDEN FORTUNE.

The annual meeting of the Golden Reward Co., held recently at Deadwood, resulted in the election of the following directors: A. G. Hackstaff, O. H. Kahn, Harris Franklin, Robert W. Goelet, George D. Dewitt, Henry W. DeForrest, W. B. Devereux, and Walter Luttgen. The officers will be elected at a meeting of the directors which will be held soon at New York, and will undoubtedly be A. G. Hackstaff, president; Harris Franklin, vice-president; C. C. Tegethoff, secretary and treasurer, and N. E. Franklin, of Deadwood, South Dakota, assistant secretary. At the meeting 692,448 shares were represented, of a total issue of 1,000,000 shares. The Black Hills Standard Mining Co. is the newest corporation in the Black Hills, having just been organized to take over the property of the Deadwood-Standard and Spearfish companies, and the adjoining group, known as the Slavonian ground. The 100-ton cyanide plant at the Deadwood-Standard has been overhauled and has started work, handling ore from that property. As soon as possible the company will open the Slavonian group, where there is a good showing of ore. It is across the gulch from the mill. The officers of the company are John Gray, president and general manager; Paul Rewman, secretary and treasurer; and Edward Manion, superintendent. All are successful Black Hills miners and operators, and other people interested in the concern are practical men of local experience, so that it is safe to predict a success for this company. The ore occurs in the Carboniferous limestone and is easily cyanided. Dry crushing is the process in use. The Ruby Mining Co.'s annual meeting resulted in the election of the following directors: Mrs. James Conzette, president; Arthur M. Hanna, vice-president; Norman T. Mason, secretary; and Rollin Maxam, treasurer. The company owns property in Ruby gulch, Galena district, which shows a large body of porphyry gold ore.

The Homestake company has started work on a building to be known as 'Recreation Hall,' which, as its name suggests, will be used as a gathering place for employees. It will be fitted with a large hall, for public gatherings, club-rooms, lounging rooms, gymnasium, and baths, and will in fact be an up-to-date club-house, built, supported, and fostered by the Homestake company, but managed by a board of directors elected from among the employees. The building will be on Main street, Lead, next to the Hearst Free Kindergarten, and Christ church, which property, in turn, adjoins the government building. The Homestake has recently installed a 150-hp. electric-driven Ingersoll-Rand air-compressor to eliminate steam power in the machine shop and foundry. Repairs are being made, under the direction of George Morthland, at the flume from Little Elk creek, which supplies a portion of the water for the Homestake. The flume is in bad condition, but will be practically rebuilt, and vitrified tiling used in some places. The Homestake company is now the owner of the Hidden Fortune property, having acquired it from the trustee at a price of $51,000. This amount represents labor and supply liens, receiver's fees, and taxes. The latter item was the largest, amounting to practically $34,000. The property totals 300 acres, and adjoins the Homestake on the west and northwest. This is the final chapter in the history of a property that a few years ago was the basis of a company capitalized for $5,000,000, with stock peddled broadcast over the United States at from 50c. to $2.50 per share. After two years of fancy financing and manipulation it became the object of litigation, and operations were suspended six years ago. A mill was erected three miles from the mine, on the Northwestern railroad, but it is stated that the Homestake company will not use it.

The New Reliance company has paid off its indebtedness, amounting to $14,000, and started the mill. The plant is equipped with 30 stamps, Dorr classifier, sand-leaching tanks, and treats the slime by agitation and decantation. Directors of the Hidden Treasure company, elected at a meeting held at Deadwood, are: S. T. Cochran, president; J. N. Andrews, vice-president; R. S. Grimes, secretary; Banks Stewart, treaturer and general manager; Nate Hart; and J. P. Knowles. A contract will be let for about 200 ft. of driving, following a showing of fluorspar which carries argentiferous galena.

MELBOURNE, AUSTRALIA

BRITISH BROKEN HILL.—NORTH NUGGETY AJAX LITIGATION.—ANOTHER VICTORIAN SCANDAL.—MT. LYELL.—BROKEN HILL PROPRIETARY AND THE IRON BUSINESS.

In my last letter I dealt with the scandal in connection with the management of the locally controlled Victorian mine, the North Nuggety Ajax; today I have to speak of an English-governed mine whose scene of operations is in New South Wales. This is the British Broken Hill, a mine which has had within the past twelve months or so a remarkable rise in its share-value by reason of the proving of a vast body of ore reckoned to turn it into practically a new mine. After its dashing uprush, it came down like a stick when news came that it was proposed to issue 75,000 new shares at 50s., one-fifth of these to be held in reserve. In face of that fact it is hardly likely that the shares would retain their price of 62s. The unpleasant feature of the business is the ignorance in which the Australian shareholders have been kept. It is a constant complaint here that London Boards act without any consideration of Australian holders, and this is but another instance of the fact.

Regarding the North Nuggety Ajax Co., an interim injunction has been granted against the acting directors, the Victorian Chief Justice deciding that the action of the chairman of the general meeting of shareholders in the company, in refusing to accept a motion dissenting from his ruling, and declaring the meeting closed, was illegal. The way is now clear for the hearing of the main case, which provides for the acknowledgment of the two directors chosen by the general body of shareholders after the chairman had left the meeting. The very discreditable circumstances connected with recent development in the property of this company have been followed closely by a scandal in connection with another Victorian mine. This is an alluvial gold concern, the New Langi Logan, at Ararat. Shares dropped from 19s. to 17s. 6d., and then a wire was received by the company's secretary in Melbourne to this effect: "Bore through to clay at 77 ft." The wire was posted and taken to mean that, having failed to locate wash, the bore had been discontinued in clay; with the result that values receded to 13s. 9d. The same day, however, strong buyers came in, and prices rallied to 16s. The next morning a wire came through from the mine manager as follows: "Continued bore and went through to heavy water-worn wash at 87 ft. Wash resting on given reef, carrying gold. Still boring in strong wash." Prices at once advanced to 21s. It is obvious that some one knew that the

facts were not as the first telegram implied; and inquiries have been instituted as to the source of that wire. The mine manager has acknowledged that the earlier wire was from him, and explains that he thought the bore was through into clay, but that on continuing it he found the clay to be but a thin layer. The explanation leaves much yet to be explained.

At Mt. Lyell, Tasmania, production is getting back to the normal, the North Lyell mine producing 9000 tons per month, and the Mt. Lyell nearly 5000 tons of pyrite per week. The total number of men employed in the two mines is nearly 900, or over 1000 in excess of the number employed in this department of the company's operations twelve months ago, so that it is not surprising that mining costs increase. The total number of men at the mines and smelters is, however, about 100 less than twelve months ago, so that the increase at the mines themselves is more than compensated for in other directions. The total number of the company's employees in the Lyell district is approximately 1500.

In connection with the proposal of the Broken Hill Proprietary to go into the manufacture of iron and steel, David Baker, of Philadelphia, Pennsylvania, has made a favorable report upon the project; and it has been confirmed by Mr. Delprat. An extraordinary general meeting of shareholders is to be held on September 27, when a proposal will be put forward for the creation of 340,000 new shares of 8s. each, fully paid (thus raising the number of shares to 1,500,000). Another extraordinary general meeting will be held to obtain consent to the enlarging of the process of the company so as to permit of engaging in all the branches of business of an ironmaster, after which the sanction of the Supreme Court of Victoria will have to be obtained.

HOUGHTON, MICHIGAN

LAKE SUPERIOR MINING INSTITUTE MEETING.—EXCURSIONS AND PAPERS.—MINING WASTE AND BUREAU OF MINES.

The seventeenth meeting of the Lake Superior Mining Institute was held at Houghton the last week in August, with F. W. Denton presiding. Wednesday was spent in an excursion to the South Range, taking in the Michigan smelter of Copper Range Consolidated and the mines of the same company near Painesdale; in the evening a business meeting was held at Houghton. On Thursday there was a trip to Calumet and points north of Portage Lake, followed by a dinner at the Onigaming Yacht Club in the evening, with a concert by the Calumet & Hecla band. A business meeting was held on Friday morning and the afternoon was spent at the Michigan College of Mines. A number of interesting papers were read, several being by members no longer residing in the Lake Superior district, including one by Benedict Crowell, of Cleveland, on 'Methods of Sampling at Lake Superior Iron Mines'; by Alfred C. Lane, of Tuft's College, on 'The Unexplored Parts of the Copper Range of Keweenaw Point'; and by O. P. Hood, of the Bureau of Mines, on 'Balancing Rock Crushers.' Particular interest was manifested in 'Applications of Concrete Underground,' read by H. T. Mercer, mining engineer for the Copper Range mines, as this subject has been discussed considerably at meetings of the Copper Country M. C. M. Club; also in 'The New Franklin Hoist,' by R. H. Corbett, as the hoist in question uses the weight of a descending skip to store energy in an air-compressor instead of the more usual method of counterweighting. Two interesting shaft-sinking papers were presented by E. N. Cory and S. R. Elliott, both of Negaunee. The shafts described were sunk about a mile apart in the Negaunee basin, the first by the Jones & Laughlin Co. and the second by the Cleveland-Cliffs Iron Co. The Jones & Laughlin shaft was raised, enlarged, and timbered in old-fashioned style by nine men, who did their own tramming and timbering; the Cleveland-Cliffs shaft was sunk and concreted throughout along modern lines by a larger force and at much greater expense. F. W. Sperr's talk on 'Mining Methods' was well received. In addition, the following papers were presented: 'System of Safety Inspection of the Cleveland-Cliffs Iron Co.,' by William Conibear, Ishpeming; 'Mine Sanitation,' by E. B. Wilson, Scranton, Pennsylvania; 'Foot-wall Shafts in Lake Superior Copper Mines,' by L. L. Hubbard, Houghton; 'Rock-House Practice of the Quincy Mining Co.,' by T. C. DeSoller; 'Construction of Intakes at the Mills of the Champion and Trimountain Companies,' by Edward Koepel, Beacon Hill, Michigan; 'In the Lake Superior Area—What Influences, if Any, Did the Ancient Topography of Footwall Beds Have Upon the Subsequent Disposition and Distribution of Copper in Overlying Beds?' by L. L. Hubbard, Houghton; 'Notes of Methods of Mining Ore in the Lake Superior District,' by F. W. Sperr, Houghton; 'Failures of the Rule of Following the Hanging in the Development of Lake Superior Copper Mines,' by F. W. Sperr, Houghton.

Among the visiting members were: J. A. Holmes, director of the Bureau of Mines; William A. Paine, of Boston, president of Copper Range Consolidated; Thomas F. Cole, W. G. LaRue, J. H. Hearding, of Duluth; E. P. Ryan, of Mexico City; H. O. Young, of Ishpeming; J. M. Longyear, of Brookline, Massachusetts; F. M. Prescott, of Milwaukee; and S. L. Mather, of Cleveland. Mr. Holmes, of the Bureau of Mines, gave a brief address following the dinner at the Onigaming Club; he dwelt upon the breaking down of barriers effected by the Institute, pointing out the change from conditions of twenty years ago when one mine scarcely knew what another was doing. The Bureau of Mines, he stated, wanted to gather all the information possible regarding conservation of life and resources in mining, in order to give it out through channels where it will do the greatest good. "Company secrets are not wanted, and the Bureau refuses absolutely to have relations with the courts. Its officials have been called upon to testify in case of mine accidents where Bureau investigations have been made directly after the catastrophe, but they have steadfastly refused to comply, and have been supported in this by the attorney general and the courts themselves." It was stated, concerning metal mining, that the first appropriation for this branch was made this year, the amount being $50,000, which is entirely too small for the work the Bureau would like to accomplish. Regarding the conservation of resources, Mr. Holmes said: "Exhaustive research has shown that the Western hemisphere has very little real coal either north or south of the United States. If this country can export coal to South America in exchange for the products of that continent which we need, great good will be accomplished. To this end it behooves the coal operators to save the 250,000,000 tons of coal wasted yearly by bad mining, a half ton being wasted for every ton extracted. The yearly waste of natural gas is greater than the total yearly consumption of manufactured gas in all plants of the country." Mining officials present gave strong endorsement to Dr. Holmes' views and testified personally to the benefit derived from the work of the Bureau, as well as the value of its publications. As a result of Dr. Holmes' visit, the Institute has appointed a committee to coöperate with the Bureau.

At the dinner, also, there was some further discussion of safety appliances and regulations, which was closed by M. M. Duncan with a graceful compliment to the methods followed in the copper country, the success of which he said the iron mining companies, under the stress of difficult circumstances and conditions, were striving to emulate.

At the election of officers held at the Michigan College of Mines, the following were elected for the ensuing year: president, Pentecost Mitchell; vice-presidents, F. J. Webb, A. D. Edwards, and W. B. Chinn; managers, G. S. Barber, W. H. Johnston, and C. H. Baxter; treasurer, E. W. Hopkins; secretary, A. J. Youngbluth. While the place at which the principal sessions of next year's meeting will be held has not been decided, the Mesaba range will be the district to be visited. The secretary reported 286 members, 27 of whom had been gained during the past year, and 70 applications of membership yet to be acted on. Resolutions of respect to the memory of the late Graham Pope, of Houghton, a former president of the Institute, were passed.

General Mining News

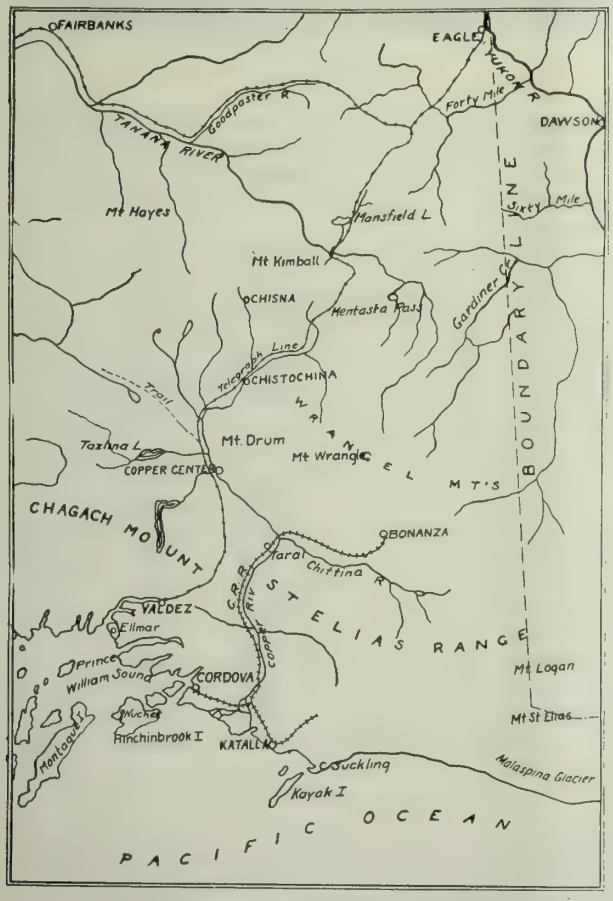
ALASKA

Cordova

There is a good deal of activity being shown in the White river country, in staking claims and development, near Scolai pass, and along the foot of Scolai and Russell glaciers. It is reported that $200,000 has been paid for a group of copper leases. Surveyors are at work 300 miles from Haines Mission, through the Alsac country, to the headwaters of the White river, near the rich coal deposits on Rabbit and Boulder creeks. Men are working on both sides of the boundary line, and get supplies from Dawson at a cost of 75c. per pound. Besides this, there is a duty of 20 to 60% on foodstuffs originally from Seattle or San Francisco. It costs a prospector from $1500 to $2000 a year to live in the White River country. Efforts are being made to have a trail from the American side.

Fairbanks

The Koyukuk river has been very low. The steamer *Reliance* brought down $150,000 in gold dust from the



MAP OF CORDOVA-FAIRBANKS REGION.

Koyukuk camp. Considerable gold is being found at Hammond from deep diggings, but costs of recovery are high. A nugget, containing gold worth $280, was found in the sluice-boxes at the Morrison bench claim, known as 21 Goldstream. Gravel from $10 to $48 per pan has been found at Noeller and Gustasson's claim, on Three Below, Fairbanks creek. A $20 nugget was picked up. At present 23 men are working on the claim.

Juneau

During July the 120-stamp mill at the Alaska Mexican worked 29.75 days with water-power, and crushed 19,824 tons of ore, with a yield of $29,547 from free gold and $33,895 from 402 tons of concentrate, making a total of $63,442. Operating expenses were $24,847, and construction $4921, and the net estimated profit $33,039. The yield per ton milled was $3.20. Development covered 206 ft., and the stock of broken ore increased 16,133 tons. At the Alaska United, the two 120-stamp mills worked 29.67 days, crushing 37,450 tons of ore, producing free gold worth $53,409, and $57,060 from 861 tons of concentrate, the total being $110,469. The average yield from the Ready Bullion mine was $3.56 and from the 700-Ft. Claim $2.81 per ton. The total estimated profit was $53,943. Development work in the Ready Bullion covered 175 ft., and in the 700-Ft. Claim 284 ft., the stock of broken ore in the former increasing by 10,226, and decreasing in the latter by 1048 tons.

Nome

Four of the new dredges brought here this season are now at work, and several more may begin before the freeze. Work generally has been helped by a good fall of rain during the week. The last steamer this season for Nome left Seattle on September 2.

Valdez

Heavy rain during the past 10 days, the breaking of a glacier on the line of the Copper River & Northwestern railroad, together with high tides and heavy inshore wind, have caused a wash-out of 20 miles of the line. Traffic cannot be resumed for 30 days.

ARIZONA

Gila County

(Special Correspondence.)—After September 1 the wages of all underground employees in the mines of the Globe-Miami district will be increased by 25c. per day, as the result of a recent conference of the mine managers of the district. After that date the minimum rate will be $3.75 per day of eight hours instead of $3.50 which is paid at present. The mines affected include Miami, Inspiration Con., Old Dominion, and others. Churn-drill hole No. 8, at the Southwestern Miami, is 880 ft. deep and still in chalcocite-bearing schist. It is being enlarged with a 6¼-in. under-reamer. Holes No. 6 and 7 are 905 and 885 ft. deep, in schist, respectively. About 500 men are employed in development and construction work at the Inspiration Con. mines.

The concrete lining of the 2-compartment Kingdon shaft of the Old Dominion mine has been completed from the collar to the bottom, a distance of 1017 ft. This shaft will be used for ventilation and for the men working in the eastern end of the mine. The work was done under contract by Paul Michaelson and C. H. Weideman. Churn-drill hole No. 3 of the South Live Oak Development Co. is 285 ft. deep in silicified schist carrying oxide, silicate, and carbonate of copper in small amounts. The White Metal Development Co., of Globe, is cleaning out the 200-ft. level of the old McMorris silver mine, 8 miles northeast of Globe. The work is slow and difficult, as the drifts have caved badly, the mine having been closed down about 30 years. A shoot of good smelting ore 4 ft. wide has been opened up on the 650-ft. level in the Williams shaft of the Iron Cap mine, about 125 ft. east of the shaft. It consists mostly of soft hematite and is estimated to average 8 to 10% copper, which occurs as oxide and carbonate. The west drift on this level is also being advanced. The Gibson mine, 9 miles west of Miami, continues to make steady shipments of chalcopyrite ore, averaging 16% copper, to the Old Dominion smelter, and shipped four cars in August. The ore is nearly all coming from the fourth level on the Pasquale vein, though a small amount is taken out in the progress of driving south on the fifth level, which is in 170 ft. and in which small stringers of ore are being found. Five or six stopes are being worked on the fourth level, one of which is 9 ft. wide and carries several shoots of shipping ore. It is proposed to soon begin driving on the sixth level. About 30 men are employed.

Globe, August 29.

Greenlee County

Basic brick has arrived at the Arizona Copper Co.'s

smelter, and will be tried in the converters. This process is in successful use at the Cananea Consolidated and the Calumet & Arizona. During the half-year ended March 31, the Arizona Copper Co. produced 9073 tons of bessemer copper. Gross profits were $850,215; capital outlay was $249,000, of which $150,000 was spent on new plant. High-grade ore is being shipped from the New York & Arizona company to the smelters. The mill and cyanide plant are not working at present, but it is intended to erect a tube-mill later on.

CALIFORNIA

Calaveras County

The Poorman mine, near Glencoe, which has been shut down for 30 years, has been bought by Pennsylvania capitalists. This mine was originally worked by Lewis brothers, who are reported to have taken a good deal of gold out of it to 140-ft. depth. Some rich gravel is being worked by R. King at the Three B mine on the Calaveras river.

El Dorado County

(Special Correspondence.)—The Atwood Mines Co. is arranging to develop the recently acquired Secombe & Jones group. It is stated the first payment on the purchase price has been made. A. W. Tennant is manager. Tennant and associates are also interested in the Martin mine, Grizzly Flat district. A stamp-mill may be erected at this mine later on. Indianapolis capitalists are contemplating resuming work at the Grand Victory. This mine was formerly a noted producer, but has been idle about twelve years. The equipment includes a 60-stamp mill. John C. Wright is heavily interested. It is stated that George M. Clark will probably be placed in charge of operations.

Placerville, August 31.

A suit has been brought by the owners of the Georgia Slide mine against the directors of a company which leased the mine last October, to recover $750 alleged to be due under agreement giving to the owners 25% gross of the gold taken from the mine. In addition, the mine-owners sue for $250 for time and money spent to recover the royalties. According to bullion receipts, $6572 was realized by the Georgia Slide Mining & Milling Company.

San Bernardino County

The Golden State Mining Co. is developing claims in the Whipple Wash district. The veins are said to yield from $10 to $100 per ton at the surface, by panning. In the same district, the Kansas City Mining & Milling Co. has built a 40-stamp mill for custom work. It will be ready early in September.

San Diego County

It is reported that there has been a revival of mining in the old Campo district, fifty-five miles southeast of San Diego, and within three miles of the Mexican border. Gold has been found on 27 claims, and Utah and California men are developing the property, which is called the Lost Alice, after the Alice claim, supposed to have been worked by a Scotchman about 200 years ago. In fact, it is stated that one of the earliest discoveries of gold ore within what is now the United States, was made here. There are three veins on the Lost Alice being opened by shaft and adit. In a recent find, an 18-in. vein was exposed, and a 3½-in. streak assayed very high. Nineteen pounds of ore gave 3.4 oz. of bullion. There is plenty of water on the property.

COLORADO

Gilpin County

The shaft of the Wild Cat company is now down 100 ft., and levels will be driven east and west. A local pool is developing the Homer lode, on Central hill. An adit has been driven 200 ft. on Shanks lode on Quartz hill, and a width of about 5 in. of ore returns $50 per ton. From the National tunnel 72 tons of ore was shipped to the Iron City mill, returning 18 tons of concentrate worth $15 per ton. The lode is 4 ft. wide, and a 25-ton sample has been sent to Idaho Springs for testing purposes. Eight tons from the War Dance mine yielded $161 per ton at the smelters.

Ouray County

From a report issued on the operations of the Camp Bird mine, it appears that, at June 30, the amount of dry ore broken in the stopes had been reduced to 1152 tons; but active development was to be undertaken with a view

CAMP BIRD MINE.

to reaching the rich ore recently found in deep ground between levels four and five. At the Santa Gertrudis mine, in Mexico, development continues satisfactory, and additions to the mill, to increase its capacity, will be completed by November.

Teller County (Cripple Creek)

According to local statistics, the output of the Cripple Creek district for August was 75,326 tons of ore, with a gross value of $1,193,515. As compared with July, the tonnage and the gross value is slightly less that of last month. This in part is due to the temporary suspension of work in several of the local mills. The reports made by the heads of the various mills follow:

Mill.	Gross tonnage.	Average value.	Gross bullion value.
Golden Cycle	32,000	$20.00	$640,000
Portland	10,000	22.00	220,000
Portland (Cripple Creek dist.)	15,300	3.10	47,450
Independence	9,926	2.76	27,395
Joe Dandy	1,950	2.10	2,940
Wild Horse	1,100	2.40	2,640
Isabella	700	1.20	840
Gaylord	500	4.00	2,000
Smelters	3,850	65.00	250,250
	75,326		$1,193,515

It has been decided to use the water flowing from the Roosevelt tunnel for generating power, and T. R. Countryman has been instructed to prepare plans and estimates of the horse-power that can be developed, and submit to the tunnel company. For the first 15 days of August there was a marked recession of water in the Gold Coin shaft, but since then it has risen 2 ft., due to seepage.

During a stoppage of the Golden Cycle pumps for two days, water rose in the Vindicator shaft above the 1600-ft. level, but work has since been resumed at this point. The water zone, in which these two mines are situated, seems to be out of that section drained by the Roosevelt tunnel, so it is necessary to pump. Eight machines are now working in the Modoc mine, on Battle mountain. Ore from levels 7, 9, and 13 is being shipped to the Pueblo smelter. The Blue Flag mill has started work again after three months' stoppage for repairs. The changes are said to include some improved leaching process.

IDAHO

Coeur d'Alene

On September 4, the Bunker Hill & Sullivan company

paid dividend No. 180, amounting to $65,400, making the total to date $13,715,550.

IDAHO COUNTY

The Mineral Zone mine has been sold to Philadelphia men for $100,000, by Mrs. M. A. Parr. The ore is said to assay $30 per ton. The Buster mill has been leased by the new company.

JUAB COUNTY

Shipments from the Tintic district for the week ended August 30, totaled 231 cars of ore, the Centennial-Eureka sending out 46 cars; Iron Blossom, 30; Chief Consolidated, 26; and Mammoth, 24. The matter of zinc ore freight rates has not been settled yet, so shipments are being held back. It is said that the Chief Consolidated is in a strong financial position, and a dividend ought soon to be paid. About 100 tons of copper ore is being mined per week on the 600-ft. level of the Iron Blossom mine.

SUMMIT COUNTY

During the week ended August 31, Park City district mines shipped 1550 tons of ore. Thirty expert drill-men arrived at the Daly Judge, where they have a contract, under J. A. McIlwee & Sons, of Denver, to drill for this company and the Daly West.

MISSOURI

JASPER COUNTY

The Granby company of Joplin is starting a big drilling campaign, and nine drills will be set at work. Three churn-drills are to work near former workings of the Granby camp; while two, which are stationed to the south and east, are in unprospected territory. Two other drills are at work in isolated regions between Granby on the southwest and Duenweg on the northwest. Surface indications at this point are said to be encouraging; but no mining has so far been undertaken. The two other machines are drilling at Oronogo and Chitwood, respectively. The weekly output from the properties of the Granby company is about 350 tons of blende, 200 of calamine, and 50 tons of lead. From the Granby and Spring City lands comes the bulk of calamine production. Drilling on the Chitwood tract is of importance, as it is the initial step looking toward mining operations by the land-owning company in this district. Hitherto all the production has come from leasing companies.

MONTANA

BEAVERHEAD COUNTY

(Special Correspondence.)—Local men are preparing to drill for oil in the shales six miles south of Dillon. Oil-bearing strata have been known there for years, but so far no systematic development has been attempted.

Dillon, August 23.

LEWIS AND CLARK COUNTY

In a circular to the stockholders of the Barnes-King Development Co., C. W. Goodale, president, states that the company has purchased the North Moccasin property, which covers 2000 ft. in length along the formation between the Barnes-King on the north and Kendall on the south. The price of the new claims is $150,000, and $5000 will be paid in cash, the balance out of net profits of mining operations, within no stated time. From each month's yield the Barnes-King is to retain $3.50 per ton and pay 75% of the balance to the North Moccasin people, until the above-mentioned price has been paid. From the latter claim, 25,000 tons of ore produced bullion worth $127,000. It is proposed to repair the Barnes-King shaft and open the North Moccasin by an incline which will be sunk under the lode from the 400-ft. level of the former mine. It is expected that mining and milling costs will not exceed $3.50 per ton. The Piegan-Gloster property has also been secured, under terms, for $125,000. It includes 200 acres and covers 9000 ft. along the Piegan-Gloster vein. The old Gloster mine was opened to 500-ft. depth in 1888, and produced considerable bullion. The Piegan claim has yielded 10,000 tons of ore, and the present reserves are 23,000 tons worth $8.50 per ton. G. T. McGee, formerly manager of the Barnes-King, has been appointed to take charge of the new ventures. The directors state that 100 mining properties have been considered during three years. In the suit of the Western Development Co. of Arizona against the Barnes-King for $97,000, the first hearing was in favor of the latter. Plaintiff appealed, and the Circuit Court of Appeals overruled the previous decision, sending the case back for trial on the complaint, which is now pending. In the case of Killen *v.* Barnes-King, for personal injuries, the former got a verdict for $5000. An appeal has been lodged against this. The financial statement of the Barnes-King company shows that cash in various banks amounts to $207,655, and bonds of $54,764, drawing 4% interest, are held.

FLATHEAD COUNTY

(Special Correspondence.)—Kalispell capital has been secured to drill for oil in the Tertiary beds southwest of the town. Some oil and gas were found there last spring in a well which was being drilled for water.

Kalispell, August 23.

JEFFERSON COUNTY

(Special Correspondence.)—John D. Pope, manager of the North Butte company, and G. W. Wilson, both of Butte, have organized the Mount Washington Copper Co., to operate the Fred Kauf property near Wickes. The company is capitalized at 100,000 shares, par value $5. This property lies between the Blue Bird, Pen Yan, and Alta mines. The ore consists of silver, lead, and gold. An electric hoist is being erected, as well as the necessary buildings.

Butte, August 23.

MISSOULA COUNTY

(Special Correspondence.)—British Columbia smelting interests are said to have purchased the Monitor, Richmond, and Log Cabin groups, near Saltese. Active development is to begin at once.

Missoula, August 23.

SANDERS COUNTY

(Special Correspondence.)—Nearly all the machinery for the hydro-electric plant on Prospect creek has arrived, and its erection has been started. This will be an auxiliary plant, the power from which will be used primarily for the construction of the large plant at Thompson Falls. Thirty-three men are now employed on the Prospect creek work, and the plant should be in operation early this fall. The Iron Mountain mine, at Superior, expects to receive power from the new plant, but the main Coeur d'Alene district will not be benefited until the large Thompson Falls plant is at work.

Thompson, August 23.

SILVERBOW COUNTY

B. B. Thayer, president of the Anaconda Copper Co., has completed his semi-annual inspection of the company's properties in Montana. "The improvements we have been making the past year or two are rounding into shape," he said. "Several of the large hoisting engines are being operated by air compressed by electric power, and are working satisfactorily. It is the intention of the company to equip all of the larger shafts and many of the smaller ones with compressed-air engines. The electric pumps supplanting the steam pumps formerly in use are now in operation at many points and are giving perfect satisfaction. The mines generally are in fine condition and are making a normal output of ore, with the exception that for the month of August and a portion of September the shipments to the Anaconda smelter will be slightly curtailed owing to the fact that the reconstruction of the first section of the Washoe concentrator is under way."

NEVADA

ESMERALDA COUNTY

(Special Correspondence.)—Operations at the Pittsburg-Silver Peak mine and mill are in the usual condition. Ex-

tensions to slime presses have been completed, making three 86-frame presses. For regrinding the coarsest sand, a 5 by 18-ft. chain-driven tube-mill is at work, being fed by an Akins classifier. Additional plates have been fitted for amalgamation after regrinding.

Blair, August 28.

The shaft of the Goldfield Merger mine is down 1300 ft. That of the Grizzly Bear claim of the Goldfield Consolidated has been enlarged and retimbered from the 1000 to the 1300-ft. level, and is being sunk to 1450 ft. Rich ore is being extracted from the 1300-ft. level. Good ore is being mined on the 250-ft. level of the Florence Goldfield.

Lyon County

The Thompson smelter received 4856 tons of ore for the week ended August 22, and shipped away eight carloads of copper matte.

Nye County

(Special Correspondence.)—A project is being promoted to supply Tonopah and Goldfield mines with cheap power by producing commercial coke from the coal beds at Coaldale, a station on the Tonopah & Goldfield railroad, 35 miles from Tonopah. It is stated that large deposits of coal have been proved and the product can be converted into coke at low cost. The project includes the establishing of electric generating stations, steam to be generated from coke, and supplying electrical power to the mines and mills. It is also planned to furnish coke and gas for domestic and manufacturing purposes to nearby towns. N. S. Cutter, president of the Tonopah & Goldfield railroad, is said to be interested. It is reported that the coal beds will be shortly sold outright to the new company by P. V. Rovlanenk, the owner. The steady rise in the price of silver has added about $30,000 per month to the value of Tonopah's output since August 1. Tonopah ores average about two-thirds silver and one-third gold in net values, and the gold content practically covers all costs, leaving the silver as a net profit. The steady advance of the white metal has not only encouraged operating companies, but has materially stimulated prospecting and development work on the smaller properties. The Nevada-California Power Co. reports the closing of new contracts amounting to $101,900 in the past 30 days for Tonopah mines. The additional power is divided among 21 companies. The new Belmont mill is at last in full operation. Failure of the Tonopah Water Co. to furnish sufficient water for the batteries handicapped initial runs. The company has augmented its supply, and the Belmont people are also pumping water from the mine, and no further trouble from this source is anticipated. While in most camps water in the mine is considered detrimental, in Tonopah its presence is being converted into an asset.

Tonopah, August 26.

At the Manhattan Big Four mine, a raise from the 500-ft. level is in $15 ore. A lode of white quartz 30 ft. wide, worth $60 per ton, has been cross-cut on this level. The triple pump is being fitted together. A 150-ton mill has been ordered from the Joshua Hendy company. It will contain ten 1050-lb. stamps crushing through 4-mesh screens, two tube-mills, amalgamating plates, and other plant. Tonopah mines shipped 10,000 tons of ore during the last week of August, worth $250,000. At the 850-ft. level, 6 ft. of ore ranging from $19 to $37 per ton has been opened in the North Star mine. At the Montana-Tonopah 5 ft. of good ore has been cut on the 390-ft. level; also 5 ft. on the 565-ft.; and 4 ft. on the 765-ft. level. The West End company has purchased the Salsberry and Crocker claims, 600 ft. south of the West End lease. An initial shipment of bullion was made by the Belmont new mill, valued at $27,000.

Storey County

During the week ended August 31, the Mexican mill treated 110 tons of ore worth $19.80 per ton, with an extraction of 92%. The plant was shut down for several days for repairs to agitators, pumps, Chilean and tube-mills, and filters. The southwest drive on the 2500-ft. level of the Ophir is out 499 ft. in quartz and porphyry of low value. Work at the cyanide plant is well forward. At the C. & C. shaft, 24 shifts were worked on the temporary pump plant. Sundry repairs were made from the 800 to the 2100-ft. stations in Ward shaft.

Bullion tax statements filed for the quarter ended June 30, for the Comstock mines, show that 21,356 tons of ore was treated for bullion worth $269,616. The tax to be paid amounts to $2178.

TEXAS

Brewster County

(Special Correspondence.)—The Texas Mica Co. has acquired 800 acres of mica land which it is developing. This is situated along the dividing line of Culberson and El Paso counties, southwest of Van Horn. It is stated that unlimited quantities of sheet and scrap mica have been found. The product is ground into 100-lb. sacks and shipped from Van Horn in carload lots, being sold for $35 per ton at Van Horn. A company of Austin, Texas, men is developing a vein or dike of disseminated tungsten ore situated on the east side of the Diablo mountains. The ore in seams is high-grade, but at present has not been found in commercial quantities. A force of 15 men is employed.

The properties of the Silver Hill Mining & Milling Co. at Shafter, Texas, are at present being worked under lease and bond by the General Development Co. of New York, controlled by the Lewisohns. These mines adjoin the famous property of the Presidio Mining Co. The Lewisohn concern has been drilling with churn-drills to cut the formation at 400-ft. depth. T. H. Clark is the local agent, and Louis A. Wright consulting engineer.

The Consolidated Kansas City Smelting & Refining Co. is erecting an additional converter and new blowing engine to its large copper smelters at El Paso. In view of the increasing production of New Mexico and western Texas, the company has found it necessary to increase its capacity. An extension is also being made to the power-house. These improvements will increase its daily capacity by about 500 tons. K. Doer has been made general manager of the company's interests in the southwest.

Austin, September 1.

El Paso County

At the Hazel mine, ten miles north of Allamore, a 100-ton dry concentrating mill of the Steele-Sutton-Steele type is being erected. The building is to be three stories high, of wood, steel, and concrete, 65 by 155 ft. The engines are 55 and 85 hp., respectively, and the crusher and pulverizer have a capacity of 200 tons per day. Tests by this process show that 10 tons can be concentrated into one ton valued at $150. On old dumps there is over 50,000 tons of ore which will average $15 per ton in copper and silver.

Wood County

The Bonanza mine, in the Quitman mountains, thirty-five miles by rail southeast of El Paso, has recently been purchased from the Republic company of Weatherford. There are 30 men at work, and regular shipments of sphalerite averaging 44% zinc, are being made to the Granby smelters at Neodosha, Kansas. The property has been opened to 300-ft. depth. The ore also carries galena, which is hand-sorted from the zinc ore and sent to El Paso smelter.

CANADA

British Columbia

In the Nelson division the Motherlode Sheep Creek Mining Co. is operating its 10-stamp mill, crushing ore from No. 1 vein, and it has been reported that No. 2 and 3 veins have been cut on the 300-ft. level. The Queen gold mine, with its 20-stamp mill, and the Emerald lead mine are two other properties in this part of Nelson mining division that are steadily maintaining production. Near the city of Nelson, the Kootenay Gold Mines, Ltd., with a 20-stamp mill, continues to take out and crush ore from its Granite-Poorman mines. At Rossland the Consolidated

Mining & Smelting Co. is keeping up the output from its Centre Star-Le Roi group, shipments for the half-year having totaled rather more than 100,000 tons of gold-copper ore. Le Roi No. 2 is also shipping its usual quantity of ore. In the Boundary district the Granby company's production for the past six months has exceeded 600,000 tons, while that of the British Columbia Copper Co. has been approximately half that amount. The latter company is exploring Voigt's group of mineral claims, in Similkameen district, but the ore developed is not yet enough to insure the bond being taken up. The Hedley Gold Mining Co. is doing well, as usual; its dividends for the half-year have totaled $120,000, which is 10% on the issued capital.

Cobalt

During the week ended August 24, twelve mines shipped 391 tons of ore. The Penn-Canadian sent out nearly 30 tons; while the Crown Reserve shipped one carload containing 135,000 oz. of silver to the Saxon Government, under its contract with that country, to supply silver for coinage. Silver bars weighing 77,424 oz. were produced by the Nipissing and Crown Reserve mines.

A large party of men interested in the Cobalt Townsite mine has visited the property, and considered everything to be satisfactory. Besides its shipments of high-grade ore, the company is having 150 tons per day milled at the Northern Customs concentrator, 20 additional stamps having been erected to deal with this ore.

Porcupine

A plant consisting of 10 stamps, two tube-mills, and amalgamating plates is to be erected at the Dome Lake mine. Concentration and cyaniding will be used later if necessary. Underground development continues to show encouraging results. At the 300-ft. level of the McIntyre mine the lode has been opened for a good width, the quartz veins carrying fine pyrite. Extensions to the existing mill will consist of rolls and Chilean mills, tube-mills, Colbath classifiers, thickeners, agitators, and filters. Cyanide solution will be added to the Chilean mills.

MEXICO

Chihuahua

(Special Correspondence.)—At Chihuahua, the American Smelting & Refining Co. is working full time; while the Rio Tinto, at Terrazas, has just blown in one furnace, and expects to blow in another soon. The Santa Eulalia mines, of the Chihuahua Mining Co., are shipping to full capacity. The Yoquivo Development Co., above Minaca, has managed to keep its cyanide plant working, and recently made a shipment of bullion to Chihuahua. They have been harassed by rebels under command of Captain Salasar, while his superior officer, Colonel Gamboa, has occupied the Ocampo region. All the mines at this place are closed down except the Concheño, at which property a new steam electric-power plant is being erected. The Zaragosa shaft is being retimbered and mill repairs made preparatory to starting again.

Temósachic, August 21.

Guerrero

(Special Correspondence.)—The present condition of affairs in the states of Guerrero and Morelos is dangerous. Recently a mechanic of the Alixtec Mining Co., in the former state, was held up and robbed by bandits within two hours' horseback ride of the mines.

Mexico City, August 28.

Jalisco

The Mololoa and El Favor mines, in the Hostotipaquillo district, continue to maintain production, and development is opening new stopes. During July, 36 tons of high-grade ore was shipped from the former to the Aguascalientes smelter, while 523 tons was treated at El Favor mill. From 298 tons of El Favor ore sent to the same smelter, the estimated value is ₱40,000. A profit of ₱4000 was made on treating 417 tons of manganiferous ore in the El Favor mill.

Personal

Professional men are invited to send news of their engagements and travels. Such news is interesting to friends.

F. M. Simonds is in Cuba.

H. Ries is in San Francisco.

F. L. Sizer is at Carson City.

H. C. Hoover is in San Francisco.

W. R. Calvert has gone to Alaska.

Charles Janin is back from Nevada.

H. W. Turner is in San Francisco again.

Edmund Juessen has returned from Nogales.

Charles W. Morse is at Jackson, California.

E. H. Nutter has returned from British Columbia.

W. J. Sharwood has been called to Washington, D. C.

John Seward is examining the Kerr Lake mine at Cobalt.

J. F. Kemp, who has been at Panama, is in New York again.

C. C. Broadwater has returned from the East and British Columbia.

R. P. McLaughlin has returned from Shasta county, California.

A. F. Flynt, of Tepic, Mexico, is in San Francisco and will go to Duluth.

R. W. Pack is studying the California oilfields for the U. S. Geological Survey.

W. H. Aldridge may hereafter be addressed at 14 Wall street, Bankers Trust building, New York.

H. M. Crookshanks has resigned as general manager for the Atlixtec Mining Co., Guerrero, Mexico.

J. W. Malcolmson is expected at El Tigre, Sonora, and will go from there to Los Angeles and San Francisco.

A. W. Cole is now mill superintendent for the Concheño Mining Co., at Temosachic, Chihuahua, Mexico.

R. B. Hutchinson has resigned as general manager for Corrigan, McKinney & Co. in Mexico, and is motoring through California.

Norval J. Welsh is at Orogrande, New Mexico, planning development of the By-Chance mines for the Jarilla Copper Syndicate, Limited.

Spencer Browne has gone to New York by way of British Columbia. He will hereafter be with the Canadian Mining & Exploration Company.

P. Jensen, general manager at the Simau Mines at Lebong Tandai, West Sumatra, is at San Francisco, and will visit various American gold mines.

William J. Priestly, Jr., has resigned the position of superintendent at the Rhodes-Hall mine, Fairbanks, Alaska, and has gone to Brigham City, Utah.

Obituary

W J McGee, whose serious illness was noted in a recent number of the *Mining and Scientific Press*, died at Washington, D. C., September 3, as a result of cancer. Mr. McGee was born at Dubuque, Iowa, in 1853 and read geology while working as clerk in a lumber yard. He used his vacations for travel on foot over eastern Iowa, studying the Pleistocene formations, and became one of the pioneers in the study of glacial deposits. In 1883 he became a member of the U. S. Geological Survey, where he rose to the position of principal assistant to J. W. Powell, then director. He later served in the Bureau of Ethnology, and as director of the Anthropological exhibit at the Louisiana Purchase Exposition. He was one of the active men in the organization of the conservation movement, and at the time of his death was in the service of the Department of Agriculture. Mr. McGee was a forceful man with much originality and power. He was simple and kindly in his tastes, and many a young worker in science remembers gratefully encouragement and stimulus received from him at times when they were most helpful.

Market Reports

LONDON QUOTATIONS

(By cable, through the courtesy of C. S. Burton & Co., New York.)

	September 4.
Camp Bird Ltd	$ 6¾
El Oro	3⅛
Esperanza	8¾
Oroville Dredging	1⅞
Santa Gertrudis	7½
Tomboy	6⅞

COPPER SHARES—BOSTON

(By courtesy of J. C. Wilson, Mills Building.)

	Closing prices, September 5.		Closing Prices September 5.
Adventure	$ 8	Mohawk	$ 67½
Allouez	46½	North Butte	34½
Calumet & Arizona	82	Old Dominion	60¾
Calumet & Hecla	545	Osceola	116
Centennial	21	Quincy	89
Copper Range	58¾	Shannon	16½
Daly West	4¾	Superior & Boston	1⅞
Franklin	11	Tamarack	42
Granby	57⅜	Trinity	6
Greene Cananea, ctf.	10	Utah Con	11¾
Isle-Royale	35½	Victoria	3
La Salle	6¼	Winona	4½
Mass Copper	7¾	Wolverine	96

NEVADA STOCKS

(By courtesy of San Francisco Stock Exchange.)

San Francisco, September 5.

Atlanta	$ .25	Mexican	$2.75
Belcher	.35	Midway	.56
Belmont	9.75	Montana-Tonopah	2.20
B. & B.	.05	Nevada Hills	1.97
Big Four	.50	Ophir	.67
Booth	.06	Pittsburg Silver Peak	1.00
Challar	.10	Round Mountain	.40
Combination Fraction	.13	Savage	.08
Con. Virginia	.47	Tonopah Extension	2.65
Florence	.98	Tonopah Merger	.90
Goldfield Con.	3.50	Tonopah of Nevada	7.00
Jim Butler	.65	Union	.70
Jumbo Extension	.40	Vernal	.11
MacNamara	.23	West End	1.60

OIL SHARES

(By courtesy of San Francisco Stock Exchange.)

San Francisco, September 5.

Associated Oil	44.00	Monte Cristo	$ 1.35
Brookshire	.51	New Pa Pet	.55
Caribou	.80	Palmer	.39
Claremont	.60	Palmer Union	.18
Coalinga Central	.20	Premier	.40
De Luxe	.70	Republic	.26
Maricopa 36	.35	United Oil	.25
Maricopa National	.20	W. K. Oil	2.00

MINING STOCK QUOTATIONS—NEW YORK

(By wire from C. S. Burton & Co., New York.)

	Closing Prices. September 4.		Closing Prices. September 4.
Amalgamated Copper	$ 86⅛	Miami Copper	$ 29⅜
A. S. & R. Co.	85¼	Mines Co. of America	8
Braden Copper	7½	Nevada Con	22⅜
B. C. Copper Co.	5⅜	Nipissing	8¼
Chino	40	Ohio Copper	¾
First National	2⅛	Ray Con	22
Giroux	5¼	Tenn. Copper	42¾
Goldfield Con.	3⅝	Tonopah Belmont	9⅛
Greene-Cananea	10	Tonopah Ex	2⅛
Hollinger	12⅜	Tonopah Mining	7¼
Inspiration	18⅜	Trinity	6¼
Kerr Lake	2¾	Tuolumne Copper	2⅜
La Rose	2⅜	Utah Copper	53¼
Mason Valley	12⅛	West End	1⅜
McKinley-Darragh	2	Yukon Gold	3⅝

ASSESSMENTS ON COMSTOCK MINES.

Company	No.	Del. Board	Sale Day	Amt.
Con. Virginia	21	Aug. 11	Sept. 5	.20
Sierra Nevada	31	Sept. 21	Oct. 16	.10
Andes	77	Sept. 23	Oct. 17	.05
Savage	25	Sept. 23	Oct. 24	.10
Seg. Belcher	51	Sept. 28	Oct. 25	.02
Hale & Norcross	31	Oct. 1	Oct. 24	.05

LOCAL METAL PRICES

San Francisco is not a primary market for the common metals except quicksilver. The prices quoted below therefore represent sales of small lots and are not such as an ore-producer could expect to realize. Ore contracts usually call for settlements on the basis of Eastern prices, less freight and treatment charges. The prices quoted are in cents per pound, except in the case of quicksilver, which is quoted in dollars per flask of 75 pounds.

San Francisco September 5.

Antimony	11—11½c	Quicksilver (flask)	42.50
Electrolytic Copper	18—18½c	Tin	.50—51½c
Pig Lead	5.10—6.05c	Spelter	.8—8½c

Zinc dust, 1400 lb. casks, per 100 lb., small lots $9.50—9.75; large $7.50—8.50

METAL PRICES

(By wire from New York.)

NEW YORK, September 4.—Copper is quiet and firm. Consumption is excellent. Early deliveries are scarce. Lead is strong and advancing. There is good demand at higher prices. Spelter is quiet but firm. Average daily prices for the past week, in cents per pound, based on wholesale transactions, standard brands, are given below.

Date.	Electrolytic Copper.	Lead.	Spelter.	Silver, per oz.
Aug. 29	17.59	4.65	7.17	61¾
" 30	17.58	4.85	7.23	62⅛
" 31	17.58	4.85	7.26	63⅛
Sept. 1	Sunday.	No market.		
" 2	Holiday.	No market.		
" 3	17.55	4.85	7.29	—
" 4	17.55	4.85	7.29	62¾

SILVER

Below is given the average New York quotation, in cents per ounce, of fine silver for the months indicated:

	1911.	1912.		1911.	1912.
Jan.	53.81	56.25	July	52.57	60.67
Feb.	52.23	59.06	Aug.	52.17	61.32
Mch.	52.76	58.37	Sept.	52.43	....
Apr.	52.32	59.20	Oct.	53.37	....
May	53.31	60.88	Nov.	55.77	....
June	53.04	61.29	Dec.	54.85	....

COPPER

Daily quotations on copper as published in this column represent average wholesale transactions on the New York market and refer to electrolytic copper. Lake copper commands normally from 1-5 to 1-4c. per lb. more. Below are average monthly quotations in cents per pound:

	1911.	1912.		1911.	1912.
Jan.	12.29	14.09	July	12.47	17.19
Feb.	12.26	14.08	Aug.	12.41	17.49
Mch.	12.14	14.68	Sept.	12.20	....
Apr.	12.02	15.74	Oct.	12.19	....
May	11.99	16.03	Nov.	12.61	....
June	12.39	17.23	Dec.	13.55	....

COPPER SURPLUS

Figures showing the visible supply of copper at the beginning of each month are now widely available. Below are given the amounts, in pounds, known to be available at the first of each of certain months.

		U. S.	European.
January	1910	141,766,111	244,961,280
January	1911	122,030,195	230,264,280
December	"	111,785,188	164,151,680
January	1912	89,454,695	178,329,920
February	"	66,280,643	153,820,800
March	"	62,939,988	141,125,680
April	"	62,367,557	137,806,000
May	"	65,295,368	134,176,000
June	"	49,615,643	117,801,600
July	"	44,335,004	107,817,920
August	"	50,281,280	113,285,760

UNITED STATES PRODUCTION AND CONSUMPTION

(Compiled from reports of the Copper Producers' Association)

	Production.	Domestic deliveries.	Exports.
July	112,167,934	56,982,582	74,880,658
August	125,493,667	59,935,364	69,885,660
September	115,588,950	57,311,584	50,824,011
October	118,255,442	64,068,656	60,084,349
November	111,876,601	68,039,776	67,049,279
December	122,896,697	65,988,474	79,238,716
Total for 1911	1,431,938,338	709,611,945	754,932,733
January 1912	119,337,753	62,343,901	80,167,904
February	116,035,809	56,228,368	63,148,096
March	125,694,601	67,847,556	58,779,566
April	125,694,001	69,513,846	53,252,326
May	126,737,836	72,702,237	69,485,945
June	122,315,240	66,146,229	61,449,650
July	137,161,920	71,093,120	60,121,600

LEAD

Lead is quoted ordinarily in cents per pound or dollars per hundred pounds delivered at St. Louis or New York. The difference is normally 15c. per hundred pounds, and any larger or smaller difference is promptly met by sales. The daily price in New York is published each week in this column. Below are the average quotations by months:

	1911.	1912.		1911.	1912.
Jan.	4.48	4.43	July	4.50	4.71
Feb.	4.44	4.03	Aug.	4.50	4.54
Mch.	4.39	4.07	Sept.	4.48	....
Apr.	4.41	4.20	Oct.	4.27	....
May	4.37	4.20	Nov.	4.30	....
June	4.34	4.40	Dec.	4.45	....

ZINC

Zinc is quoted as spelter, standard Western brands, and based upon St. Louis or New York delivery. While New York quotations, as a matter of convenience, are commonly used, relatively little spelter actually goes to or comes from New York. The bulk is shipped direct from the plants in the Mississippi Valley to manufacturers, due allowance being made for freight. New York daily quotations are published in this column each week. Below are given averages by months:

	1911.	1912.		1911.	1912.
Jan.	5.45	6.42	July	5.70	7.12
Feb.	5.52	6.50	Aug.	5.95	6.96
Mch.	5.56	6.57	Sept.	5.86	....
Apr.	5.40	6.63	Oct.	6.10	....
May	5.35	6.68	Nov.	6.38	....
June	5.50	6.88	Dec.	6.30	....

Zinc-dust is quoted separately, the price being based upon the cost of spelter in Illinois and the cost of preparation. About half the zinc-dust used in the United States is imported through San Francisco. Delivery prices are determined largely by quantities and contracts.

QUICKSILVER

The primary market for quicksilver is San Francisco, California, being the largest producer. The price is fixed in the open market, and, as quoted weekly in this column, is that at which moderate quantities are sold. Buyers by the carload can usually obtain a slight reduction, and those wanting but a flask or two must expect to pay a slightly higher price. Average monthly quotations, in dollars, per flask of 75 lb., are given below:

	1911.	1912.		1911.	1912.
Jan.	44.60	43.75	July	48.00	43.00
Feb.	48.40	46.00	Aug.	50.00	42.50
Mch.	52.50	46.00	Sept.	47.50	....
Apr.	50.90	42.25	Oct.	46.12	....
May	46.50	41.75	Nov.	45.50	....
June	46.50	41.30	Dec.	44.50	...

TIN

New York prices control in the American market for tin, since the metal is almost entirely imported. San Francisco quotations, averaging about 5c. per lb. higher than New York, are quoted weekly in this column. Below are given average monthly New York quotations in cents per pound:

	1911.	1912.		1911.	1912.
Jan.	41.25	42.53	July	42.40	44.25
Feb.	41.61	42.96	Aug.	43.32	45.80
Mch.	40.16	42.58	Sept.	39.75	....
Apr.	42.18	43.92	Oct.	41.18	....
May	43.11	46.05	Nov.	43.12	....
June	44.61	45.76	Dec.	44.65	....

Current Prices For Chemicals

(Corrected monthly by Braun-Knecht-Heimann Co.)

Prices quoted are for ordinary quantities in packages as specified. For round lots lower prices may be expected, while in smaller quantities advanced prices are ordinarily charged. Prices named are subject to fluctuation. Other conditions govern Mexican and foreign business.

	Min.	Max.
Acid, sulphuric, com'l, 66°, drums, ℔ 100 lb	$0.75	$1.00
Acid, sulphuric, com'l, 66°, carboy, ℔ 100 lb	1.00	1.50
Acid, sulphuric, C. P., 9-lb. bottle, bbl., ℔ lb	0.13	0.18
Acid, sulphuric, C. P., bulk, carboy, ℔ lb	0.09½	0.12
Acid, muriatic, com'l, carboy, ℔ 100 lb	1.60	3.00
Acid, muriatic, C. P., 6-lb. bottle, bbl., ℔ lb	0.15	0.20
Acid, muriatic, C. P., bulk, carboy, ℔ lb	0.10½	0.15
Acid, nitric, com'l, carboy, ℔ 100 lb	5.25	6.50
Acid, nitric, C. P., 7-lb. bottle, bbl., ℔ lb	0.16	0.22
Acid, nitric, C. P., bulk, carboy, ℔ lb.*	0.12½	0.15
Argols, ground, bbl., ℔ lb	0.20	0.25
Borax, cryst. and conc., bags, ℔ 100 lb	2.75	3.85
Borax, powdered, bbl., ℔ 100 lb	3.00	4.00
Borax glass, gd. 30 mesh, cases, tin lined, ℔ 100 lb	10.00	13.00
Bone ash, 60 to 80 mesh, bbl., ℔ 100 lb	4.50	5.50
Bromine, 1-lb. bottle, ℔ lb	0.55	0.65
Candles, adamantine, 14 oz., 40 sets, ℔ case	4.60	4.80
Candles, adamantine, 14 oz., 60 sets, ℔ case	5.25	5.45
Candles, Stearic, 14 oz., 40 sets, ℔ case	5.00	5.20
Candles, Stearic, 14 oz., 60 sets, ℔ case	5.70	5.90
Clay, domestic fire, sack, ℔ 100 lb	1.50	2.00
Cyanide, 98 to 100%, 100-lb. case, ℔ lb	0.20¾	0.24¾
Cyanide, 98 to 100%, 200-lb. case, ℔ lb	0.20	0.24
Cyanide, 129%, 100-lb. case, ℔ lb	0.27½	0.28½
Cyanide, 129%, 200-lb. case, ℔ lb	0.26¾	0.27½
Lead acetate, brown, broken casks, ℔ 100 lb	8.75	9.65
Lead acetate, white, broken casks, ℔ 100 lb	10.00	10.25
Lead acetate, white, crystals, ℔ 100 lb	11.75	12.25
Lead, C. P., test., gran., ℔ 100 lb	13.00	15.00
Lead, C. P., sheet, ℔ 100 lb	15.00	18.00
Litharge, C. P., silver free, ℔ 100 lb	10.50	13.00
Litharge, com'l, ℔ 100 lb	7.50	9.00
Manganese ox., blk., dom. in bags, ℔ ton	20.00	25.00
Manganese ox., blk., Caucasian, in casks, ℔ ton (85% MnO_2—$\frac{3}{4}\%$ Fe)	42.50	50.00
Nitre, double ref'd, small cryst., bbl., ℔ 100 lb	7.00	8.00
Nitre, double ref'd, granular, bbl., ℔ 100 lb	6.50	7.50
Nitre, double ref'd, powdered, bbl., ℔ 100 lb	7.25	8.00
Potassium bicarbonate, cryst., ℔ 100 lb	12.00	15.00
Potassium carbonate, calcined, ℔ 100 lb	15.00	18.00
Potassium permanganate, drum, ℔ lb	0.11	0.12½
Silica, powdered, bags, ℔ lb	0.03	0.05
Soda, carbonate (ash), bbl., ℔ 100 lb	1.50	1.75
Soda, bicarbonate, bbl., ℔ 100 lb	2.00	2.50
Soda, caustic, ground, 98%, bbl., ℔ 100 lb	3.15	3.50
Soda, caustic, solid, 98%, drums, ℔ 100 lb	2.65	2.85
Zinc shavings, 850 fine, bbl., ℔ 100 lb	11.80	13.00
Zinc sheet, No. 9—18 by 84, drum, ℔ 100 lb	10.00	11.25

*Extra charge for packing nitric acid for shipment to conform to regulations.

Current Prices for Ores and Minerals

(Corrected monthly by Atkins, Kroll & Co.)

The prices are approximate, subject to fluctuation, and to variation according to quantity, quality, and delivery required. They are quoted, except as noted, f.o.b. San Francisco. Buying prices marked *.

	Min.	Max.
Antimony ore, 50%, ℔ ton	*$22.00	$25.00
Arsenic, white, refined, ℔ lb	0.05	0.05½
Arsenic, red, refined, ℔ lb	0.08	0.09
Asbestos, according to length and quality of fibre, ℔ ton	100.00	350.00
Asbestos, lower grades, ℔ ton	5.00	50.00
Asphaltum, refined, ℔ ton	10.00	20.00
Barium carbonate, precipitated, ℔ ton	42.50	45.00
Barium chloride, commercial, ℔ ton	42.50	45.00
Barium sulphate (barytes), prepared, ℔ ton	20.00	30.00
Bismuth ore, 10% upward, ℔ ton	*75.00	upward
Chrome ore, according to quality, ℔ ton	10.00	12.50
China clay, English, levigated, ℔ ton	15.00	20.00
Cobalt metal, refined, f. o. b. London, ℔ lb	2.50	
Coke, foundry, ℔ 2240 lb	14.50	15.00
Diamonds:		
Borts, according to size and quality, ℔ carat	2.00	15.00
Carbons, according to size and quality, ℔ carat	50.00	90.00
Feldspar, ℔ ton	5.00	25.00
Firebrick:		
Bauxite, ℔ M	175.00	
Magnesite, ℔ M	190.00	275.00
Silica, ℔ M	42.50	47.50
Flint pebbles for tube-mills, ℔ 2240 lb	19.50	22.50
Fluorspar, ℔ ton	10.00	15.00
Fullers earth, according to quality, ℔ ton	20.00	30.00
Gilsonite, ℔ ton	35.00	40.00
Graphite:		
Amorphous, ℔ lb	0.01½	0.02½
Crystalline, ℔ lb	0.04	0.13
Gypsum, ℔ ton	7.50	10.00
Infusorial earth, ℔ ton	10.00	15.00
Magnesite, crude, ℔ ton	5.00	7.50
Magnesite, dead calcined, ℔ ton	23.50	27.50
Magnesite, brick (see firebrick).		
Manganese ore, oxide, crude, ℔ ton	10.00	25.00
Manganese, prepared, according to quality, ℔ ton	30.00	70.00
Mica, according to size and quality, ℔ lb	0.05	0.30
Molybdenite, 95% MoS_2, ℔ ton	400.00	500.00
Monazite sand (5% thoria), ℔ ton	150.00	200.00
Nickel metal, refined, ℔ lb	0.45	0.60
Ochre, extra strength, levigated, ℔ 100 lb	2.25	3.25
Platinum, native, crude, ℔ oz	40.00	45.00
Silex lining for tube-mills ℔ 2240 lb	32.50	35.00
Sulphur, crude, ℔ ton	15.00	25.00
Sulphur, powdered, ℔ ton	40.00	45.00
Talc, prepared, according to quality, ℔ ton	20.00	50.00
Tin ore, 60%, ℔ ton	450.00	475.00
Tungsten ore, 65%	425.00	475.00
Vanadium ore, 15%, ℔ ton	150.00	180.00
Wolframite (see tungsten ore).		
Zinc ore, 50% up, ℔ ton	*15.00	20.00

James Lewis & Son's Copper Report

During July, standard copper prices have been subject to market attacks, followed by the absorption of large quantities by leading dealers, and considerable covering of previous sales by operators. The result at the end of the month is a rise of 15s. per ton for cash, three months' prompt being unaltered.

From £77 6s. 3d. for cash on July 1, standard fell to £71 13s. 9d. on July 9; but rapidly recovered next day to £75 10s., on receipt of favorable American statistics. It again declined to £72 12s. 6d., and advanced steadily to £79 5s. on July 23, with a backwardation of 2s. 6d. per ton for three months. Prices have since dropped to £77 8s. 9d. for cash, and £77 11s. 3d. for three months prompt; but recovered to £78 12s. 6d. cash on August 1. English warrants available amount to only 27,200 tons, of which 1200 tons is in the form of wire bars and ingots.

European demand for refined copper has been but moderate, manufacturers' requirements being supplied from previous purchases, with a disinclination on their part to carry more stock than is absolutely necessary. A large demand was, however, experienced from American consumers last week, who are reported to have purchased over 10,000 tons of electrolytic copper at 17¾c., leading producers being well sold for October and November delivery. Good orders for English manufactured copper have been booked, and the electrical industry continues very active, both in Europe and the United States, early delivery being unobtainable. There is every prospect of consumption of copper continuing to be very large for many months to come.

The consumption of foreign copper in Germany for the half-year is returned as 109,727 tons.

American shipments from northern ports for July are given as 26,561 tons. The total imports into England and France for the month have been 19,034 tons, and deliveries 17,056 tons fine copper. Chilean copper amounting to 1115 tons has arrived in England, and deliveries 858 tons; while from other countries the totals were 10,027 and 10,297 tons respectively. Liverpool and Swansea received from the United States 2290 tons of bars, 1058 of plate, and 11 of matte, equal to about 3336 tons of fine copper. In London 175 tons was received, and in France 6020 tons. The Chilean charters for the month are advised at 4000 tons, including 1675 tons for the United States. Exports from the former country to July 31 were 21,060 tons, against 18,749 for the same period of 1911.

STOCKS OF COPPER (FINE TONS)

	1912			
Chilean in—	Jan. 1.	May 1.	July 1.	Aug. 1.
Liverpool and Swansea..	4,225	5,203	5,414	5,671
France	714	778	926	1,005
American in—				
Liverpool and Swansea..	12,939	8,215	4,289	3,531
France	4,033	4,690	3,958	5,848
Sundries in—				
Liverpool and Swansea..	786	1,148	574	722
London and Newcastle...	6,462	5,060	4,292	3,918
Birmingham	346	850	392	515
France	507	567	601	623
English in—				
Liverpool and S. Wales..	17,346	14,210	13,735	14,263
Total in England and France	47,358	40,721	34,118	36,096
Sundries in—				
Germany and Holland...	13,400	10,121	6,545	5,578
Total European stocks.	60,758	50,842	40,663	41,674
Afloat—				
From Chile	1,575	2,050	1,475	2,900
From Australia	8,350	7,000	6,000	6,000
Total visible supply...	70,683	59,892	48,138	50,574

Metal Mining in Oregon

The value of the mine production of gold, silver, and copper in Oregon in 1911, according to Charles G. Yale, of the U. S. Geological Survey, was $669,016, against $700,676 in 1910. No output of lead or zinc was reported in either 1910 or 1911. The ore (and 'tailing') treated in 1911 was 94,353 short tons, against 82,132 short tons in 1910. The tailing treated in 1911 amounted to 44,246 tons, against 12,142 tons in 1910, so that the increased total tonnage treated in 1911 was not due to a larger production of crude ore. The production of gold decreased from $679,488 in 1910 to $633,407 in 1911. Gold output from deep mines decreased $43,430, and that from placer mines decreased $2651, compared with the output of 1910.

The production of silver increased from 39,978 fine ounces, valued at $19,428, in 1910, to 45,221 oz., valued at $23,967, in 1911. Of the silver, 34,011 fine ounces was derived from silicious ores, 9953 oz. from copper ores, and the rest from placer mines. The copper ore shipped to smelters amounted to 4205 tons, having a copper content of 93,136 lb., valued at $11,642. This indicates an average recovery of 22.2 lb. of copper per ton. The average recovery of gold and silver from copper ores was $3.32 per ton.

Baker county led in gold production, with an output of $389,786, of which $372,405 was derived from 74,558 tons of silicious ore and from tailing. Josephine county produced $99,363 in gold, of which $86,557 came from placer mines. Of the silver production of 45,221 oz., over two-thirds came from Baker county. Copper ores yielded the greater part of the 10,436 oz. of silver credited to Josephine county, which also produced about 90% of the 1911 output of copper in Oregon.

The combined output of gold from southwestern Oregon in 1911 was $188,971, of which $123,008 was placer gold. The placer gold production of this region decreased $7095 and the deep-mine output decreased $13,258. The mines of northeastern Oregon produced $444,436 in gold in 1911, of which the placer yield was $45,266 and the deep-mine yield $399,170. The placers of this region showed an increase of $4444 and the deep mines a decrease of $30,172.

There were 40 deep mines and 136 placer mines operated in Oregon in 1911. Of the placer mines, 88 were hydraulic, 3 dredging, 9 drifting, and 36 sluicing properties.

PRIVATE PROPERTY in mining lands in Brazil is recognized, but ownership implies certain responsibilities. To the proprietor of lands beneath which mineral deposits are known to exist is secured the first right of exploration. Already known deposits may be registered by their proprietor, whereupon he is granted three years' exemption from taxation in which to begin work; at the end of this term a small tax is levied on the declared or estimated value of the property, which may be expropriated if not being worked. Licensed prospectors may prospect on public or private grounds, and discoveries made on the latter entitle the prospector to expropriate the estate for its surface value as declared by arbitration. Discoveries on public land entitle the discoverer to a grant of the land, with a reasonable period wherein to commence active work.

The number of productive mines in New Mexico in 1911 was 105, of which 20 were placers, as against 108 in 1910, of which 23 were placers. The average total recoverable value per ton of ore produced decreased from $13.89 in 1910 to $11.54 in 1911. There were 232,699 short tons of ore from New Mexico sold or treated in 1911, an increase over the output of 1910 of 40,834 tons. Of this total, 109,113 tons went to amalgamating and cyaniding mills, 59,622 tons to mills for concentrating only, and 63,964 tons went crude to smelters. Of the $452,592 in gold and 771,014 oz. of silver in bullion produced in New Mexico in 1911, the cyanide process yielded $370,472 in gold and 769,608 ounces of silver, the remainder being recovered by amalgamation.

Concentrates

Most of these are in reply to questions received by mail. Our readers are invited to ask questions and give information dealing with the practice of mining, milling, and smelting.

QUICKSILVER to the extent of 35.12% was lost at the Alaska Treadwell mills last year.

USE of petroleum for fuel at numerous *oficinas* in the nitrate field has upset the balance of traffic between Europe and South America. Steamers that formerly took coal from England and Australia to the West Coast and to carry nitrate on the return trip, are now at a loss for outbound traffic.

CONCENTRATE may be fed into an Edwards furnace by means of small screw conveyors working in a cast iron tube or barrel, bolted to the feed-end of the furnace. They may also be fed in by means of a slow-running belt about 14 in. wide, which drops them into a small hole in the top of the furnace at the feed-end. The belt may be fed from a storage bin by a screw or push conveyor.

QUEENSLAND'S gold yield for June was valued at $590,000, a decrease of $132,000, compared with the same month of 1911. This falling off was due to decreases mainly from Charters Towers and Gympie. For the first half of the current year the output was valued at $3,618,000, a decrease of $303,000 on last year. Dividends paid in June totaled $288,500, of which Mt. Morgan paid $240,000. The annual report of the mines department gives the charges for crushing ores at different mining districts in Queensland, the following being at the better known centres: Charters Towers, $2.64 per ton; Chillagoe, $2.88; Croyden, $2.40; Etheridge, $3; Gympie, $1.68; Mt. Morgan, $3.60; and Palmer, $4.80 to $6 per ton.

PLATINUM, according to the U. S. Geological Survey, was produced only in California and Oregon among the United States in 1911. The total output was 628 oz., valued at $18,138, compared with 390 oz., valued at $9507, in 1910. Importations of crude platinum sand in 1911, resulted in an estimated refined product of 27,500 oz. An additional amount was derived from imported ore and matte, so that the total refined platinum produced in domestic refineries was 29,140 fine ounces. The platinum imports for consumption in the United States in 1911 were valued at $4,866,207, an increase of $1,212,543 over those of 1910. Exports amounted to $8139. The world's production of the metal in 1911 was 314,323 oz., compared with 286,952 oz. in 1910.

DURING the year ended December 31, 1911, the Han-Yeh-P'ing Iron & Coal Co., Ltd., produced 93,337 tons of pig iron and 24,216 tons of rails. Of the former, 4465 tons was exported to the United States, 5765 tons to Australia, and 58,535 tons to Japan. From the company's Tayeh iron mines 359,467 tons of ore was produced, of which 110,500 tons was exported to foreign ports during 1911. Owing to the revolution in China, the iron and steel works at Hanyang have been shut down since last October, but work will soon be resumed, the furnaces not having been so seriously injured as was expected by their being abandoned while charged. The iron mines were worked right through the fighting. All the foreign experts formerly employed have been discharged.

ROASTING a concentrate containing 20 to 30% sulphur in an Edwards furnace, an important factor in successful results is the free access of air on the hearth, and keeping the temperature of the feed end of the furnace as low as possible. It was found at the Horse Shoe mine that minute particles of concentrate became oxidized on the exterior, while the interior was practically unroasted. To remedy this defect, all the side ports were left open except the last four on the finishing hearth, with the result that a greater roasting capacity per furnace, and a sweeter roast were attained. Additional air is also admitted to the furnaces by having all the rabble spindles, not water-cooled, hollow, so that a strong current of air is drawn down through each spindle, and on the concentrate being roasted.

DRY CLEANING of coal has been adopted in Franklin county, Illinois, and a process adapted from the anthracite region of Pennsylvania is in use. The coal is first carefully sized on a series of gyratory screens, and then by a spiral separator which makes three products: coal, bone coal, and 'slate.' The spiral separator consists of a centre column, with a series of spiral bands, down which the coal and slate slide. The coal maintains a fixed path as long as the friction of the coal on the chute and the centrifugal force balance. As the velocity increases, to where it overcomes the friction, the coal moves over the outer edge of the spiral plate and is carried off through a hopper. The slate, with a higher coefficient of friction, follows the regular path down the spiral and at the bottom goes into the refuse pocket. The bone coal takes a path between the two and slides to the outer edge of the spiral, but does not follow the coal over the edge. It is delivered at the bottom through a special gate, and may then be conveyed to the boiler house.

GAS-ENGINES of many makes are used to a large extent in Western Australia for driving mills, generators, and all types of industrial machinery, with generally satisfactory results. In the issue of the *Mining and Scientific Press* of August 3, in a paper on the Yuanmi mill, mention was made of the Crossley gas-engine driving 20 stamps, tube-mill, and slime plant. In the June issue of the Chamber of Mines *Journal*, W. R. Degenhardt gives full details of a test of this engine, the following being a few of the more important data obtained:

Horse-power at sea-level	200
Cylinder, inches	24 by 32
Speed, revolutions per minute	166
Hours run for month	734
Brake-horse-power (average)	147
Explosions per minute	83
Pounds of charcoal used per hour	147
Pounds of charcoal used per hp-hr	1
Cost per ton of charcoal delivered at generator	$14.16
Cost of charcoal per hp-hr., cents	0.63
Gallons of condensed water used	16,165
Gallons of lubricating oil used	147
Total costs per hp-hr., cents	1.38

STOPING by the 'rill' system it becomes necessary, in handling the broken rock, to make connections between levels by raising and winzing about every 100 or 150 ft. along the orebody. After the leading stope is taken off for the full length of a drift, the level is timbered. Single stulls up to 14-ft. width are put in. If the span is too great for stulls, set timbers or saddleback stulls are used. Stulls are lagged over with slabs or 4-in. poles, and wooden chutes are built at intervals of 50 feet. Ore passes are cribbed up through the filling directly above each chute, and are built of 7-in. round or 3 by 9-in. square timber, the passes measuring 4 by 4 ft. in the clear. Occasionally a double pass may be carried up, one side serving as a traveling way. Stoping is commenced off the winzes, and rills are gradually formed, one on either end of each winze. The rills are generally at an angle of 37° off the horizontal, this allowing for the boring of all water-holes. After the rill is cut through, and the ore, which gravitates down the rill to an ore-pass, is cleaned up, machines are shifted to another position of the stope, ore-passes built, and the stope filled. The filling, generally consisting of residue, is dumped down the winzes from the level above, and gravitates down the rill into position, although at the extreme points of rills, a certain amount of handling is required.

Decisions Relating to Mining

Specially reported for the MINING AND SCIENTIFIC PRESS.

CONFLICTING LOCATIONS

The location or extension of a mining claim upon ground within the marked boundaries of another valid and subsisting location is absolutely void for the purpose of founding a contradictory right, and it is immaterial that the overlapping locator was the first to make a discovery either within or without the overlapping area.

Becker *v.* Long (Alaska), 196 Federal, 721. June 4, 1912.

CLAY NOT A 'VALUABLE' MINERAL

The Land Department is of the opinion, from an examination of standard authorities on cement materials and manufacture, that clay suitable for use in the manufacture of portland cement is so widely distributed that its value in a natural state in place constitutes such a small element of the cost of the manufactured product, and that its practical availability as a cement ingredient is so largely dependent upon the existence of certain extremely favorable artificial or natural conditions, it cannot properly be regarded in and of itself as a valuable mineral deposit within the meaning of the mining laws, and hence is not subject to location as a placer claim.

Bettancourt *v.* Fitzgerald (Land Department), 40 Land Decisions, 620. January 29, 1912.

EXTRACTION OF MINERALS TO DETRIMENT OF SURFACE

A land-owner conveyed a certain tract to the plaintiff in this case, reserving all minerals under the surface. Subsequently the owner conveyed to the defendant all subsurface mineral rights, but in extracting the shale, which was the mineral in question, defendant greatly damaged and injured the surface of the ground. In a suit to enjoin further mining operations it was held: (1) that shale was a mineral within the meaning of the reservation clause in the deed, (2) that defendant acquired by the grant of mineral rights the right to sink shafts, slopes, drifts, or to make openings of a character reasonably necessary and convenient for mining operations, but where the stratum of mineral lies so close to the surface that it cannot be mined without destroying the surface in its natural state, the mineral so located cannot be mined.

Bibby *v.* Bunch (Alabama), 58 Southern, 916. June 4, 1912.

MINING LAWS APPLICABLE TO ALASKA AMENDED

By an Act of Congress, approved August 1, 1912, the mining laws applicable to Alaska have been amended as follows:

1. No association placer-mining claim shall hereafter be located in Alaska in excess of 40 acres, and $100 assessment work shall be done each year and until patent for each and every 20 acres or excess fraction thereof.

2. No person shall locate any placer claim in Alaska as attorney for another unless he has a duly acknowledged power of attorney on record in the recorder's office of the judicial division where the location is made. Any person so authorized may locate placer claims for not to exceed two other persons under his power of attorney for them, and not to exceed two placer claims for each of said principals during any calendar month.

3. No person may locate or cause or procure to be located for himself more than two placer claims in any calendar month, provided that one or both of such locations may be included in an association claim.

4. No placer-mining claim hereafter located in Alaska shall contain a greater area than is fixed by law nor which is longer than three times its greatest width.

5. Any placer attempted to be located in violation of this Act shall be null and void, and the whole area thereof open to location as if no such prior attempt had been made.

Act of Congress, approved August 1. (Not yet published.)

Recent Publications

SLAGGING TYPE OF GAS PRODUCER. By C. D. Smith. Bureau of Mines Technical Paper 20. 14 pp.; ill. Washington, 1912.

RESULTS OF SPIRIT-LEVELING IN ALABAMA. By R. B. Marshall. U. S. Geol. Surv. Bull. 517. 36 pp.; ill., index. Washington, 1912.

ONONDAGA FAUNA OF THE ALLEGHENY REGION. By E. M. Kindle. U. S. Geol. Surv. Bull. 508. 139 pp.; ill., map, index. Washington, 1912.

FUEL BRIQUETTING IN 1911. By E. W. Parker. Advance chapter from 'Mineral Resources of the United States, 1911.' 12 pp. Washington, 1912.

COAL FIELDS IN UINTA AND WASATCH COUNTIES, UTAH. By C. T. Lupton. U. S. Geol. Surv. Bull. 471-I. 52 pp.; maps. Washington, 1912.

PRODUCTION OF BARYTES IN 1911. By W. C. Phalen. Advance chapter from 'Mineral Resources of the United States, 1911.' 8 pp. Washington, 1912.

IGNITION OF GAS BY MINIATURE ELECTRIC LAMPS WITH TUNGSTEN FILAMENTS. By H. H. Clark. Bureau of Mines Technical Paper 23. 5 pp. Washington, 1912.

ALASKA MINING INDUSTRY IN 1911, AND RAILWAY ROUTES IN ALASKA. By A. H. Brooks. U. S. Geol. Surv. Bull. 520-A. 90 pp.; maps, tables. Washington, 1912.

PRODUCTION OF MINERAL PAINTS IN 1911. By W. C. Phalen. Advance chapter from 'Mineral Resources of the United States, 1911.' 25 pp. Washington, 1912.

PRODUCTION OF TIN IN 1911. By Frank L. Hess. Advance chapter from 'Mineral Resources of the United States, 1911.' 12 pp. Tables. Washington, 1912.

PRODUCTION OF MAGNESITE IN 1911. By H. S. Gale. Advance chapter from 'Mineral Resources of the United States, 1911.' 17 pp.; maps. Washington, 1912.

PRODUCTION OF BORAX IN 1911. By C. G. Yale and H. S. Gale. Advance chapter from 'Mineral Resources of the United States, 1911.' 12 pp.; maps. Washington, 1912.

PROCEEDINGS OF FOURTH ANNUAL DRAINAGE CONVENTION HELD AT ELIZABETH CITY, NORTH CAROLINA. By J. H. Pratt. State Geol. Surv. Paper 26. 45 pp. Raleigh, 1912.

GAZETTEER OF SURFACE WATERS OF CALIFORNIA. PART I—SACRAMENTO RIVER BASIN. By B. D. Wood. U. S. Geol. Survey. Water-Supply Paper 295. 99 pp. Washington, 1912.

PRODUCTION OF PLATINUM AND ALLIED METALS IN 1911. By W. Lindgren. Advance chapter from 'Mineral Resources of the United States, 1911.' 19 pp. Washington, 1912.

PRELIMINARY REPORT OF THE GEOLOGY AND ORE DEPOSITS OF CREEDE, COLORADO. By W. H. Emmons and E. S. Larsen. U. S. Geol. Surv. Bull. 530-E. 26 pp. Washington, 1912.

REPORT ON MINING OPERATIONS IN THE PROVINCE OF QUEBEC DURING THE YEAR 1911. By Theo. C. Denis. Canadian Department of Mines. 207 pp. Ill., index. Quebec, 1912.

PRODUCTION OF IRON ORE, PIG IRON, AND STEEL IN 1911. By E. F. Burchard. Advance chapter from 'Mineral Resources of the United States, 1911.' 58 pp. Ill. Bibliography. Washington, 1912.

CARLYLE OIL FIELD AND SURROUNDING TERRITORY. By E. W. Shaw. U. S. and Illinois Geol. Surv. THE CARLINVILLE OIL AND GAS FIELD. By F. H. Kay. Ill. State Geol. Surv. Bull. 20. 50 pp.; maps. Urbana, 1912.

PROCEEDINGS OF SECOND ANNUAL CONVENTION OF THE NORTH CAROLINA FORESTRY ASSOCIATION, HELD AT RALEIGH, NORTH CAROLINA. By J. S. Holmes. FOREST FIRES IN NORTH CAROLINA DURING 1911. By J. S. Holmes. Suggested Forestry Legislation. State Geol. and Econ. Surv. Paper 25. 71 pp. Raleigh, 1912.

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EDITORIAL

WHY has not the Chinese Republic been recognized by the United States? Is this more of the "dollar diplomacy"?

CANANEA seems safe from the rebels for the present, as the Federal troops have been reinforced. Mexican troops have been allowed to cross United States territory, and it will be but an easy step from that, if need be, to allow United States troops to follow raiders across the border.

CAREFUL investigations of the coal and transportation problems of Alaska are under way. The new Alaska Railroad Commission has already sailed for Seward and a party of engineers from the Bureau of Mines is about to start for Katalla. Delay in passing the appropriation bills at Washington precludes much work being done this season, but, with large parties, something at least may be accomplished.

SEASONS are short at Nome, and work must move fast through the summer months. The first boat in and the last boat out are always crowded. Usually the last boat comes down late in October, after which communication is only by dog train to Fairbanks, and so out to the coast. By error we announced in our news columns last week that the last boat had already left for Nome. The well known *Senator* will, however, go up as late as October 7.

FROM a report made by an 'engineer,' the following sentences are culled: "The vein occupies a fissure of large extent horizontally and perpendicularly along the axes of an incline, with a strike north and south standing perpendicularly." * * * "Working of this mine consists of approximately 8000 feet and a shaft 600 feet deep, originally operated as a tunnel to a depth of about 400 feet." Interesting food for reflection may be found in determining whether an incline "standing perpendicularly" is a greater natural wonder than a tunnel which has been plunged into the earth to serve as a shaft.

OUR circle of special correspondents has again been broken, this time by the death of T. Lane Carter, at Dillon, Montana. Our readers have received much both of pleasure and information from his writings, and join us, we are sure, in extending sympathy to Mrs. Carter. The affair is all the more tragic in that Mr. Carter's death occurred while they were on their wedding journey, in which business and pleasure had been combined. While details are still lacking, Mr. Carter is known to have lost his life while examining the Polaris mine. He was one of the young American engineers who first made a name for himself in foreign lands, and he was one who cultivated not only the art of doing things, but that of describing them as well. His work carried him to the queer places of Africa, Central America, and other countries, and he saw clearly the human as well as the technical side of mining engineering. We print elsewhere a brief account of his life.

APPARENTLY Judge W. H. Pope thinks he has solved the old problem of how to eat your cake and still have it; at least he seems to have decided in the Stratton's Independence case that removal of ore from a mine does not cause an irreplaceable loss, and that therefore it is not to be charged to depreciation. The matter came up in connection with the United States excise law regarding income of corporations. Since that law went into effect there has been a fairly startling change in mine bookkeeping and lively competition among operators to show their losses. Without having the decision before us, we are unable to say upon what ground Judge Pope directed a verdict against the company, but certainly exhaustion of ore reserve constitutes depreciation, if that word has any meaning. The case has been appealed to a higher court for final decision.

LAST week the sixth session of the International Association for Testing Materials assembled at New York. This is one of the most important international engineering societies, one that has pursued a consistent constructive program. Americans will be glad to welcome visiting members of the association. The meeting in New York at the same time as the International Congress of Applied Chemistry assured a good attendance of foreign scientists. Excursions, we understand, have been arranged to Washington, Pittsburg, Buffalo, Niagara, and other points. Incidentally there is to be an international conference of the directors of mining experiment stations at Pittsburg, and the engineers of the United States Bureau of Mines are to have the privilege of submitting their work and program to the disinterested criticism of foreign experts. Experimental work is expensive, and coördinate results only are reliable. Coöperation is therefore especially important in this field.

TRAINING miners, as distinguished from mining engineers, has received too little attention. In the old days there was in mining, as in other industries, an established system of apprenticeship. Under the pressure for men, incident to the rapid expansion of mining, the old system has gone and nothing has taken its place. In South Africa there is a chronic shortage of even the most unskilled labor, and the project of substituting in part of the work a smaller number of trained men, offers fascinating possibilities. Attempts in this direction have met with only moderate success, and there is a deep-seated belief that where white men and black men work in the mines, the former will not do any manual labor. This is not true in American mines, and, while the conditions are by no means parallel, the fact affords basis for hope. More efficient workmen are needed in the mines as badly as anywhere, and if the standard of living is to continue to rise, the standard of performance must also go up. Mr. M. W. von Bernewitz reviews elsewhere some of the efforts being made to meet this problem, but the outlook is evidently not particularly encouraging. It ought to be possible to devise a system that would train men to perform well the work before them and at the same time open the way of promotion to those showing especial ability and diligence. In the coal mines of the United States, where the influx of ignorant and untrained men has been especially large, multiplication of petty bosses affords some relief. The opportunity for study unfortunately is afforded almost entirely by correspondence courses conducted by private corporations. The American states, notably liberal in their educational work, have done practically nothing to help men already employed in their industries. In the West an exception must be made in favor of the Virginia City School of Mines, where Mr. D. T. Smith gives, to a small number, individual practical instruction along lines helpful to miners, millmen, and prospectors. While perhaps an occasional graduate mistakes himself for a mining engineer, as does his fellow-graduate from more pretentious institutions, the main work of the school is good and helpful. If we are to keep pace with our competitors and with our own desire for increased luxury in living, we must frankly face this problem of training somebody to do the work of the world.

ANNOUNCEMENT that the Freeport Sulphur Company is about to begin production at Bryan Heights, Texas, attracts renewed attention to the curious domes of the Gulf Coastal Plain, from which gas, oil, sulphur, and salt are being won. Mr. Gilbert D. Harris has described these domes in much detail and has explained them as due to the upward thrust developed by salt crystallizing when deposited by artesian water returning to the surface along the intersections of crevices. The theory, which is substantiated by many detailed facts, is a very pretty explanation, and the whole subject of the domes is one of much interest to economic geologists. Credit for recognition of their economic importance is due Mr. A. F. Lucas, who, it will be recalled, was the moving spirit in pioneer drilling at Spindle Top, near Beaumont. Before others were ready to believe that these insignificant mounds, which rise but a few feet above the surface, had any structural significance, he became convinced that they were genetically related to petroleum. We are glad to know that an ample fortune was the reward of his clear thinking and courage. Mr. Herbert Frasch was another who by courageous work won fortune from these domes at the same time that he enriched his profession through development of the technology of the sulphur industry. Just how the Freeport Sulphur Company and the Union Sulphur Company are to get along remains to be seen, but the whole series of discoveries reinforces the old rule that even most insignificant topographic features may often be studied with profit by geologists and engineers.

WORK of the giant converter at the Great Falls plant of the Anaconda Mining Company continues to be a source of both astonishment and satisfaction. Later results than those given in these columns August 7 show a production of 52.3 tons of copper in a single 'blow,' the total time required being 8.5 minutes per ton of copper, or 6.1 minutes actual blowing time per ton of copper. This is at the rate of over 200 tons of blister copper per day from a single converter. A better conception of this enormous converter may be derived from the statement that it is considerably larger than a good sized room, air is blown into it at the rate of three-fourths ton per minute, and a single charge yields a carload of blister copper. The advantages of the upright, or Great Falls, type of converter have been slow in finding recognition, but it is now being employed for new construction in a number of plants in the Southwest and Mexico. This 20-foot converter further demonstrates that, in addition to first securing a proper coating upon the basic lining, the essential feature of successful operation is temperature control, which is the more easily secured the larger the mass of hot material that is handled. The heat lost by radiation and carried away by escaping gases is of less importance in a large converter, while the opening at the mouth renders it possible to add unlimited quantities of cold material to keep the temperature down. Much of the trouble formerly experienced in the operation of converters was probably due to using too small a mass of material; just as, for example, a tack-hammer would be ineffective in hand-drilling.

SMELTING is an industry which exhibits many mutations as the supply of ore available changes in character by the working out of old mines and opening of new ones, or by alterations in composition due to increased depth of working. Transportation facilities are equally potent, and ores may become available through a decreased freight rate, or through a lower smelting rate made possible by increased facilities for securing cheap fuel and supplies at the smelting plant. Interesting examples of this are the changes during the past year at the smelting plants in operation at Tacoma, Washington, and Tooele, Utah. In former years the Tacoma plant smelted a considerable quantity of lead ore, derived from the Coeur d'Alene and from the Northwest generally, as well as copper ore, derived largely from British Columbia. Since the Alaska copper mines have become steady shippers and the mines upon the west coast of British Columbia have increased their output, the copper ore-supply of the Tacoma smelter has so largely increased that the plant is now in course of reconstruction under the direction of Mr. W. H. Howard, and a year from now will become one of the important copper smelting plants of the United States, while the lead ores will be diverted to the Selby plant, on San Francisco bay. The Tooele smelter was first built as a copper smelting plant and only recently have lead furnaces been added. The ore supply for these has proved so plentiful that the lead smelting now seems likely to overshadow the copper. As an example of how short the normal life of a successful plant may sometimes be, the Granby copper smelter may be cited. This plant was built twelve years ago and has been smelting ores from the mines owned by the company at the rate of over one million tons per year. Every mine has a bottom, especially when worked at so rapid a rate, and the known ore reserve is expected to last but five or six years more. Meanwhile the company is erecting a smelter at its recently-purchased Hidden Creek mines, and will take up smelting at Granby bay before the end comes at Grand Forks. Such is the isostasy of industry.

San Francisco and the International Engineering Congress

Last winter preliminary steps were taken toward the organization of an international engineering congress to assemble at San Francisco in 1915. Representatives of the national societies, selected after conference with the officers of each organization, met and outlined a plan which has already been made public. It was proposed to hold a series of meetings at some convenient time in 1915, at each of which one of the national societies should act as host to foreign organizations of engineers in the same line of work. Local arrangements were to be in charge of a local committee, but invitations were to be extended in each case by one of the national societies. For example, the plan contemplated that the American Institute of Mining Engineers and the Mining and Metallurgical Society of America should meet at San Francisco at the same time or in quick succession and should extend invitations to that meeting to the Canadian Mining Institute, the Mexican Institution of Mining and Metallurgy, the Mining Institute of Japan, the Australian Institute of Mining Engineers, and others. As a preliminary step, engineers resident in California undertook to raise a general guarantee fund of $10,000, and the Exposition officials offered to furnish a suitable auditorium and meeting rooms. A large part of the guarantee fund has been pledged and plans for the auditorium have been approved. Recent conferences between representatives of the local committee and the conference committee of the national societies in New York, developed some differences of opinion as to the conduct of the proposed congress. The western representatives, Messrs. W. F. Durand and George W. Dickie, promptly made it clear that the Californians were not insistent upon any particular detailed plan, but were ready to work under any that was likely to produce good results. As finally agreed, the conference committee is to recommend to the societies represented, that the congress be under the control of a general committee of thirty, consisting of the president and secretary and four local members of each of the following five societies: The American Society of Civil Engineers; American Institute of Mining Engineers; American Society of Mechanical Engineers; American Institute of Electrical Engineers; and American Society of Naval Architects and Marine Engineers. It was further proposed that an additional fund of $30,000 be raised, apportioned as follows: civil engineers, $9000; electrical engineers, $9000; mining engineers, $5000; mechanical engineers, $5000; naval architects and marine engineers, $2000. This plan is to be referred to the societies concerned for acceptance, and in the meantime nothing can be done.

It will be noted that not all the national societies are included in this revised plan, and this, we believe, is a mistake. While the older societies may naturally be expected to take the lead, there are several young but vigorous organizations that should be invited to take part. For example, any one cognizant of the relative financial conditions of the American Institute of Mining Engineers and the Mining and Metallurgical Society of America, will at once recognize that the latter is in much the better position to give financial aid to the proposed congress. The money matter is, however, by no means the most important. If the congress is to accomplish all that is expected, the big engineers of the world must be brought together. That involves prompt issuance of invitations, since society programs are usually made several seasons in advance. Furthermore, a well considered program must be laid out and much preliminary work must be done. The best sessions of the International Congress of Geologists have been determined six years in advance, and the most important work, such as the world's conference on iron-ore resources that marked the meeting in Sweden, resulted from two or three years' work of international committees. The Canadians are preparing for next year's meeting a corresponding monograph on the world's fuel resources. What could be more appropriate as a general topic for the meeting of 1915 than the world's gold resources? California, first made known to the rest of the world through the discovery of gold, would be an especially appropriate place for taking stock of the known and suspected reserve still in the crust of the earth. Such questions as to whether the supply of gold may be expected to increase in ratio with the world's trade; whether we must look for increase to discovery of veins or improvement in process; whether 'scientific prospecting' will pay; whether the present land laws hinder or help development; all these are at once of world-wide and of intense local interest. The opportunity afforded by the proposed international gathering for a general survey and summing up of these problems is unique. With proper foresight, through coöperation of the American Institute of Mining Engineers, the Mining and Metallurgical Society, and the Geological Society of America, with the help of the affiliated and the foreign societies, a monumental piece of work may be accomplished. It is necessary, however, to act promptly, and we would respectfully call attention to the fact that at present the whole program is stalled for want of action by the societies having headquarters in New York.

Gold-Dredging in the Boise Basin of Idaho

By John H. Miles

The history of Idaho practically commences with the discovery of gold in 1862, in what is known as the Boise Basin, an area of some fifteen miles square. As many as twenty thousand people worked in the placer mines in the sixties. In '63 the output was reported as $5,000,000; in '64, $10,000,000, the amount being probably greater than these figures, as much was taken out of the district that did not pass through Wells-Fargo hands. Many estimates of the total output to date place it between one hundred and two hundred millions of dollars, and some claim even higher figures. In those early days much fairly good ground at creek level was left because of the expense of working it by hand, and many of these spots were covered by tailing from hillside claims. Later, elevators were used to some extent to work such places. Experience has shown that creek-bottom ground is best worked by dredges.

BOW OF DREDGE, WITH LADDER STOPPED FOR OILING.

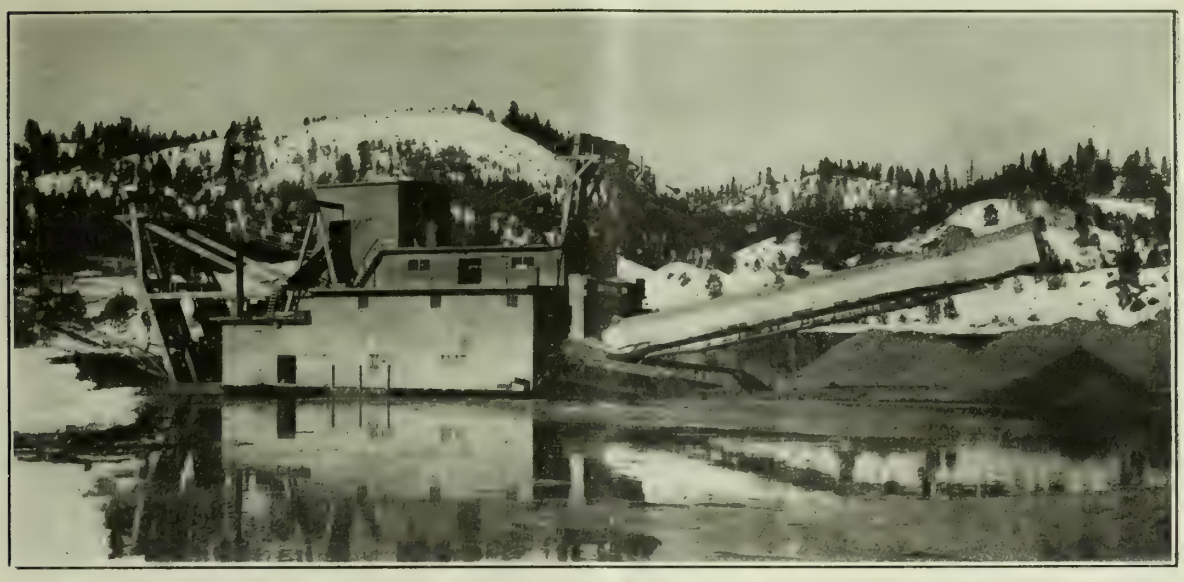
In the spring of 1898 the Bed Rock Dredging Co., a corporation owning 200 acres of land at Placerville, Idaho, constructed a dredge of the Bucyrus type, open-link, double-lift, with 5-cu. ft. bucket capacity. After a month's work in the second season, the dredge was shut down.

In the same year the Centerville Gold Dredging Co. built a dredge of the same type to work its property above Centerville. This dredge was operated all of the season of 1899, was remodeled in 1900, worked during the season of 1901, two months of 1902, and the season of 1903, when it ceased operations. The Bullion Dredging Co. also built a dredge and operated one season. The power for the operation of these dredges was supplied by a plant on Grimes creek, which used a Pelton wheel at high head. On commencing work it was found that the water-supply was insufficient to develop the necessary power, which fact accounts largely for the intermittent operation of the dredges and for the final cessation of work. The Moline Mining Co., operating a Risdon dredge by steam power, with wood as fuel, dredged near Placerville for five years, averaging eight months per season. By working three 8-hour shifts, 1400 cu. yd. was handled per day. The buckets were of the open-link type and 5-cu. ft. capacity. Operations ceased in the fall of 1911, as the ground became deeper than the dredge could handle.

In the fall of 1908 the Boston Gold Dredging Co., managed and owned largely by the late Charles Souther of Boston, built a 3½-cu. ft., open-connected Risdon dredge two miles below Idaho City. The dredge worked successfully until the fall of 1905, when it sank. It was then considered too old to be worth raising, and was abandoned after having worked over about 38 acres. A dipper dredge was built in 1901 near Idaho City. Although it was remodeled in 1902, in 1903, and again in 1904, it did not prove a success, and was abandoned the same year that the neighboring dredge sank, after handling only 11 acres. Both boats were steam operated, using wood as fuel.

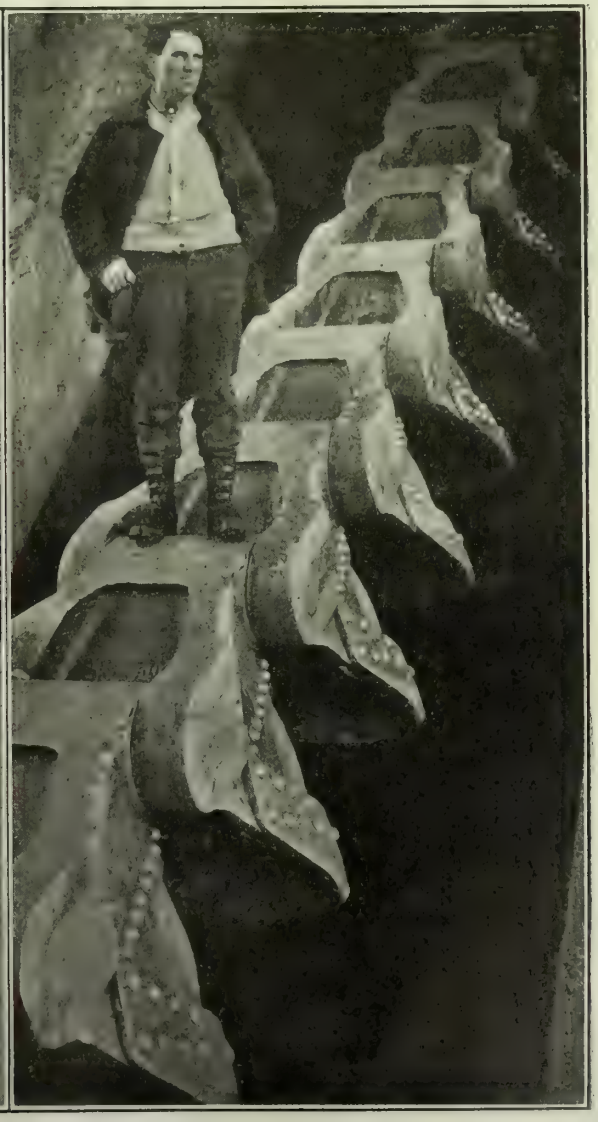
Shortly after this the stock of the company was taken over by F. W. Estabrook, of Boston, who at that time was dredging in the California field. Under new management the ground was carefully re-drilled. Plans were made to secure a better and cheaper power supply, and the spring of 1909 saw the completion of a modern power plant about 22 miles from the dredging field. In July 1909, a 5-cu. ft. Risdon dredge was moved from California to the lower portion of the Idaho City property. This dredge has proved quite successful and is handling at present an average of 68,000 cu. yd. per month. The buckets were formerly of the open-connected type, but have been changed to the close-connected type.

A 15-cu. ft. California type dredge built by the Yuba Construction Co., of Marysville, for the Boston & Idaho Gold Dredging Co., on ground above Idaho City, commenced dredging in May 1911. This dredge (and also the smaller one) has worked continuously through the winter months, night and day, and except for minor repairs, has been in constant use up to the present time, notwithstanding the fact that at times the thermometer has stood as low at 22° below zero. From October 1911 to April 1912 the average width of the pond in which this dredge has dug was 720 ft., with an average depth of 32½ ft. The maximum run was made in October, when 361,876 cu. yd. was handled. For the past twelve months this dredge has handled an average of 307,628 cu. yd. per month at 80.1% running time. The ground carries a great deal of sand, and it is often necessary to run the top material dry. The company owns 680 acres on Moores creek and Elk creek. Although the lumber for both dredges came from the company's own mills and a material saving was effected, it has proved rather expensive to get other portions of the boats, the average railroad freight on the steel and castings being $1.65 per hundred pounds, and team freight from the nearest railroad point (Boise, 36 miles distant) varying from ¾ to 1¼ cents per pound.



GENERAL VIEW OF DREDGE, WITH COVERED TAILING STACKER.

LOADED BUCKETS COMING UP.



EMPTY BUCKETS GOING DOWN.

An idea of the size of the Yuba dredge will be obtained from the illustrations and the following details:

Length of hull	125 ft.
Width of hull	52 ft.
Overhang on each side	5 ft.
Depth of hull	11.5 ft.
Lumber in hull	700,000 bd. ft.
Length of digging ladder	97 ft.
Weight of digging ladder	60 tons.
Capacity of bucket	15 cu. ft.
Number of buckets	68
Number buckets dumped per minute	22
Weight of each bucket with pin	4200 lb.
Boiler, for heating purposes only	80 hp.
Pipe, 2-in., for heating only	1 mile.
Weight of upper tumbler and shaft	14 tons.
Diameter of shaft	25 in.
Length of shaft	14 ft. 11 in.
Weight of lower tumbler and shaft	11 tons.
Diameter of shaft	14 in.
Tie-rod through lower shaft	4 in.

SCREEN

Length	50.5 ft.
Diameter	9 ft.
Size holes in screen	7/16 to 5/16 in.
Weight of screen	111,921 lb.

PUMPS

	Ft. Head.
1 high-pressure, 14-in.	60
1 low-pressure, 14-in.	30
1 priming, 5-in.	70

BELTS

	Width, in.	Length, ft.
Conveyor	42	235
Main drive	30	80
Ladder hoist	30	60
Screen drive	18	60
Winch drive	18	50
Stacker hoist	6	40

CABLES

	Thickness, in.	Length, ft.
Head-line	$1\frac{1}{2}$	1000
Ladder hoist (2)	$1\frac{1}{8}$	1600
Stacker hoist	$\frac{7}{8}$	600
Bow swing (2)	1	3000
Stern swing (2)	1	1600

MOTORS

Use.	Type.	Speed	Voltage	Capacity, hp.
Main drive	Variable speed	0-450	2200	300
High-pressure pump	Synchronous	600	2200	275
Low-pressure pump	Constant speed	600	2200	75
Screen drive	Constant	600	2200	75
Stacker drive	Variable	0-600	2200	50
Winch	Variable	0-600	2200	35
Priming pump	Constant	900	2200	20
Exciter set	Constant	600	110	10
Drill press, etc.	Constant	900	110	2

Power is supplied to the dredges from the company's plant on the south fork of the Payette river, where one of the highest rock-filled timber dams in the country was completed in 1909. Two pairs of Leffel Sampson water-wheels are direct-coupled to two 450-kw. generators that furnish 2-phase current at 500 volts and 30 cycles to the transformers, which step the voltage up by means of 'Scott' connection to 19,050 volts, 3-phase. A peculiarity of the system is that the neutral point of the 3-phase side of the Scott system is grounded at the station, a special tap being provided on the transformers for this purpose. This arrangement permits the use of all of the 11,000-volt transformers first used by the company, by star-connecting them. A break in a single line wire has allowed the operation of considerable load, two wires and the earth completing the circuit to two transformers out of three. After passing over some 27 miles of line, the current is stepped down to 2200 volts, 3-phase, for use on the dredges, being finally taken aboard through armored cables. Owing to the fact that the new load due to the Yuba dredge would make the total load on the power-plant somewhat more than its kilowatt rating, it was decided that the power factor must be increased to avoid overheating the generators and to help the regulation of the system. Accordingly, the specifications were changed to have the 150-hp. induction motor operating the high-pressure pump replaced by a 275-kw. synchronous motor. Dredge engineers were reluctant to do this, fearing that it would prove too complicated and delicate a piece of apparatus for dredge work. However, the motor has proved entirely satisfactory, and has improved the regulation as expected. With leading current equal to the full capacity of the motor windings, the power factor at the plant varies from 97 to 99% lagging. It is possible to bring this motor to synchronous speed with the pump full and discharge-valve closed, but the method used in priming is to start the pump empty and admit a 5-in. stream from the priming pump to the suction pipe of the 14-in. pump, leaving the discharge-valve fully open.

TURNING OFF THE LOWER TUMBLER SHAFT FOR NICKEL STEEL SLEEVES, IN THE FIELD.

The altitude at Idaho City is 4200 ft. Owing to the dryness of the climate and the intensity of the summer sun, some trouble is experienced through the rapid deterioration of rubber-insulated cables lying on the sand of the creek bottom, and cable-makers propose to furnish varnished cambric cables with waterproofed covering and outer armor for this service. Winter imposes severe mechanical strains on a cable, owing to the depth of the snow and heavy crust at times. The usual galvanized-wire armor, while necessary to the strength and protection of the cable, greatly increases its weight and adds much to the difficulty of handling it in winter. In general, aside from trouble at times with ice in the ponds in extremely cold weather, dredging in Idaho compares quite favorably with that in California fields.

MINING in Uruguay remains almost stagnant, owing to lack of transportation facilities, scarcity of labor, and insufficient legal protection. New railways under consideration should help the first difficulty. Two American geologists have been engaged to organize a geological survey. The total mineral exports during the first half of 1911 were valued at $328,786. Boring for coal is under way, while graphite and asphalt are being mined. A cement factory with an annual capacity of 300,000 bbl. has been built at Sayago. The country contains a great variety of minerals in payable quantities.

Geology and Ore Deposits of Creede, Colorado

By W. H. Emmons and E. S. Larsen

*The Creede mining district is situated in Mineral county, southwestern Colorado, near the eastern border of the elevated region generally known as the San Juan mountains. In the eighties the upper portion of the valley of the Rio Grande was a route of transportation between Wagon Wheel Gap and the flourishing camps near Silverton and Lake City. This route passed very near the present site of Creede and nearer still to Sunnyside, a small camp about two miles west of Creede. Some of the Argonauts halted on the way long enough to prospect the steep mountain slopes along the valley, and, finding encouraging indications, located several claims. J. C. McKenzie and H. M. Bennett located the Alpha, at Sunnyside, April 24, 1883, and with James A. Wilson pegged out the Bachelor claim, near the present site of Creede, July 1, 1884. Some prospecting was done in the middle eighties, principally at Sunnyside, and futile attempts were made to work the ores in arrastres. There is no record of any new discoveries from 1886 until August 1889, when N. C. Creede, E. R. Naylor, and G. L. Smith located the Holy Moses mine on Campbell mountain. The following summer Mr. Creede located the Ethel, and C. F. Nelson located the Solomon claim. The mining district that was formed was called the King Solomon district; it is east of and nearly contiguous to the Sunnyside district.

When it became generally known that Mr. Creede had sold an interest in the Holy Moses mine to D. H. Moffat, of Denver, prospecting was renewed with great vigor, and in June 1891 several prospectors from Del Norte discovered the Last Chance mine on Bachelor mountain. This was on the Amethyst or 'Big' vein, upon which the Bachelor claim had been located six years before, but the two locations were nearly three-fourths of a mile apart. Soon after the location of the Last Chance, Mr. Creede located the Amethyst claim, which joined it on the north, and within a few months the Amethyst vein was pegged for a distance of nearly two miles along its strike.

The railroad from Wagon Wheel Gap was extended to the district in 1891, and the first train arrived at Creede on December 16 of that year. The district has been producing almost continuously since the advent of the railroad. During some of these years silver was at a low price, but the mining operations were profitable, nevertheless. The production in 1910 was $1,036,286. The total production cannot be stated accurately, but on the basis of data obtained from several reliable sources, the total production is estimated at $37,500,000. This includes, in order of their value, silver, lead, gold, and zinc. About half this sum was paid as dividends, notwithstanding the low prices at which the metals were marketed.

Mining and Treatment of Ore

The larger part of the ore of Creede was partly or completely oxidized. Such ore is not suitable for mechanical concentration and was shipped without dressing to smelters. The greater part of it went to the plant of the American Smelting & Refining Co. at Pueblo.

In the lower levels of the mines on the north end of the Amethyst vein, especially in the Amethyst and Happy Thought mines, large bodies of sulphides suitable for concentration were found. This ore was dressed in the Humphrey mill at North Creede. The Humphrey and Amethyst mills are of the same general type, the equipment including crushers, rolls, classifiers, jigs, tables, and canvas plants. The zincblende and galena are readily separated, giving clean and satisfactory concentrates, and the pyrite is not so abundant as to reduce the grade of zinc concentrate greatly. Gold and silver are recovered mainly with the lead concentrate or in the slime. Two smaller mills, the Solomon and the Ridge, are situated on East Willow creek about 1½ miles above North Creede. The ore of the Solomon vein is very soft and is crushed by rolls without preliminary breaking in a jaw crusher. Only the Humphrey and Solomon mills were in operation in the summer of 1911, the Amethyst having been closed early in that year.

Conditions are favorable for cheap mining, as the veins are nearly everywhere of good width and have been subjected to very extensive fracturing and crushing since they were formed, so that much of the work has been done with pick and shovel. One of the largest stopes was milled from the bottom without preliminary blasting or breaking the ore. At present all the stoping is done by hand. Owing to the fractured condition of the rock, the miners find their labors lighter than in many neighboring districts.

The mines on the Amethyst vein and those on the Solomon are served by deep adits. The topography is so rugged that these gain depths of 1000 to 1400 ft. within comparatively short distances. The mines contain large quantities of water, which is drained through the adits and is used for milling. Although several deep shafts have been put down, all the mining is done at present through the adits.

Geology

Creede lies within the great Tertiary volcanic area of the San Juan mountains, and, so far as known, no rocks other than the Tertiary volcanics are exposed within a radius of many miles. All the rocks of the area shown on the map of Creede and vicinity are thought to be included in the Potosi volcanic series, which is the third series of the Tertiary volcanic rocks thus far recognized in the region. The rocks of this area are naturally separable into several divisions, and most of these divisions

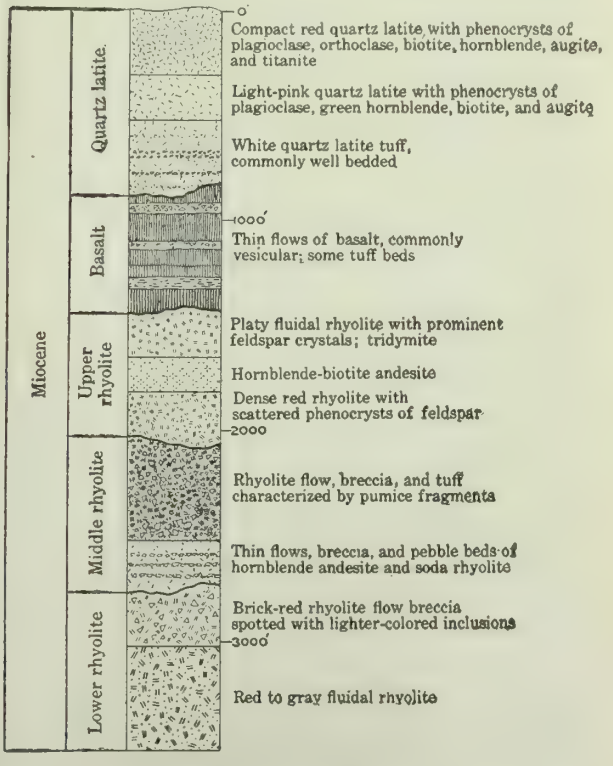

Miocene
Quartz latite
Basalt
Upper rhyolite
Middle rhyolite
Lower rhyolite
0
Compact red quartz latite with phenocrysts of plagioclase, orthoclase, biotite, hornblende, augite, and titanite
Light-pink quartz latite with phenocrysts of plagioclase, green hornblende, biotite, and augite
White quartz latite tuff, commonly well bedded
1000'
Thin flows of basalt, commonly vesicular; some tuff beds
Platy fluidal rhyolite with prominent feldspar crystals; tridymite
Hornblende-biotite andesite
Dense red rhyolite with scattered phenocrysts of feldspar
2000
Rhyolite flow, breccia, and tuff characterized by pumice fragments
Thin flows, breccia, and pebble beds of hornblende andesite and soda rhyolite
Brick-red rhyolite flow breccia spotted with lighter-colored inclusions
3000'
Red to gray fluidal rhyolite

Fig. 1. Generalized columnar section of rocks on ridge east of Rat creek, near Creede, Colorado.

*From a preliminary report in Bull. 503-E, U. S. Geol. Survey.

are separated by erosion surfaces. Each division is generally made up of two or more flows or other subdivisions. Fig. 1 is a generalized columnar section representing the succession of the rocks as seen on the ridge east of Rat creek. This section does not show the quartz latite of McKenzie mountain, which overlies a very irregular surface of the other rocks, nor the lake beds in the Rio Grande valley, nor the rhyolite near the Equity mine. The exact positions in the column of the latter two are not known.

The lavas in general dip gently to the north, but the lake beds south of Creede dip gently to the south. It is not known to what extent these structures are original or to what extent they represent actual tilting of the beds. Complicated block faulting is the most important structural feature of the region.

Ore Deposits

The ore deposits are silver-lead fissure veins in rhyolite and fractured zones of silver ore in shattered rhyolite. The total production, except a few thousand dollars, has been obtained from the silver-lead fissure veins. These are strong fault fissures and are extensive both vertically and along the strike. They include the Amethyst, Holy Moses, Solomon, Alpha, Mammoth, and several smaller lodes. All of these strike in the northwest quadrant, and the majority dip west or southwest.

Brecciation and faulting have taken place on a large scale, as is indicated by slickensided surfaces with abundant movement striæ and at some places by a lack of correspondence of the rocks on the two sides of a vein. Some of the veins fill fissures along normal faults, and at some places in the hanging-wall blocks there are subordinate fissures which join the principal faults in depth. Such relations are thought to show that the hanging wall was shattered as it was drawn downward by gravity along the foot-wall.

Some of the veins have been opened by movement since the ore was deposited. The results of such movement in the Amethyst vein are very pronounced. The ore itself is crossed by striated slickensided planes, and locally the vein quartz with associated sulphides forms a friction breccia. The ore minerals include zincblende, auriferous galena, pyrite, chalcopyrite, and their alteration products. The gangue minerals include quartz, much of it amethystine, with chlorite, barite, and fluorite. The several veins show considerable differences mineralogically. Hydrothermal metamorphism is not pronounced a few yards away from the veins, but along the most productive portion of the Amethyst vein considerable alteration has taken place. It is attended by silicification and the development of adularia and some sericite. Ribbon quartz and banded crusts are common, indicating deposition in open spaces. At some places near the veins, however, the intensely altered replaced rhyolite constitutes good ore. For reasons which will be mentioned in a subsequent paper, it is thought that these veins have been deposited by ascending thermal waters. As they cut rocks that are probably of Miocene age, the deposits are Miocene or later. In some of the deposits secondary enrichment is pronounced. The rich secondary ores extend downward to great depths, owing to the high relief of the area and consequent ample head of the solutions and the open character of the veins, all of which facilitate a rapid downward circulation.

The fractured zones of silver ore in shattered rhyolite include the deposits of the Mollie S. and Monte Carlo mines. The fractures and joint planes of the rhyolite are filled with thin veinlets of green chrysoprase and other green copper minerals, and locally contain large amounts of silver. Argentite, cerargyrite, and native silver are plastered on the walls of the thin narrow cracks. Iron sulphides are not abundant. The rhyolite along the veinlets is apparently fresh and glassy and is not greatly affected by hydrothermal metamorphism. Deeper exploration has not exposed any body of sulphide ores, and it is possible that the rich ores of this class are genetically related to the present topographic surface.

Amethyst Lode

The Amethyst lode is the most important deposit of the Creede district. Its total production is estimated at about $35,000,000 in silver, lead, gold, and zinc. It is developed for about 9500 ft. along the strike, and for the greater portion of this distance it has been exploited to depths of 1000 to 1400 ft. below the surface. Its strike is in general about N. 22° W. At the north end it strikes nearly north and at the south end it strikes about southeast. It dips southwest at 50 to 65°, or locally at greater angles.

The outcrop of the Amethyst vein is notably inconspicuous. The sheeting and crushing which are everywhere apparent along the lode have probably favored its disintegration, and it does not form a ridge at any place.

None of the outcrops, except the one between the Amethyst and Last Chance shafts, would perhaps be considered particularly promising. At this place only has the ore been worked at the surface, and at most places along the lode the stopes do not extend within 200 ft. of the apex. In view of the persistence and the great regularity of the workable ore in the deeper levels, these relations may reasonably be interpreted as indicating a leaching of the oxidized zone.

The great bononzas of the Amethyst vein were oxidized or partly oxidized ore. This ore consisted chiefly of lead carbonate with some lead sulphate containing large amounts of silver. The gangue of the ore is quartz and silicified rhyolite stained with iron and manganese oxides. Gold was of subordinate importance in the richer oxidized or partly oxidized ores, although some of this ore contained several hundred ounces of silver to the ton. Some of the silver is present as the chloride, cerargyrite, with which is associated the lead chlorphosphate, pyromorphite. Much native silver was present in the ore mined from the upper levels. It occurred as sheets and stringers in the oxidized ore and as little balls of silver wire nesting in open cavities. A common occurrence is a red jasper with flakes and sheets of the native metal. Some selected specimens of this jasper contain as much as 10% of native silver. In cabinet specimens the sheets of silver exhibit a ribbon-like structure with combs of chalcedonic quartz, and both are intergrown and contemporaneous. Under the microscope the jasper is seen to be made up of quartz and finely divided iron oxide. Native silver and jasper are confined to the oxidized ore and were not noted in the lowest levels of the mines.

Sulphide Ores

In the lower levels, in general about 500 to 800 ft. below the apex of the vein, sulphides of zinc and lead become increasingly prominent. These are more abundant in ore found at higher elevations in the north end than in the south end of the lode. There is no sharp line of contact between the oxidized and sulphide zone, but along fractures the oxidation extends downward here and there to the adit level. Partly oxidized ore is found in several of the mines 1000 to 1400 ft. below the surface. In the lower levels of the Happy Thought and Amethyst mines the sulphide ore is cut in places by seams of black manganese oxide, and the amount of gold in parts of such ore is conspicuously greater. The minerals of the sulphide ore include pyrite, sphalerite, galena, and a little chalcopyrite; probably some argentite is present also. The sulphur compounds of arsenic and antimony have not been noted.

Secondary Enrichment

In many deposits of copper, silver, and gold the ore near the surface is of relatively low grade and is unworkable. At greater depths richer ore is found, and at still greater depths such ore gives way to lower-grade sulphides. These relations are generally assumed to indicate that the metals have been dissolved out of the upper portion of the orebodies and have been redeposited lower down. The leached portions of the deposits are in general highly oxidized. The richer portions are only partly oxi-

dized, whereas the lower-grade ore in the deeper portions of the deposits shows comparatively little alteration. Briefly stated, many deposits may be divided into four zones: (1) an oxidized leached zone at or near the surface; (2) an oxidized or partly oxidized zone of richer ore below the leached zone; (3) a zone of rich sulphides below the rich oxidized zone; and (4) the lower-grade primary sulphide ore below the rich sulphides.

These relations are indicated by the vertical distribution of the richer ore of the Amethyst vein. The horizon of the richest ore is in general from 200 to 800 ft. below the surface, although such ore extended to the outcrop between the Amethyst and Last Chance shafts. The upper portion of the richer zone was highly oxidized, but a considerable number of nodules and masses of sulphide ore was present in the lower portion and the number of these increased in depth. The oxidized ore is valuable for silver, chiefly as the native metal and the chloride, and lead, as the carbonate and sulphate. The proportion of gold to silver increased greatly below the thoroughly oxidized ore, suggesting a transfer of gold by descending waters. The lode is very strongly fractured and considerable oxidation has taken place along fractures and seams as deep as exploration has gone, or more than 1200 ft. below the surface. Limonite, set free by the oxidation of iron sulphides, and manganese oxide, liberated by the weathering of amethystine quartz, were deposited along some of these fractures. The great bulk of the ore in the lower levels carries from 6 to 20 oz. of silver to the ton, 5 to 15% of lead, $1 to $2 per ton in gold, and a variable percentage of zinc. Some of it is well within the limit of profitable exploitation, although it is considerably lower in grade than much of the more highly oxidized ore in the upper levels.

Extension in Depth

As bearing on the possibility of profitable developments below the adit level, inquiry may be made respecting the position of this level in the zone of secondary enrichment. If the adit is below the bottom of the altered zone, any orebodies that may be found below the adit will be primary. If the adit is above the bottom of the zone of alteration, bodies of enriched ore may be expected. One would be bold indeed to prophesy in advance of development that such orebodies will or will not be found, yet there is some evidence that bears directly on this point.

With respect to the distribution of silver, it may be stated frankly that no bonanzas comparable to those which were worked in the upper levels of the mines have been developed within 100 ft. of the adit level. Stopes have been raised at many places from the adit, but they are small compared with those higher in the vein and, as already stated, the ore in them is generally of lower grade. The evidence of decrease in value alone, however, does not warrant the conclusion that the bottom of the zone of possible enrichment has been reached. The state of the ore with respect to alteration processes is important in this connection. At the southeast portion of the vein, in the Bachelor and Commodore mines, comparatively thorough oxidation extends to greater depths than in the mines on the lode farther north. At some places a considerable amount of oxidation has taken place in the Bachelor mine within 100 ft. of the adit, and on the Commodore claim, which lies just north of the Bachelor, a stope called the Wire Silver stope was raised from level E, which is just above the Commodore tunnel. The bottom of this stope is about 225 ft. above the Nelson drainage adit and about 1200 ft. below the surface. Although this stope was not accessible, the presence of wire silver in the ore is regarded as an indication of secondary alteration. A winze that was sunk below the adit in the Bachelor mine is now filled with water, but according to report some sulphide ore of shipping grade was developed.

The fracturing of the lode is very great, and the secondary fracturing is complicated, the ore being much more permeable at some places than at others. On the whole, however, the circulation of water from the surface is exceptionally vigorous, owing to the highly fractured condition of the ore. These observations lead to the conclusion, therefore, that the adit level in the Bachelor and Commodore mines is probably not below the bottom of the zone which is marked by partial secondary alteration of the ore. Whether processes of enrichment have gone far enough to make exploration of this part of the lode profitable is a question which cannot now be answered.

The northwest end of the lode, as already stated, is not so thoroughly oxidized in the lower levels as the southeast end. Nevertheless, the sulphide ore in the lower levels of the Last Chance, Amethyst, and Happy Thought is crossed by numerous fractures in and along which limonite and manganese oxide have formed. Some of the ore which is cut by stringers of these oxides is low-grade concentrating ore. Locally, however, this ore contains considerable gold. There is not much doubt that the gold of this ore has been increased somewhat by secondary processes, for the association of gold with manganese dioxide is significant of such processes. For example, in the Happy Thought mine on the Amethyst vein between levels 7 and 8, a body of partly oxidized ore composed of galena, zincblende, copper carbonates, cerusite, and anglesite contains a conspicuous amount of manganese dioxide, which coats the older sulphides and occurs in fractures cutting the partly oxidized ore. A considerable tonnage of this ore concentrated in the Humphrey mill yielded $20 in gold per ton, and some of it ran as high as $100 per ton. This figure is of significant magnitude, for the average content of gold in the Happy Thought ore is about $2 per ton.

In reviewing these facts, it is pertinent to inquire whether they warrant the expectation of any enrichment of gold below the adit level in the north end of the Amethyst vein. It has been shown that gold in these relations is found in stopes just above the adit level, but so far as is now known, the enrichment of gold due to secondary deposition at this level is not great. The present methods of concentration, however, permit the recovery of lead, silver, zinc, and gold, and in much of the ore the gold value is rather subordinate. Silver is comparatively low in these levels, but so far as is indicated by the data available, there is no reason to suppose that lead and zinc will be less abundant in the zone 200 ft. below the adit than in the zone 200 ft. above it, provided, of course, that the ore of the vein maintains an equal width.

In connection with the possibilities of profitable development below the adit level, certain considerations other than the changes in the character of the ore in depth merit attention. The amount of water which issues from the portal of the adit is very great, and most of it is collected in that part of the adit which is driven in or near the vein. No notable quantity of water is added in the portion of the adit that cross-cuts the country rock. In sinking a deep winze that was put down in the foot-wall in the Commodore mine, pumping charges were high, and they would doubtless have been higher if the cross-cuts had been run to the vein. Owing to the highly fractured condition of the vein, any project which contemplates deep exploration should provide for handling a considerable proportion of the water now draining from the adit. Some of this drainage could probably be kept out of lower workings, but extensive stoping below the adit would surely increase the flow.

The annual report of the Chemical, Metallurgical & Mining Society of South Africa shows that there were 1229 members at the beginning of June. W. R. Dowling was elected president for the forthcoming year. Revenue from subscriptions amounted to $7550, while the net cost of publishing the society's journal was $4060. There was a deficit of $1630 on the year's work. During the year 30 technical papers on all mining and metallurgical subjects were read by members.

Stamp-duty of Rand mines increased 0.69 tons per day in 1911, as against that of 1910.

Training of Mine Employees

By M. W. von Bernewitz

A good deal of attention is being directed to the better condition and education of men working in mining fields throughout the world, and on the Rand there have been several discussions on the subject of late. At the June meeting of the Chemical, Metallurgical, and Mining Society of South Africa, F. J. Pooler read a paper entitled 'The Surface Workers on the Rand and Their Technical Education'; at a meeting of the Society of Civil Engineers, H. Bromley read a paper on 'The Training of Artisans and Skilled Operators in South Africa'; and on 'The Training of South African Miners', Mr. Schumacher made some interesting remarks at a meeting of the Transvaal Chamber of Mines.

In the first-mentioned paper it is said that, since June 1909, the Consolidated Goldfields company has made an organized effort to employ young white men on its surface work; the experiment has so far justified itself as to become a settled policy. The Rand Mines, Ltd., also instituted a scheme on somewhat similar lines, a special 'White Labor Department' being created to deal with the matter. The paper dealt with the learners and apprentices who came under such schemes as the above, or who are working in the mines where no special scheme is in existence. In the conditions of service the learners are informed before applying for posts that the work they are called upon to do is hard, and therefore good physique and grit are a necessity. Mr. Pooler said that, from personal experience, he noticed this point had not been fully realized by some of those appointed during the past three years. Though work may commence in the mills, for those who have done well, after a reasonable period, other surface work of a less arduous nature is found. The following table should be of some interest, showing results at the Consolidated Goldfields mines:

	Number.	Per cent.
Total learners employed	220	
Still employed December 31, 1911.....	105	47.73
Employed in other departments, or groups	28	12.73
Left of own accord	73	33.18
Dismissed as unsuitable	14	6.36

Some dissatisfaction has been expressed as to the wages paid to learners at different mines, but this seems to be unfounded, considering the rates, per 8-hour shift, on the length of service as shown below:

	Months.	Wages.
Employed less than.....	6	$2.08
" over	6	2.42
" "	12	2.42
" "	18	2.94
" "	24	3.53
" "	30	3.64

These figures show that this scheme offers a reasonable prospect of advancement to any youth who cares to do a fair day's work, and sink his personal dislike to dirty hands in his determination to succeed.

Mr. Pooler did not intend to discuss the relative merits of the technically trained and the practical man, as both are absolutely necessary for carrying out any work. A member of the Society had stated that there were not enough practical experienced men in charge of the underground operations; but it is certain that in reduction works there cannot be too many technically trained men, so long as these men are also conversant with the details of the processes they supervise. In April 1912 the *South African Mining Journal* drew attention to the regrettable fact that many of the more recent improvements in metallurgical practice had had their origin in America. It may be that the local younger generation is not taking as full advantage of the facilities provided by local institutions as might be reasonably expected. The white labor department of the Rand Mines, Ltd., informed Mr. Pooler that, of 275 learners, there were only 30 attending the Transvaal School of Mines and Technology during 1911, but there were more during the present term. It is more than likely that, in future, regular attendance at one or the other of the technical classes will be an indispensable condition before a learner obtains promotion. From data supplied by the principal of the above institution, it appears that there were 151 students on the roll, of whom 62 were learners and apprentices. From official figures issued by the government inspector of white labor at the end of 1911, it appears that there were employed on the Rand 1493 millmen (excluding fitters), 1137 cyanide men, 309 samplers, and 174 assayers and assistants; a total of 3113. Of these, there were 261 mill and 223 cyanide learners and apprentices. From this comparison it is obvious that many men are not taking advantage of the facilities provided in the various grades of chemistry, metallurgy, and assaying. Besides the above classes, between 130 and 140 mine apprentices were attending preliminary classes of all kinds during the first term of 1912, some of these men being engineering apprentices.

In discussing the reasons for failure, Mr. Pooler asks, "Is one of the main reasons for this failure to take advantage of educational facilities, not due perhaps to a distrust of scientific method and theory of any sort?" Many inventions come from practical men, but how many more labor-saving devices might there have been if more of those who have risen from 'among the ruck' had known how to apply scientifically the many useful hints acquired in the day's work? This lack of interest in things scientific can scarcely be put down to the charge of the heads of the departments of the mining industry on the Rand. Mr. Pooler is inclined to think that more enthusiasm is shown for technical training by engineering students. Of course, men working regular shifts find it impossible to attend classes regularly, and even may not be in fit condition for so doing. Some are materially unfit to benefit by instruction, and many are not fitted to benefit because of deficiencies in their preliminary education. In conclusion, it is important to note that the exigencies of the labor market demand that white men technically trained shall be in charge of the surface work on the mines.

In the discussion following this interesting paper, W. A. Caldecott regretted the general attitude of workers. Position and pay at 20 years of age matter comparatively little, but at 40 they are all-important, hence the favorable conditions for acquiring knowledge and experience through study and varied training in the earlier years should be utilized. The Americans say: "Theory is worth nothing, practice alone is worth $5 per shift, and the combination may be worth anything." Others who discussed the paper shortly, but effectively, were J. E. Thomas, E. J. Laschinger, S. Newton, and C. Toombs.

Mr. Bromley, in his paper read before the Society of Civil Engineers, contended that for the proper training of tradesmen, operators, skilled laborers, overseers, and unskilled laborers, it is essential to have: (1) compulsory education up to the sixth standard grade in the case of tradesmen, and up to the fourth in the case of others; (2) the indenturing of apprentices to the various trades; (3) the providing of local night classes or trades schools; (4) the providing of practical instruction from first-class tradesmen; (5) the opportunity for training tradesmen, skilled workers, operators, and laborers in the undertakings of the Union of South Africa; and (6) the rearrangement of the scale of wages to attract the class of men required.

Mr. Schumacher, speaking before the Chamber of Mines, said that his group of mines employed 603 learners on the surface and underground, and there were more underground learners at the Village Deep than at the Wolhuter school. The Crown Mines has 120 learners underground, of whom half are Dutchmen. Five years ago Mr. Schumacher was a member of the committee which reported to the Government on the question of establishing a training school. The Government was recommended to take an

entire mine, in which students should actually take over the work. On a basis of crushing with 60 stamps, there would be needed 420 apprentices after three years, thereafter putting out 35 trained miners every three months; that is, there would be an intake of 35 learners and an output of 35 trained miners every three months. The scheme failed for the reason that no suitable site could be obtained. He would again recommend the Government to test ground which had been opened, and believed that the mining companies would support them financially as they were prepared to do in 1907 and 1908.

In Germany every facility is afforded mine employees to study and better themselves, many companies insisting on men being technically trained to some degree before employing them. It has been said that every foreman at the Mansfield copper mines and plant had had a good scientific training. While indirectly connected with mining, the practice of the Brunner Mond Chemical Co. is of interest. This is probably the most skilfully managed chemical industry in Great Britain, and perhaps there is no industrial undertaking, even in Germany, more scientifically administered. Since its foundation there has been 'no resting on oars,' but an ever striving forward policy seems to dominate the officials, and even the workmen. The employees have every facility afforded them to study and improve their position. It is compulsory for apprentices, not only to attend evening technical classes, but those held during certain days as well. The company contributes to a sickness and maintenance fund, to enable men to retire in comfort. Sir John Brunner once said, "the men who make the profits should participate in them."

In most of the important mining centres of Australia and New Zealand there are good public primary and private secondary schools, continuation classes, technical schools, and schools of mines, especially catering to men working at mines and mills. The most important are at Ballarat, Bendigo, Charters Towers, Kalgoorlie, Thames, and Zeehan, while there are several others in smaller centres. The Mt. Morgan company has been liberal in its help to the local school in the town mainly supported by its operations. Beside these, Adelaide has a large school of mines, while Auckland, Brisbane, Dunedin, Melbourne, and Sydney have universities where mining in all its branches may be studied. To what extent are these schools of mines used in the mining centres? On the whole, they are attended to a fair degree, but not nearly what they should be. At Kalgoorlie there are about 5800 mine employees, and under 200 attend the local school of mines, which is large, well equipped for every class of student, caters to men working shifts, and offers, along with the Chamber of Mines, valuable scholarships and prizes. A large number of young people in the town, apart from mine employees, attend night classes. The wages paid and general conditions at Kalgoorlie have attracted a good class of workers, and their general efficiency is high, as is proved by the low costs prevailing in the district; lower comparatively than on the Rand with colored labor. From several years' observations, I must say that there seems to be a feeling of 'don't care' or 'cannot be bothered' among the majority of mine employees. They do their work in good style, but after it is finished there is little desire to read or to try to improve themselves. There are numbers of men who rarely read the daily newspaper; and many who do, only study the sporting page. Throughout Australian mining districts the sporting element is too prevalent altogether. Apart from these men, there are others, especially in mills, who take great interest in their work, read at work if there is spare time, and study at some technical school. Such men get on. Managers at Kalgoorlie are not slow in recognizing merit. There are two splendid libraries in the district, yet out of say 20,000 adults only about 1500 are members, and the majority of these are business people. Miners and millmen are comfortably provided. Each company has first-class change houses, and men can go to work in good clothes and after work can be thoroughly clean. Conditions of work are also decent on the whole. Of course, the summer heat partly accounts for the careless attitude toward study. Nearly all the large mines generally make room for a few learners or cadets, and they are given as much assistance as possible. Cadets at some mining camps complain that they are kept in one department too long, and there may be room for objecting to being so placed. The trouble with some students is that they think they should take it easy, having been given employment under some influence or other. There have been cases where they got through the day's work and then gave themselves up to all sorts of enjoyments till late hours, further study being seldom thought of. This class of learner will never get on. On the other hand, there have been cases of hard and determined work, and such men are sure to advance. Every encouragement is given to employees of the Mt. Lyell and Broken Hill companies, and suggested improvements to plant are always carefully considered, and, if valuable, credit is given the man making the suggestion. Men in the Zeehan district of Tasmania have good opportunity to study at the local school of mines. In New Zealand, at the Reefton, Thames, and Waihi mining camps, many men have done well at the school, but many miners are too busy with labor troubles to bother about study.

In the United States there are many technical schools, and much has been written on sociological conditions at certain centres, and how large companies try to help their men to advance their position or make them more contented, but in many cases few bother themselves. In summing up, it might be said that although everybody cannot be in charge of mines and mills, yet a little effort on the part of mine employees would make work more interesting and life more satisfactory.

Gulkana and Susitana Placers

The U. S. Geological Survey has just issued Bulletin 498, 'Headwater Regions of Gulkana and Susitana Rivers, Alaska,' by Fred H. Moffit, a report which deals primarily with the district including the Valdez creek gold placers, but also gives an account of mining developments during the past few years in the Slate Creek district, at the head of Chistochina river. Slate creek and its gold placers were visited by W. C. Mendenhall in 1902 and were described by him in Professional Paper 41. Mr. Mendenhall also visited Delta river in 1898, but the region west of Delta river, including the head of Susitna river has never been described geologically before the field work of 1910, on which Bulletin 498 is based, was undertaken. During the summer of 1910, D. C. Witherspoon, assisted by C. E. Giffin, made surveys for a topographic reconnaissance map to be published on a scale of 1 to 250,000, or about 4 miles to 1 in. This map is the base of the geologic map accompanying the report.

Feldspar Production

The year 1911 showed the largest production ever recorded in the feldspar industry, the output being greater by 901 tons in quantity and $20,064 in value than that of 1907, the year of maximum production until 1911. The production in 1911, according to a report on feldspar and quartz by Jefferson Middleton, just issued by the U. S. Geological Survey, was 92,700 short tons, valued at $579,008, against 81,102 short tons, valued at $502,452, in 1910. In 1911 deposits in California, Connecticut, Maine, Maryland, Minnesota, New York, North Carolina, Pennsylvania, and Virginia were worked. Maine led all the other states in quantity produced, with 25,976 short tons; New York was second, with 18,800 short tons; Connecticut third, with 16,497 short tons; Pennsylvania fourth, with 13,284 short tons; and Maryland fifth, with 12,694 short tons.

REVENUE of the Union Government of South Africa derived from mines in the Transvaal from May 31, 1910, to March 31, 1911, amounted to $8,350,000. This was the result of government ownership and taxes on mining.

A Mine Model

By Maxwell C. Milton

As models are becoming more and more a part of the working apparatus of large mines, a description of several made by the Copper Queen Consolidated Mining Co., of Bisbee, Arizona, may be of interest.

The ores of this mine occur in bodies of irregular shape, separated by greater or less intervals of waste, and are found distributed over an area of approximately two square miles. Practically all the ore is mined by the square-set system, the floors being 8 ft. apart, with levels at 100-ft. intervals. Filling is carried on contemporaneously with stoping and, in general, no attempt is made to rob the stopes of the timber used for holding the ground.

In the summer of 1911, fire was discovered in the filled portion of a large orebody from which extraction was still going on. As the shape of this body was very irregular, a model was planned to aid in showing the best places for cutting off the burning sections from unmined ground, and in general to prevent the fire spreading. After some experimenting, celluloid was found to be the best material for use in the model. The information obtained and the results achieved by the use of this model, were so satisfactory that it was decided to show the most important portions of the mine in a similar way, as the method used shows very clearly the irregularities of the ore, and also correlates different orebodies on different horizons and sometimes gives a clue to possible ore extensions.

It was decided that the standard scale of the mine maps, 1 in. to 50 ft., would not only give sufficient size for showing the stoping work done in detail, but would save considerable labor in making working plans. With this scale, it was impracticable to make the model in one frame, so it was made in sections that could be placed side by side. A maximum size for easy handling was found to be 36 in. square. The frames were made with four 1-in. posts, set on pine foundations, 4 in. wide by 1½ in. thick. The centre of the foundations are occupied by ground glass for illuminating purposes. At proper intervals, ¼-in. iron bars are dove-tailed into the posts, for supporting the levels, the posts being grooved so that each level can be taken out of its frame independently. The posts are kept in alignment by oak strips joining the tops. All frames rest on a table fitted with electric light, so placed as to throw an even illumination on each model, from below.

Each level is represented by plate glass, on which drifts, claim lines, sill-floors of stopes, etc., are traced from the map. Ordinary drawing ink is used, the drifts, etc., being colored in solid. The tracings are given a coat of shellac to prevent them from flaking off when dusted. The stopes are cut from transparent celluloid, bought in sheets, of such thickness as to represent eight feet. Paper is pasted on the celluloid upon which each floor is carboned from tracings made from the stope maps. The floors are then cut out with a 10-ft. band saw, electrically driven. A little practice enables one to cut to a line, so that filing is necessary only to remove the saw marks. The paper is then removed from the celluloid, the parts assembled and cemented with the following solution:

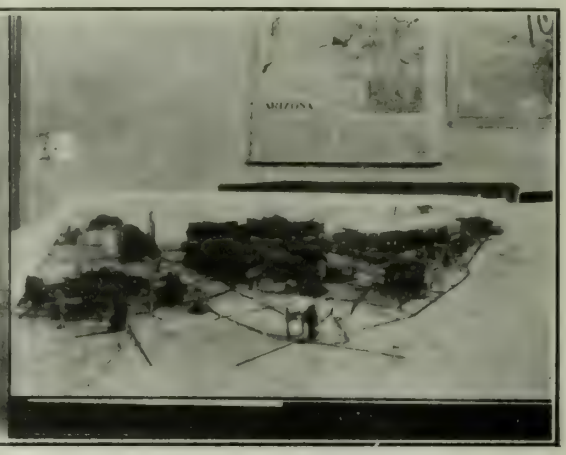
Dissolve 1 part gum camphor in 4 parts alcohol.

Dissolve equal weight of shellac in the above solution.

This cement sets quickly and is very strong. Alcohol will also do as a cement. The sides of the stopes are painted with conventional colors to represent the different grades of mineralized ground left. The completed stopes are placed on the glass levels as the final step.

The model can be kept up to date easily, and the cost is not large, the principal item of expenditure being labor. There is some danger from fire, but experiments indicate that nothing short of a flame will start the celluloid blazing.

SECTION OF MODEL IN FRAMES.



ONE LEVEL FROM THE MODEL.

The accompanying photographs show a typical level, and the assembled sections so far built.

Gold has been found in its bedrock source in the slate area south of Valdez creek in Alaska and is present in some of the stream-gravel deposits within that area. Most of the placer gold from this district, however, has come from an old filled-in channel or canyon once occupied by Valdez creek and from the stream-gravels of that part of the present channel of the creek which lies below the point where the old and new channels intersect. The gold in the new channel is in large part a re-concentration from the rich auriferous filling of the old canyon. This old channel represents an earlier stage of the topography on which the present stage is superposed, the whole process being closely connected with the intense glaciation which this region has undergone and which is not yet completed. The old channel and the three or four creek claims below it on the present stream constitute an excellent example of the importance of re-concentration in the production of rich gold placers. The region was recently studied by the U. S. Geological Survey.

Slate creek is 75 miles east of Valdez creek. It is the site of an older camp than Valdez creek, and with its tributary, Miller gulch, has been the greatest producer of placer gold within the Copper River basin, having yielded more than $1,500,000. Its gold is derived from a mineralized area in slate. Diorite intrusive rocks are present, and in these respects the deposits resemble those of Valdez creek. It is believed, however, that the slate of Valdez creek is younger, although the diorite intrusives are probably of the same or nearly the same age. The richest gold deposits of Slate creek and Miller gulch are approaching exhaustion and the district has reached that stage where its future will depend on the introduction of more economical means of mining than have been used in the past.

Comparative Method of Screen Analysis

By A. T. Tye

The standard method of screen analysis used at the concentrating plant of the Cananea Consolidated Copper Co. is the wet one. General samples from the fine jigs, Wilfley tables, and vanners of each of the four sections of the plant, are taken each shift. A certain weight of each of these samples is taken, and put in dust-proof, galvanized-iron boxes. Therefore, there are three samples of each tailing per day, or about ninety per month. At the end of the month, each of these composite samples is carefully cut down to about 1000 gm. A screen analysis is made, giving the percentage of weight and the assay of the material on each different screen. This method is followed year after year, and the results recorded in the office. The value of this method lies in the fact that results obtained by any new system of classification, or by an increase or decrease of size in the screen aperture of the Bryan mill, may be compared to the previous average monthly composite screen analyses over a long period, and the beneficial or detrimental results determined with great accuracy.

The Cananea screen analysis system is carried to a point which gives much additional information. As 100 gm. is taken as a sample for screen analysis, the percentage of weight is at once read off without any chance of error, and there is sufficient material available to make a careful panning test on the material remaining on each screen. The mere percentage of weight, and the assay of each screen size gives only part of the information wanted, and may be misleading, from the fact that each screen size contains some free concentrate mixed with the true clean tailing and does not give the lowest tailing possible on each screen. If, for instance, there should happen to be a larger amount of free concentrate in the coarse tailing than in the succeeding finer size, it would appear to show that the concentrate was included in the gangue and would require fine-grinding. By panning this material, however, the fallacy of this supposition is at once made apparent, as the produce would be a small amount of rich concentrate, and a tailing much lower in copper than the general assay for that screen size, and also lower than the next finer screen assay of clean tailing.

The screens used at Cananea for analysis are the Tyler standard testing sieves, and have the following apertures as given by the manufacturer and tested by micrometer:

Mesh.	Inch.	mm.
20	0.0335	0.8509
60	0.0091	0.2311
100	0.0055	0.1397
200	0.003	0.0762

The method of wet-screening analysis at Cananea is as follows: The first sieve to be used, say 240 mesh, is placed on a wire triangle over a deep copper bucket, and a kilogram of tailing is placed upon the screen. Clear water is added at one side, and the material in the immediate vicinity is gently stirred by the fingers, keeping the screen clear in that part, so that the slime may be carried through the screen as fast as possible. Gradually all the material is worked over in this manner until all the slime has passed into the bucket and only sand remains upon the sieve. After the sand is once free from slime, the screening goes on fairly rapidly. For certain trials it is preferable to add the tailing to be de-slimed in small amounts, de-sliming and removing the clean sand alternately for each lot treated. With coarse material, such as Wilfley and sand-jig tailings, the de-sliming may require only three minutes, whereas with vanner tailing, rich in slime, it may require ten minutes. The de-slimed sand is next placed on the coarsest-sized screen to be used, say 20-mesh, and a small amount of water added while the screen is kept in motion. This carries through most of the material of finer sizes into the copper pan below, which is placed at one side and the screen placed in another similar pan and water added. Any additional sand passing the screen is removed from time to time and added to the sand first passing the screen. After the more easily screened sand has been removed, the screen is given a jigging motion which is continued until no more sand will pass it. This point is sharply defined, as white sand shows up very distinctly through the clear water against the red copper of the pan. As soon as a fair quantity of white sand has passed the screen it is removed and added to that previously collected, so that the grains are not crushed under the rim of the sieve. The jigging motion is continued with the frequent addition of clear water until no more sand passes the sieve. The sieve is then inverted and the sand remaining on the wires is carefully washed out upon a drying pan, 10 by 12 in. by 1 in. deep. The pan is placed in a drying oven heated by steam.

This method is very simple and gives exact results. Although the concentrators treat ores from different orebodies, yet the average mixture in 60,000 tons per month appears to be quite constant; so that, so long as no changes are made in the classifiers or screen system, the percentage of the same tailing remaining on any particular screen will give almost identical results every month. An ordinary screen analysis from 20-mesh to slime requires a little more than two hours, including time of weighing the screen size. On account of the large number of screen analyses required daily without increase in the number of operators, during tests on products of the Richards-Janney classifier, and comparative tests between the Hardinge and Bryan mills, it was decided to make experiments to determine if some other method or modification of wet screening would not give as accurate results in less time. The following results as to time and accuracy were secured. They are instructive in showing the composition of the tailing of the concentrators of the Southwest treating hard and soft ores.

Frue Vanner Tailing

Test No. 1.	Copper, %.		Weight, %.	
	Wet.	Semi-dry.	Wet.	Semi-dry.
On 100.....	0.33	0.28	2.76	2.52
On 200.....	0.29	0.35	7.64	9.14
On 240.....	0.35	0.37	11.15	9.02
Through 240.....	0.95	0.87	78.45	79.32
Time, minutes			105	50

The regular wet grading-analysis was made as previously described. On an equal amount of the same material a semi-dry screen analysis was made. This was done as follows: The tailing was de-slimed as in wet-screen analysis, but instead of continuing the process wet, the de-slimed sands were dried and screened dry. The small amount of material through 240-mesh obtained by dry-screening was added to that previously obtained by the de-sliming process.

The variations which may occur in the assay of the same sample of this material is about 0.05% Cu for the sand, and about 0.10% Cu for the slime, and this applies to all other assays given. This is the variation allowed in every-day work where several hundred assays are run.

Frue Vanner Tailing

Test No. 2.	Copper, %.		Weight, %.	
	I	II	I	II
On 100.....	0.39	0.28	3.12	2.95
On 200.....	0.24	0.27	7.80	8.50
On 240.....	0.41	0.39	11.50	9.75
Through 240.....	1.00	0.88	77.58	78.80

These wet-screen analyses were made on different days, but upon different samples of the same general sample of tailing, to learn of any variation in the daily work.

TAILING FROM FINE SAND PLANT

Test No. 3.	Copper, %.		Weight, %.	
	Wet.	Semi-dry.	Wet.	Semi-dry.
On 100.....	0.27	0.29	12.62	14.42
On 200.....	0.27	0.31	17.74	18.05
On 240.....	0.56	0.51	15.00	13.05
Through 240.....	1.05	1.06	54.64	54.45
Time, minutes			120	70

This test was made on intermediate material, between vanner, jig, and Wilfley tailing, to secure a correct average and determine if the results found with the vanner tests agreed with the fine and coarse sand tests.

WILFLEY AND FINE JIG TAILING (SOFT ORE)

Test No. 4.	Copper, %.		Weight, %.	
	Wet.	Semi-dry.	Wet.	Semi-dry.
On 20.....	0.45	0.44	9.05	9.27
On 60.....	0.44	0.47	36.20	36.22
On 100.....	0.39	0.39	20.65	22.54
On 200.....	0.43	0.47	11.90	11.07
On 240.....	0.99	1.07	5.35	5.50
Through 240.....	1.27	1.36	16.85	15.40

The average variation in weight between wet-screen analyses on the same sample was 0.97%, and the same in semi-dry analyses. The average variation in assays between wet analyses was 0.07% Cu, compared with 0.04% Cu in semi-dry work. Wet analyses took 120, compared with 75 minutes in the semi-dry method.

WILFLEY AND FINE JIG TAILING (SOFT ORE)

Test No. 5.	Wet.		Dry No. 1.		Dry No. 2.	
	Wt.	Cu, %.	Wt.	Cu, %.	Wt.	Cu, %.
On 20..	4.85	0.40	6.12	0.43	6.00	0.47
On 60..	38.87	0.40	41.08	0.44	41.00	0.44
On 100..	24.45	0.40	26.68	0.40	27.20	0.43
On 200..	4.87	0.48	16.60	0.48	16.00	0.52
On 240..	7.35	1.07	1.20	0.88	1.52	0.73
Through 240..	20.68	1.27	8.32	1.33	8.28	1.32
Time taken, minutes..	130		30		25	

Taking the wet analysis as standard, the dry analysis shows an error of over 18% in weight with soft ore, and an average variation of 0.15 to 0.25% Cu compared to 0.07% Cu in wet analyses. On the other hand, the dry screening required only one-fourth the time necessary for wet screening.

WILFLEY AND JIG TAILING (HARD ORE).

Test No. 6.	Dry.	Dry.		Wet.	
	Wt.	Wt.	Cu, %.	Wt.	Cu, %.
On 20....	16.76	17.20	0.28	15.80	0.24
On 60....	49.72	49.48	0.28	48.90	0.24
On 100....	15.20	15.40	0.21	14.25	0.24
On 200....	8.80	8.92	0.24	7.45	0.21
On 240....	0.88	0.96	0.35	1.00	0.25
Through 240....	8.64	8.04	1.07	12.60	0.98
Time taken, minutes..	30	43		135	

The variation in weight between the ordinary dry-screen analysis, and the dry analysis with extra time on each sieve, gives a difference of only 0.84%. With hard ore the error in weight by dry-screen analysis is only 4.6%, instead of over 18% with soft ore, which slimes considerably. The assays show a difference of about 0.13% copper.

In conclusion, it may be said that semi-dry screen analysis gives almost identical results as complete wet-screen analysis, both as to weight and assays, and the former can be made in about half the time required for the latter. Duplicate dry analyses check each other quite closely, both as to weight and assays, showing that about the same amount of fine material remains with the coarser particle in each test. Thanks are due to F. J. Strachan, superintendent of the plant, for permission to publish the results of the above test.

ROCK-DRILLS numbering 4671 were at work in the Transvaal gold mines in 1911.

Determining Pitch of Gears

By DOUGLAS WATERMAN

Having had occasion to determine the pitch of partly worn gears with a view to ordering new ones, I was confronted by a problem, the solution of which could not be found in any of the standard hand-books nor in the manufacturers' catalogues. While it is possible to forward the makers a templet of the gear, and this is recommended in the case of special patterns, it is not only more convenient but safer to specify the exact pitch of the gears. It is a necessity if the gears must be ordered by cable. The notes taken during a study of this subject and a description of the method finally adopted for determining the exact pitch of gears are given in the following text.

When ordering gears the important dimensions are: (1) pitch diameter; (2) pitch; (3) number of teeth; (4) face; (5) bore; (6) keyway in hub; (7) distance through hub (if space on shaft is limited); (8) backing (if gears are bevel, angle, or mitre).

A comprehensive definition of 'pitch circle,' 'pitch diameter,' and 'pitch' is given in Kent's 'Mechanical Engineers' Pocket Books,' as follows: "If two cylinders with parallel axes are pressed together, and one of them rotated on its axis, it will drive the other by means of the friction between the surfaces. The cylinders may be considered as a pair of spur wheels with an infinite number of very small teeth. If actual teeth are formed upon the cylinders, making alternate elevations and depressions in the cylindrical surface, the distance between the axes remaining the same, we have a pair of gear wheels which will drive one another by pressure upon the faces of the teeth, if the teeth are properly shaped. In making the teeth the cylindrical surface may entirely disappear, but the position it occupied may still be considered as a cylindrical surface, which is called the 'pitch surface,' and its trace on the wheel, or a plane cutting the wheel at right angles to its axis, is called the 'pitch circle' or 'pitch line.' The diameter of this circle is called the 'pitch diameter,' and the distance from the face of one tooth to the corresponding face of the next tooth on the same wheel, measured on an arc of the pitch circle, is called the 'pitch' of the tooth or the 'circular pitch'."

'Circular pitch' and 'diametral pitch' are expressed in the following formulae:

$$\text{Circular pitch} = \frac{\text{Pitch diam. in inches} \times 3.1416}{\text{Number of teeth}} = \frac{\text{Circumference}}{\text{Number teeth}}$$

$$\text{Diametral pitch} = \frac{\text{Number of teeth}}{\text{Diam. pitch circle}}$$

Some makers design their gears to circular pitch expressed in even fractions of an inch, as: 1, 1⅛, 1¼, 1½ in.; others in diametral pitch, as: 3, 3½, 4 pitch. Gears designed on both these systems are frequently found on machines having two or more gears.

The relation between diametral and circular pitch is given by the following table, taken from Kent's 'Pocket Book':

Diam. pitch.	Circular pitch.	Diam. pitch.	Circular pitch.
1	3.142	2¾	1.142
1½	2.094	3	1.047
2	1.571	3½	0.898
2¼	1.396	4	0.785
2½	1.257	5	0.628

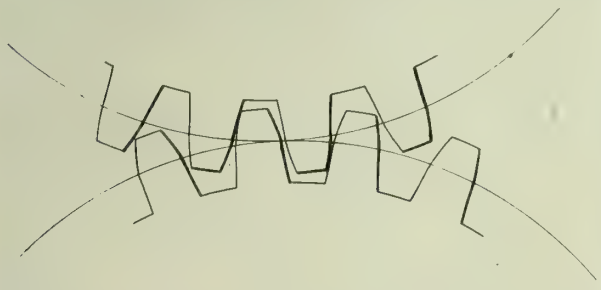
In determining the pitch, either diametral or circular, it is necessary to know the diameter of the pitch circle. I found it impossible to measure the pitch diameter with any degree of accuracy, especially if the teeth are worn, owing to the difficulty of judging the point on the tooth through which the pitch circle passes. This will be seen from the figure, which shows the position of the pitch circles with respect to the teeth of the engaging gears. There is a way, however, of determining the pitch diameter that gives close

results. An example taken from my notes will serve as an illustration.

Motor Hoist

Drum Gear.		Inter-Pinion.
Total diam. gear...	33 5/16	6 13/16
Depth of tooth.....	7/8 scant (0.80)	7/8 scant (0.80)
No. teeth	74	14
Inter-Gear.		**Motor Pinion.**
Total diam. gear....	20¾	7¼
Depth of tooth	9/16	9/16
No. teeth	81	27

There are two measurements that can be taken accurately from the gear. These are the total diameter of the wheel, and the depth of the tooth. If then some relation can be found between the depth of the tooth and the portion outside the pitch circle, we can calculate the



diameter of this circle, which is smaller than the diameter of the wheel by twice the distance of that part of the tooth without the pitch circle. The required relation is shown in the table, also from Kent, in which the circular pitch is 1 inch.

Depth of tooth above pitch line...	0.35	0.30	0.37	0.33	0.30
" " " below " " ...	0.40	0.40	0.43	...	0.35
Total depth of tooth.....	0.75	0.70	0.80	0.75	0.65

This relation varies slightly with teeth of different depths and pitch, but a close approximation is found by multiplying the total depth of the tooth by the factor 0.46. The calculations are much simplified by converting the fractions of an inch into decimals.

The calculations for the drum gear would be as follows: The total depth of the tooth being 0.80, the part without the pitch circle, or the 'face' of the tooth, is found to be 0.37 ($0.80 \times 0.46 = 0.37$). Twice this number subtracted from the total diameter of the wheel gives us the pitch diameter.

$$\text{Pitch diam.} = 33.185 - 2 \times 0.37 = 32.44 \text{ in.}$$

Substituting in the formula:

$$\text{Circular pitch} = \frac{\text{Pitch diam.} \times 3.1416}{\text{Number of teeth}}$$

$$= \frac{32.44 \times 3.1416}{74} = 1.377 \text{ in.}$$

Examining the table to see if this corresponds to a standard diametral pitch, and finding that it does not, one judges it to be 1⅜ in. circular pitch (1.375), which varies only in the third place from the one that has been calculated.

The inter-pinion which engages it must have the same pitch, and here there is a check on our calculations. The inter-gear and motor pinion are found to have a pitch diameter of 20.25 and 6.75 in., respectively, and by inspection we see at once that it must be 4 diametral pitch, since

$$\text{Diametral pitch} = \frac{\text{Number of teeth}}{\text{Pitch diam.}} = \frac{81}{20.25} = 4$$

and

$$\frac{27}{6.75} = 4$$

The full specifications for ordering these gears would be as follows:

Motor Hoist

Drum Gear.		Inter-Pinion (double shrouds).
No. teeth	74	14
Pitch diam.	32.38 in. (corrected)	6.1 in. (corrected)
Pitch	1⅜ in.	1⅜ in.
Bore	2 7/16	1 13/16
Face	3	3⅜ (bet. shrouds)
Keyway in hub.	⅝ by ¼	½ by 3/16
Inter-Gear.		**Motor-Pinion (rawhide double shrouds).**
No. teeth	81	27
Pitch diam.	20.25 in.	6.75 in.
Diametral pitch ...	4	4
Bore	1 13/16	1⅝
Face	2⅞	3 (bet. shrouds)
Keyway in hub.....	½ by ¼	⅜ by ⅛

It is to be regretted that manufacturers do not in all cases stamp the pitch and diameter on their gears, thus avoiding all danger of a mistake when ordering spares. Much time may be saved by the management if all important gears are listed for future reference, and the purchasing agent furnished with a copy; each gear being designated by a code word.

Prospecting in the Yukon

The 'chechaco,' or newcomer, entering the Yukon to prospect should receive a little preliminary instruction before launching into the wilderness. He cannot start into the Yukon to spend the winter without enough money to defray the cost of a winter's outfit. If he leaves Whitehorse in the summer, the trip down the Yukon river may be made by steamer or in small boat. It always is easy to arrange accommodation. By buying in a Canadian town, goods entering the Yukon will not be subject to duty, but it is best, all things considered, to buy an outfit in Dawson; or, for one not coming into Dawson, to buy at Whitehorse. By buying in this territory, he has the benefit of experienced and scrupulous traders, who know just what is adapted to this region, and who will assist in selecting the best for the peculiar work to be undertaken.

The prospector should leave Dawson in August or September. At this time the summer floods are over, flies are less troublesome, and game and fish are plentiful. Whenever possible, the prospector should go by boat. For shallow, swift, and narrow rivers, a boat 30 ft. long, of 26-in. bottom, and 22 in. deep is the best. Having procured his boat, 150 ft. of ½-in. hemp rope, and a pair of rubber boots, the prospector next selects and loads his provisions, always bearing in mind that articles less likely to be damaged by water should be placed in the bottom of the boat.

The outfit for twelve months should comprise the following: Flour, 500 lb.; rolled oats, 150 lb.; cornmeal, 50 lb.; beans, 7 lb.; sugar, 125 lb.; Lubeck potatoes, 60 lb.; butter, 50 lb.; apricots, 25 lb.; prunes, 25 lb.; apples, 25 lb.; milk, two cases; cream, two cases; ham, 25 lb.; bacon, 50 lb.; salt, 15 lb.; pepper, 1 lb.; syrup, 5 gallons; baking powder, 2 lb.; baking soda, 2 lb.; yeast cakes, 6 boxes; soap, 12 lb.; best pilot bread, 30 lb.; candles, two boxes; tobacco; best woolen underwear, three suits; thick overshirts, 3; thick woolen sox, 12 pairs; German sox, 2 pairs; woolen pants, 1 pair; overalls, 3 pairs; felt shoes, 1 pair; rubber shoes, 2 pairs; moccasions, 3 pairs; insoles for moccasins, 6; snowshoes, 1 pair; pack straps, 1 set; eyeglasses, colored, 1 pair; good field-glasses, 1 pair; reliable

[*Writing in the *Dawson Weekly News*, Robert Henderson, discoverer of the gold in the Klondyke valley, makes such pertinent and detailed suggestions regarding outfitting for prospecting in Yukon Territory, that we reproduce the letter entire.—Editor.]

compass; fur robe; fur cap; canvas jacket; sweater; axes, 2; small camp axe; auger, ½-in., 1; cross-cut saw, 4 ft.; whipsaw; jack-plane; nails, 15 lb., 10-penny; clawhammer; flat files, 2; sheath knives, 2; three-cornered files, 2; sharpening stone; picks, 2; shovels, 3; gold-pans, 2; Yukon stove with oven or drum; .30-.30 Winchester rifle; good shotgun; 200 rounds for shotgun; 200 rounds for rifle; frying pan; knife, fork, and plate; small pots, 4; large enameled mugs, 2.

The outfit should include a small medicine chest, among the contents of which should be one box of carbolic salve and a half-pint bottle of peroxide of hydrogen or other equally good antiseptic. One gallon of concentrated lime-juice should be taken along to make a pleasant and invigorating drink, and it will be a most effectual preventive of scurvy. The tent should be 10 by 12 ft. in size. It serves, when not in use, to cover the outfit, a precaution that should never be neglected either in the boat or in camp.

The prospector will have no difficulty in providing himself with fresh meat. The country abounds with moose, bear, caribou, mountain sheep, geese, ducks, ptarmigan, partridges, and grouse, and cranes and swans alight on the bars of the upper rivers by the thousands. Beaver, land otter, marten, lynx, wolf, fox, wolverine, and other fur-bearing animals are plentiful around the upper reaches of Yukon side streams.

On the trail in severe weather, always make camp while there is plenty of daylight. Never travel in foggy or stormy weather; always have matches and dry birch-bark ready to make a fire quickly. Eat regularly, even if you are not hungry. Keep your hands and feet dry, and—don't forget your tobacco.

It is well on a trip of this kind to take two or three good dogs and a Yukon sleigh. The dogs cost little to feed in a game country. The sleigh can be packed in the boat and will be useful for moving camp from creek to creek. Make a good warm shelter for the dogs and feed them at night.

To keep the outfit while in camp, cut four trees a few feet apart, and 12 ft. from the ground. Pick off the bark, and build a platform on top and let it extend about three feet on each side beyond the supports. Place supplies on top and cover with canvas and spruce boughs. They are in this way protected from animals.

In building a cabin, make it big enough. It takes little longer to build a cabin 16 by 12 than one of less dimensions, and this is large enough for all requirements. Level off the ground, and let the first logs be imbedded in it. Cover well with moss and lay the next log on top, and so with each log until the walls are six feet high. The logs forming the gable must be pinned together with 1½-in. wooden pegs, and the ridge-pole laid in place. A smaller log on each side of the ridge-pole further supports the roof, which is made of poles three or four inches in diameter, laid side by side and covered with moss and earth. Whipsaw a few boards to make a door. Pieces of moose skin make good hinges, and a clean flour sack steeped in melted tallow or oil makes a good substitute for glass.

Your partner on a prospecting trip should be a man with whom you are well acquainted, and of jovial and optimistic disposition. Avoid arguments, especially of a religious or political nature, and the golden adage, "A kind word turneth away wrath," is no where so forcibly realized as in the wilderness.

CAMP BREAD is easily made by the Lake Superior rule: one spoonful of baking powder for each cup of flour with one spoonful of salt for the batch. Mix in water with the least possible stirring and bake quickly.

Lead and Zinc Production by Regions

By B. S. BUTLER and J. P. DUNLOP

*The productive lead and zinc territory in the central states naturally falls into seven regions, three of which are not limited to any single state. For practical purposes it seems desirable to compile the production by the natural regions irrespective of state lines.

The seven regions are as follows in order of importance of output: (1) The Joplin region, comprising the district in southwest Missouri, southeast Kansas, and northeast Oklahoma; (2) southeast Missouri, containing the great disseminated lead deposits; (3) the upper Mississippi Valley region, including all the lead and zinc mines in southwest Wisconsin, Iowa, and northwest Illinois; (4) the Kentucky-Illinois fluorspar region in southern Illinois and northern Kentucky; (5) central Missouri (owing to the small output from this region for convenience it has in this report been included in the southeast Missouri region); (6) northern Arkansas; (7) the Arbuckle Mountain region in southern Oklahoma.

The Southeast Missouri region produced 78% of the lead output of the central states and about 35% of the production of lead from domestic ore in the United States in 1911. The Joplin region produced 19% of the lead and 78% of the zinc of the central states in 1911, and was much the largest producer of zinc in the United States, yielding about 50% of the total zinc production. The Upper Mississippi region produced 2% of the lead and 20% of the zinc produced in the central states in 1911.

PRODUCTION OF LEAD AND ZINC IN THE CENTRAL STATES IN 1911 BY REGIONS, IN SHORT TONS

Region.	Concentrates.				Metal.				Total value of metal.
	Lead.[a]		Zinc.[b]		Lead.		Zinc.		
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	
Joplin	45,905	$2,545,069	268,670	$10,217,993	36,474	$3,282,660	137,633	$15,690,162	$18,972,822
Southeast Missouri[c]	219,145	10,293,400	623	15,566	147,754	13,297,860	233	26,562	13,324,422
Upper Mississippi Valley	5,221	274,435	110,009	2,324,072	4,038	363,420	33,939	3,869,046	4,232,466
Northern Arkansas	80	4,321	1,590	44,664	64	5,760	664	75,696	81,456
Kentucky - Southern Illinois	482	21,205	467	10,604	339	30,510	158	18,012	48,522
Arbuckle Mountain, Oklahoma	.....	.....	220	3,643	.....	.....	71	8,094	8,094
Total	270,833	13,138,430	381,579	12,616,542	188,669	16,980,210	172,698	19,687,572	36,667,782

[a] Includes both galena and lead carbonate concentrates.
[b] Includes sphalerite, zinc carbonate, and zinc silicate concentrates.
[c] Includes a small production from the Central Missouri region.

L. VOGELSTEIN & Co. report the following figures of German consumption of foreign copper for the months January to June 1912:

	Tons.
Imports	107,944
Exports	5,072
Consumption	102,872

These figures may be compared with consumption during the same period in 1911 of 86,188 tons. Of the above quantity, 93,523 tons was imported from the United States.

LUCKY GULCH, a small branch of Valdez creek, contributed an important amount to the gold production of the district, and Rusty creek promises to become a producing stream also. Mining on Valdez creek has been carried on under difficulties arising from high cost of transportation and labor, shortness of working season, and other troubles such that it could not have been profitable if the gravel had not been remarkably rich. The gold production of Valdez creek, including that of 1910, is probably not far from $275,000.

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*From Advance chapter 'Mineral Resources of the United States, 1911,' U. S. Geol. Survey.

Western Australia Gold Output

The June gold output was valued at $2,271,000, the principal returns being as follows:

Name.	Tonnage.	Yield.	Profit.	Div.
Gt. Boulder Proprietary	18,336	$230,830	$120,640	$328,120
Ivanhoe	23,029	192,850	80,100	.....
Kalgurlie	10,620	109,230	48,390	.....
Yuanmi	5,200	48,860	23,360	.....
Aroya Links	11,010	65,610	16,960	71,870
Sons of Gwalia	12,405	98,880	20,890	81,250
Lake View & Star	17,683	106,730	16,410	.....
Black Range	2,331	36,760	15,000	13,590
Burbanks Main Lode	1,826	22,350	10,700	.....
Oroya Black Range	4,700	40,760	10,370	.....
South Kalgurli	9,411	59,040	10,290	.....
Gt. Boulder Perseverance	20,304	118,660	10,250	.....
Associated	10,570	64,790	10,000	.....
Mararoa	2,628	22,480	7,480	.....
Golden Ridge	2,895	25,480	7,630	23,170
Sand Queen	1,208	15,420	6,250	7,500
Great Fingall	6,196	52,180	7,000	.....
Menzies Consuls	2,026	20,360	5,240	.....
Gt. Boulder No. 1	1,099	11,610	5,080	.....
Ineliston Consols, Ext.	1,193	11,000	2,600	.....
Golden Horse-Shoe	26,987	161,960	3,340	.....
Ida H.	1,090	13,860	1,330	.....
Hainault	5,814	30,390	*4,560	.....
Mountain Queen	4,001	17,090	*3,050	.....
Morning Star	1,595	11,610	*2,630	.....

*Loss.

Hand Drilling v. Machine Drilling

A unique drilling contest took place at Calumet, Michigan, August 24, when one man with a 'Butterfly' rock drill defeated a three-man team of hand-drillers. Each party was allowed 15 minutes of actual drilling; at the end of that time the hammer and drill team had drilled 49 in., breaking their record set a few weeks previously at the miners' picnic, by a quarter of an inch. The man with the machine-drill holed through the rock, 60 in., with one minute to spare, winning the prize of $50. The hammer and drill team was composed of the winners of the hand-drilling contest held at the miners' picnic, William Billadeau, Matt Kramerich, and Charles Seppala; the man with the machine drill was John Becker. The rock-drill used was an Ingersoll-Rand, Butterfly valve, one-man machine. Two other contests were held at the same time, which were essentially trials of speed in 'rigging-up' one-man and two-man machines. Each team was required to 'rig-up' its machine, drill for two minutes (to show that the job was a satisfactory one), and then put in a new drill steel.

In the two-man contest there were 20 teams entered, practically every mine in the copper country being represented. The Ahmeek team, composed of Patrick Dunnigan and Archie Paulson, won the first prize of $100, and did the work in 3 min. 42 sec., taking only 1 min. 42 sec. to 'rig up' and put in the drill. The Calumet & Hecla Amygdaloid team won the second prize of $50; the Wolverine team won the third prize of $25.

In the one-man drill contest there were 17 teams entered. The Calumet & Hecla Amygdaloid team won the first prize in 4 min. 33⅗ sec., John Bosio constituting the team. Allouez took second, and Wolverine third. The prizes were the same amounts as in the two-man contest. The two-man drill used was of Ingersoll-Rand make; the one-man drill was an Ingersoll-Rand Butterfly machine. The contests in rigging-up drill machines are in line with the recent policy of the Calumet & Hecla M. Co., which is conducting a thorough campaign in efficiency engineering in underground work. The company has coöperated with rock-drill manufacturers to secure the construction of a light one-man machine to be used in drifts which will equal or exceed the speed of a two-man machine. It is reported that the expense of changing from the two-man to one-man machines will aggregate a quarter of a million dollars, but such astounding reductions are being attained in cost of driving and stoping that this sum will be made up in the saving of the first year or two. The innovations were first tried out in the Superior mine and were so successful there that they are now being introduced in the other mines of the company.

Guggenheim Exploration Company

A circular recently distributed gives interesting details regarding this company, which was organized June 5, 1899, for the exploitation of mining properties, and it holds large interests in many of the most important mining concerns in the United States. The company's authorized capitalization is 880,000 shares with a par value of $25, making $22,000,000. Of this there is outstanding 831,732 shares at $25, or $20,793,300. The par value of the stock was changed on April 17, 1912, from $100 to $25, and the number of issued shares increased from 207,933 to 831,732. The company has no bonded indebtedness. The assets are as follows:

American Smelters Securities Co. 'A', 154,000 shares at $95	$14,630,000
American Smelters Securities Co. 6% bonds, par	1,500,000
Utah Copper Co. stock, 404,504 shares at $3.50	9,693,736
Alaska-Yukon properties and equipment, at cost	1,170,230
Miscellaneous investments at cost	24,438
Cash and demand loans as at December 31, 1911	7,721,933
Chino shares, 36,600 at $34	1,134,600
Total	$60,549,681

This is equal to about $73 per share on the present outstanding capital. Since the formation of the company, results have been satisfactory and earnings have steadily increased. The full effect of operations at the Utah Copper, Yukon, and Chino properties has not been felt, as they have yet to reach their maximum productions. In the past three years profits of the Guggenheim company have increased from 11 to 17.7%, as the following table will show:

Year Ended	Surplus.	Profit, %.	Dividends paid.	Profits in excess of dividends.
Dec. 31, 1909	$13,857,064	11.0	$2,074,840	$ 213,376
" 1910	15,124,589	16.1	2,079,330	1,267,524
" 1911	23,474,178	17.7	2,079,330	1,602,440

The officials of the Guggenheim company include the following: President, Daniel Guggenheim; vice-president, Morris Guggenheim; directors, D. Guggenheim, M. Guggenheim, I. Guggenheim, S. R. Guggenheim, L. Friedrich, C. K. Lipman, P. Yeatman, H. P. Whitney, G. S. Field, J. H. Hammond, and O. B. Perry; treasurer, Leopold Friedrich; secretary, C. K. Lipman; assistant secretary, D. A. Crockett; purchasing agent (New York), H. K. McGowan; general manager and consulting engineer, P. Yeatman.

Copper Producers' Association Report

The Copper Producers reported September 9, the copper stock on September 1 to amount to 46,701,374 lb., as compared with 50,280,421 lb. August 1. Production in August was 145,628,521 lb., while in July it was 137,161,129 lb. Domestic deliveries amounted to 78,722,418 lb., as against 71,094,381; and foreign deliveries 70,485,150, as compared with 60,121,331 in August. Total deliveries were 149,207,568, against 131,215,712 in July. This is the smallest surplus reported this year, save on July 1, when it was 44,335,004 pounds.

Discussion

Readers of the MINING AND SCIENTIFIC PRESS are invited to use this department for the discussion of technical and other matters pertaining to mining and metallurgy. The Editor welcomes the expression of views contrary to his own, believing that careful criticism is more valuable than casual compliment. Insertion of any contribution is determined by its probable interest to the readers of this journal.

Genesis of Lead-Silver Ores in Wardner District, Idaho

The Editor:

Sir—In the August 3, 1912, issue of the *Mining and Scientific Press*, F. L. Ransome has entered a protest against the form of expression used by me in referring, in my paper under the above title,[1] to the work of himself and F. C. Calkins. I had no intention of antagonizing the United States Geological Survey or any member of it. Realizing that anyone who took the trouble to compare my map with that portion of Mr. Calkins' map which covers the same area, might gain a misconception of the cause of the great difference, I undertook to intimate that it is a question largely of the time spent by each of us in the district, using, therefore, the statement that, "Mr. Calkins found that the structure in the Wardner district is too complex and obscure to enable him to do any but very generalized mapping in the time that he could give to the work." I believed I was warranted in this statement because on page 66 of Professional Paper No. 62,[2] Mr. Calkins says: "The structure is most complex and also most obscure in the quartzitic rocks near Wardner. Here the mapping must be considered as greatly generalized." Surely Mr. Ransome cannot object to my suggestion that Mr. Calkins' map would have been more detailed had he been able to give more time to the district.

Mr. Ransome seems to have taken especial exception to my use of the word "visited" in referring to his examinations in the district. I used the word deliberately, not with any intention of disparaging his work, but because I believed its use was accurate and proper. Soon after beginning work underground in the Bunker Hill mine, I learned, that in the upper workings accessible to Mr. Ransome, the fault, which had earlier in the history of the Bunker Hill, Stemwinder, and Tyler mines, been known as the 'Wardner foot-wall,' diverges from the foot-wall toward the east and downward, so that the foot-wall of the broad vein is made up of two faults of widely differing ages. This is a simple, clearly established, and important fact in the Wardner mines, but, if recognized by Mr. Ransome, there is no intimation of it in Professional Paper No. 62. Furthermore, he seemed to have overlooked abundant and clear evidences that the orebodies were formed in several stages, associated with different sets of fractures. Now I have for some years considered Mr. Ransome one of our strongest economic geologists; I, naturally, jumped to the conclusion that he did not make a detailed study of the Wardner mines, but that his investigation was of the nature of a reconnoissance underground, such as one would make on a prolonged *visit*. But if Mr. Ransome prefers, I will withdraw the term and replace it with *study*, though I will continue to deny that it was a *detailed* study. If he spent two weeks in the district, he must have covered the accessible underground openings at a rate of more than a mile a day which, in such a complex region, is a mere reconnoissance.

My paper as published was extracted from a much larger paper in which I had proposed to treat the geology of the Wardner district from every standpoint, giving due credit to the work of others. I concluded to cut it into several smaller papers, one of which should treat the faults at length from the standpoint of 'pure geology', and another, the bearing of geology on the mining operations of the Coeur d'Alene district; hence, I cut the economic paper down to bedrock. But I could not very well avoid some reference to the published work of the Government geologists. The men who really are entitled to have a grievance against me are the geologists and engineers whose work I have not mentioned.

I would have been delighted to have had Mr. Ransome's company while I was giving "leisurely attention" to the geology of the Wardner district. During the first 40 days I climbed about 120,000 ft., an average of 3600 ft. per day. I do not believe it is discreditable to me for having spent many days wrestling with those "soil-mantled and brush-covered slopes," thus evolving a system which is being successfully used in the search for new orebodies in the mines of the district.

The Coeur d'Alene region is the most difficult for geological field-work in which I have ever studied, because there is so little lithologic contrast between several of the formations, and especially between the surface débris from these formations. I can make, in a week in the desert country, a map more satisfactory to myself than I can in six months in an equal area in this country; hence, no one can better appreciate the value of the work done by Ransome and Calkins. I have always felt that Mr. Calkins' subdivision of the rocks was as good as could be made; my further subdivision of several of the formations in the Wardner district is only locally practicable. But Mr. Calkins frequently could not distinguish his own formations. For instance, I began work with a copy of his map in hand, to familiarize myself with the characteristics of the different formations. Later, I had to unlearn much. A number of small areas that were mapped as St. Regis I found are so related structurally to undoubted Burke rocks that they must be early Burke in age. At first I was strongly inclined to criticize him, but after leaving some of his Burke in the St. Regis for several years because of its purple color and being obliged to reclassify it as Burke because underground work failed to develop a fault between the purple rock and undoubted upper Burke, I feel more lenient. In a few places where small areas of a certain formation have been mapped, there is nothing remotely suggesting it, though the vicinity usually yields something that may have been the origin of the mapping. I have generally attributed this to the difficulty of inexperienced assistants determining their position with reference to the topographic map. I believe the same statements apply, though in lesser degree, to the entire Coeur d'Alene district. In the eastern portion of the district, where the structure is simple, the mapping is fairly good, but where Mr. Calkins has mapped faults there are usually others of equal structural importance; at least that has been my experience. Mine-owners and other geologists are learning that the details of the map are in many places useless for their purposes, if not even harmful. In making this statement I have no intention of arraigning Mr. Calkins. It was a physical impossibility for him to make, in six months of field-work, a map of a country like this, approaching to accuracy in detail. My map of a very small fraction of the Coeur d'Alene district, made public after several years of work, I do not consider beyond criticism. I expect in time to change some of its details as underground work is extended. Mr. Calkins' map is useful when properly understood. But I think that when a man is sent out to cover in two seasons a difficult and exceedingly complex region like the Coeur d'Alene district, the Survey should insure that the report shall clearly impress on the reader that the time given to the work was not sufficient to attain to any high degree of accuracy in the details, so that mine-owners and the general public will not place too implicit confidence in it. It is not to be supposed that the Survey can afford to carry on, in any one of the many mining districts demanding its attention, such an intensive study as the Bunker Hill & Sullivan Mining & Concentrating Co. has had conducted by myself and other geologists, and therefore I am not criticizing it for issuing Profes-

[1] June 1, 1912, pp. 750-753; June 8, 1912, pp. 786-790; and June 15, 1912, pp. 825-827.

[2] 'Geology and Ore Deposits of the Coeur d'Alene District, Idaho.' U. S. Geol. Surv., Prof. Paper No. 62, 1908.

sional Paper No. 62 after the limited amount of field work that was given to the district, but I am endeavoring to defend myself against Mr. Ransome's implied charge of unfairness for having intimated an explanation for Professional Paper No. 62's treatment of the Wardner district.

The general tenor of Mr. Ransome's communication indicates that he questions the existence of many of the faults which I have attempted to map and the practicability of dividing them into nine systems, each representing a distinct period and stress; he asks how I establish "so definitely that the nine systems of faults are of different ages and that each system has associated with it a distinct type of mineralization." I can show an attrition gouge or breccia for each of over 75% of the faults, and the others are necessary to explain the juxtaposition of formations which were originally not in contact. I never put a fault on the map when it is possible to explain the observed facts otherwise. I determine the relative ages of faults under the simple principle that where one fault has cut and displaced another fault, the displaced fault is the older; or, in some cases, by the fact that one fault has cut and displaced a mineralized zone whose mineralization is clearly younger than some other fault. When a number of faults appear to be of about the same age and to be due to a stress acting in the same direction, I group them into a system. That I have been able to do this so elaborately in the Wardner district is simply a proof of the advantage of time in geological work. The relative age of the faults having been determined, the recognition of different stages of mineralization followed as a matter of course. It is not very difficult to determine the age relation between a fault and a mineral deposit. Incidentally, I may say that the paragraph in which Mr. Ransome refers to "12 distinct and successive periods of 'mineralization'" indicates careless reading of my paper. The chief argument that I can offer in defense of the system which I have worked out is that it is meeting the critical test of development work and is aiding in the discovery of new orebodies—it is probably wrong in some details, but the principle is good.

My statement that "normal faulting made stronger gouges than reverse faulting" referred to the Wardner district, and was based on the observation of over 75 gouges; as Mr. Ransome has seen very few of these gouges, he is not qualified to question it. For stating that "gouges were distinctly inimical to the deposition of mineral" without crediting the idea to Professional Paper No. 62, I hereby make humble apology.

As to the disseminated siderite, the "conclusion previously introduced in the field," that it is not older than, but was derived from, the monzonite magma, studied in the light of all the statements in Professional Paper No. 62, amounts to no more than an *impression* on the part of Mr. Ransome. He does not present any evidence directly connecting it with the monzonite batholith, but does show that ferrous carbonate was not deposited, by solutions emanating from the batholith, in the contact metamorphic zone. To this I add evidence that the metamorphic silicates, in at least one place, replaced a carbonate which was disposed in the manner characteristic of the disseminated siderite. He states that Mr. Calkins finds that siderite "is most abundant where the rocks have been most folded and fissured," but this in nowise necessarily points to the monzonite as its source. In view of this fact, I think I am entitled to have the "impression" that the oldest form of siderite in the district is too widely disseminated to be reasonably referred to the action of the monzonite magma, and that it antedated the intrusion. The metamorphism to which I referred as being older than the dissemination of siderite in its present form is the regional metamorphism discussed by Mr. Calkins on pp. 74-75 of Professional Paper No. 62.

Tourmaline, it appears, is widely distributed in the sedimentary rocks of the Coeur d'Alene district. While "it is most abundant where the rocks have been most disturbed," Mr. Calkins shows that the tourmaline in the contact metamorphic zones "forms stouter individuals than commonly occur in the rocks not altered by the monzonite." May not the widely disseminated finer form be the product of the regional metamorphism referred to above?

That any of "the materials for the orebodies as they were successively formed were leached from older deposits" I am unable to prove, although I gave some evidence suggesting the derivation of at least some of the Blue Bird type from the disseminated lead-zinc mineralization. I suppose most of the leaching to have occurred far below the present deepest level in the Wardner mines. The idea was merely an "impression" on my part, gained from a study of the distribution of the mineralization in the various stages.

I now come to the one matter of real importance at issue between us—the question of the source of the lead, zinc, and silver of the Coeur d'Alene district. That "the ore constituents, inclusive of the siderite but probably exclusive of some of the quartz, were given off as emanations from the deep-seated portions of the slowly crystallizing batholith" of quartz monzonite is an assumption which is unsupported by any decisive evidence. "Among the facts adduced" by Mr. Ransome in support of this conclusion "was the mineralogical connection, through deposits of intermediate character, of the orebodies of the Wardner type with others in the same region that are genetically connected with contact metamorphic action." As he has shown, the district contains several ore deposits, notably those at the Granite and Sixteen-to-one mines, which are unquestionably of a contact metamorphic character. The lead and zinc sulphides were in large part deposited contemporaneously with the garnet and other contact metamorphic silicates. These silicates were formed while the sediments adjacent to the intruded mass were highly heated; in other words, at about the time of the intrusion. After the monzonite had crystallized to the depth of several thousand feet, the zone which was sufficiently heated and compressed for the formation of the metamorphic silicates had probably subsided beneath the contact metamorphic deposits; hence, the orebodies in the two mines mentioned above must have formed before the crystallization of the magma had reached its deep-seated portions. I have always understood the magmatic theory to imply that the gases emanating from the magma were expelled at the moment of crystallization; also, that as the solidification proceeds the portions remaining in solution becomes richer in the metallic elements. I do not understand that Mr. Ransome asserts that the ore constituents were to any extent derived from the upper portion of the monzonite, particularly from the monzonite off-shoots that reach the surface in the district.

No evidence is presented in Professional Paper No. 26 that lead and zinc-bearing gases rose through a great thickness of the liquid monzonite. There is, therefore, nothing known directly connecting the ores in the Sixteen-to-one and Granite mines with the deep-seated portion of the monzonite magma. All that these deposits demonstrate is that lead and zinc salts were accessible to the gases that emanated from the magma at or near the time of maximum intrusion, or to waters or vapors heated by proximity to the magma. They may just as well, and, in fact, with a little more probability, be held to have come from the sediments. It may be significant that the only typical contact metamorphic ore deposits in the district occur near the line of division between the Prichard and Burke formations, which is approximately the horizon at which I suppose the lead and zinc minerals may, originally, have been disseminated. Furthermore, it is not impossible that the lead and zinc sulphides had been subjected to concentration before the intrusion of the monzonite. The presence, in other mines, of contact metamorphic minerals, diminishing in strength of development away from the monzonite area, simply indicates their relation to the typical contact deposits. That there is a gradation to what Mr. Ransome calls the "Wardner type" means only that different mines present different mineralogical combinations. It does not prove that all these "gradations" were formed at

the same time or represent the same stage of mineralization. It does not prove that all the commercial orebodies or any of them, in the Wardner district, are of the same age as the contact metamorphic deposits in the basin of Nine Mile creek. To which stage in the Wardner district does Mr. Ransome apply the gradation? After the upper portion of the magma had solidified, he assumes that lead and zinc-depositing solutions continued to rise from the deeper portions of the batholith, but he does not present any evidence to show that these emanations came through the minute pores of the thick shell of crystallized monzonite, and does not point to any fissures in the monzonite as avenues of escape for the waters or gases. It is merely a working hypothesis; I endeavored in my paper to show that there may be another working hypothesis of equal value; that the source of the lead and zinc minerals may have been in a certain portion of the sediments. There is nothing inherently improbable in this, as it is fairly well established that the lead and zinc minerals in the great mining districts of the Mississippi basin were originally disseminated through the sediments. I did not pretend to prove my hypothesis and did not ask for its "general acceptance." The weak point in it is that I am not able to point to any one stratum in the sediments and give the amount of lead and zinc in invisible form that it may contain. I have always assumed that the laboratory at which my assays are made is not equipped to make the delicate determinations necessary in the case of a content as low as a few thousandths of a per cent. But I favor the hypothesis because it seems to explain the distribution of the vast majority, if not all, of the mines and prospects from the upper portion of the Prichard formation upward and to suggest an explanation for the fact that commercial zinc deposits are practically confined to the Prichard, whereas there is not sufficient mineralogical contrast between the formations to account for it as selective precipitation. I may finally adopt Mr. Ransome's magmatic theory, but at present the other appears to me to have the stronger support. I am searching for evidence.

In conclusion, I will say that I have been greatly and unpleasantly surprised at the tone of Mr. Ransome's communication. In several instances he misrepresents my position and then waxes eloquent in denunciation of it. My references, in the first part of my paper, to the work of himself and Mr. Calkins were not intended as a disparagement of their work, were not unwarranted by the facts, and have not justified the character of his protest. In the latter part of my paper I exercised the privilege which is due any geologist of dissenting from the opinions of another geologist. I did it without lack of respect to Mr. Ransome. His reply, however, has placed me on the defensive, and I have had to adopt his style to a certain extent. I will be pleased to continue the discussion, but along impersonal lines.

OSCAR H. HERSHEY.

Kellogg, Idaho, August 26.

Railroad Mineral Lands

The Editor:

Sir—In your issue of August 24 appeared a letter from 'Prospector' relative to the miners interested in the mineral belt of northern California and southern Oregon, as affected by the claim of the Central Pacific Railroad Co. to mineral lands therein. The Miners' Congress held at Yreka, July 18 and 19 last, which was noted by you editorially and which was participated in by the miners and mining men of the whole region, gave the situation consideration. Two resolutions, which were passed by the Congress, will fully justify publication in your valuable columns. One deals with the railroad company's claims directly, and the other approves the work of the Forest Service and seeks to have investigations as to the mineral character of the disputed lands conducted with the aid of its officials. These resolutions are as follows:

Ever since the prospectors of forty-nine blazed the trails over the Sierras and opened to the world the wealth of our gold mines, the policy of the United States, in recognition of their splendid service, has been to keep open to their class the mineral lands. This policy, incorporating as it has the miners' rules adopted at miners' meetings, into the laws of the land, after half a century trial has proved both its wisdom and its fairness. The prospector is still the greatest individual benefactor to the world's development. The 'grubstake' is still the most patriotic investment.

Contravening this policy and denying to the prospector these long unquestioned rights, the Central Pacific Railway is now claiming practically one-third of the great mineral belt, extending through Jackson and Josephine counties, Oregon, and Siskiyou, Trinity, and Shasta counties, California. This claim is in defiance to the express terms of its grant, and is against the very language of its patents. Believing this claim to be without right and that its blight upon the mining industry should be removed, not by driving the miner to engage at his own expense in litigation with that powerful corporation, but by government action without expense to the miner, just as is being done in case of the oil lands today; therefore, be it

Resolved, That the miners of southern Oregon and northern California, in this Congress assembled, do hereby respectfully request the proper federal and state authorities to take immediate steps within this mineral belt to have the mineral lands therein covered by claims or patents to the Central Pacific Railway Co. or its affiliated corporations or its predecessors in interest, exempted and segregated from said claims and patents and restored to public domain and to the right of the miner to prospect for and locate claims thereon; be it further

Resolved, That copies of this resolution, properly certified, be sent to the attorney-general of the United States, the director of the Bureau of Mines, our congressmen and United States senators, and the state mineralogists of Oregon and California; be it

Resolved, That it is the sense of this Congress that the Forest Service has proved an efficient agency, not only in preserving for the prospector the undiscovered mineral deposits in the district, by preventing their acquisition through non-mineral entries, but in facilitating their location, enjoyment, and patenting by good faith mineral claimants in accordance with laws passed in the interests of miners; and be it further

Resolved, That it is the sense of this Congress that the Forest Service employees in the field should be authorized to investigate, in connection with the miners, the lands covered by railroad grants and other non-mineral patents in the mineral belt, preparatory to government action in having such lands as are mineral exempted and segregated from lands properly held under such grants as non-mineral patent.

It is plain that where the railroad company accepted patents wherein appears the very plain reservation clause, "excluding and excepting all mineral lands should any such be found in said tracts," that it is as fully bound by the interests reserved as the Government is by the interest granted, and when the future tense is used, should any such be found in "said tracts," it is equally plain that probable subsequent segregation was in contemplation by both the Government and the company at the time the patent passed. It is also clear that if good faith has been and is to be observed between the Government and the railroad company, the fairest method of effecting the segregation will prevail. A thorough geological investigation is the first step demanded. This investigation should also be supplemented by tests by prospectors and miners. The segregation should be first done in the field, and it probably should be an arbitrary segregation, then very little will remain for the courts unless there is a resisting party, and if this resisting party is the most powerful corporation in the state of California it will not be quite fair to invite the prospector or miner to take up the gauge of battle. The Government should be the plaintiff.

Fully justifying suggestions have been made in the recent case of Van Ness *v.* Rooney, 169 Cal., 131, wherein the supreme court of the state approved the clear reasoning of Judge Bartlett of Trinity, who held that when patent was issued to the railroad company, containing the reservation clause quoted, that a mining claim within said tracts was specifically exempted from the grant of the patent, and title to it remained in the owner of the claim.

JAMES F. FARRAHER.

Yreka, August 27.

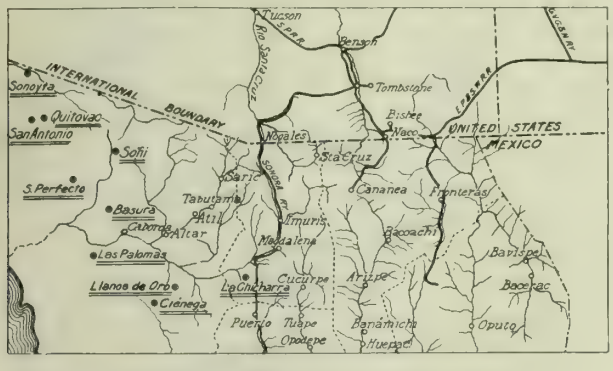
Special Correspondence

NEW YORK

LAKE COPPERS MERGE.—MEXICAN SITUATION.—COPPER AND THE RAILROADS.—COPPER MINE NEWS.—EL PASO CON. —NIPISSING.—GUGGENHEIM DIVIDENDS.

An important consolidation is anounced in the Michigan coppers. The Keweenaw is to absorb the Phoenix Consolidated Copper Co. and the Washington Copper Mining Co. The merger, as at present outlined, contemplates the taking in also of the Arnold Mining Co., the Ashbed Mining Co., and the Meadow Mining Co. The two latter concerns are controlled by the Keweenaw interests, and their absorption amounts only to a matter of bookkeeping. The Washington stockholders are to be given one share of Keweenaw for each twenty shares of stock now held, and the Phoenix shareholders are to come in on a basis of ten for one. The enlarged company will have something over 5000 acres of land on what is known as the Ashbed lode. As estimated by engineers, mining costs are about $1, milling and smelting costs 50c. per ton, and with 14 lb. of copper per ton of rock it is figured that at 17c. the company's ores will yield a profit of 88c. per ton. The stockholders of the Keweenaw are being assessed $2 per share to provide a treasury fund incidental to the merger.

The Mexican difficulties continue to be one of the chief deterrent factors in the mining situation. The beleaguerment of the Phelps-Dodge plant at Nacozari, where the



NORTHERN SONORA, SCENE OF TROUBLE.

company's Moctezuma mine is situated, and the disorders at Cananea, where peace has prevailed until recently, give to affairs a more serious aspect than at any time heretofore. There are a great many questions being asked as to how and through whom the insurrectionary forces in Mexico are being sustained. The impression seems to be growing that some unseen figures are playing a prominent part in fomenting and continuing the troubles. The State Department at Washington is apparently impressed with the idea that anything like intervention on the part of this country would solidify all the country south of the Rio Grande in opposition to the rule of the *gringo*. At the same time it is hard to see how the disregard of personal and property rights of Americans can be tolerated much longer. There is a rather interesting story to the effect that sinews of war for the insurrectionists are being furnished by a syndicate of deposed Latin-American rulers, including Castro, Diaz, and Zelaya. The theory is advanced by Señor Herberto Barron, commercial agent of Mexico, who has just returned to New York after a six-months stay in his home country. Señor Barron was at one time a candidate for the presidency of Mexico. There are some ugly rumors afloat as to the part played, or supposed to be played, by 'big business' interests in Mexico and Nicaragua. Both in New York and London, mining markets are suffering from the present conditions. Issues such as El Oro, Santa Gertrudis, Esperanza, and others that are traded in in London have marked time for more than a year. Notwithstanding the unfavorable conditions prevailing in Mexico, the Mexican Mines of El Oro has declared a dividend of 6 shilling per share, payable September 27.

There has been a great deal of discussion provoked by the announcement that the railroads were experimenting with a new formula for steel rails to contain 0.6% of copper. The statement was made that the St. Paul road had ordered some 5000 tons of steel rails to contain this amount. At present the statement cannot be verified, but there is a good deal that is of interest to be said concerning the use of copper in the manufacture of steel. At the present time there is only one regular steel product turned out by the United States Steel Corporation that contains any copper. Some time ago the Steel Corporation began making terne plates, for roofing purposes, containing a certain percentage of copper to give the steel additional weather-resisting qualities. These sheets are manufactured by the American Sheet & Tin Plate Co. A good deal of copper is used in various kinds of steel wire —piano wire being copper coated—and for this and similar purposes the Steel Corporation at present uses annually some 65,000,000 to 70,000,000 lb. of copper. One of the chief things to be considered in any experiments of this nature is the fact that the use of copper in railroading or similar purposes requires some years to complete satisfactory tests. The railroad companies can only arrive at any satisfactory conclusions after the compilation of carefully kept records extending over a period of time greater than that of the life of the regular rails now in service, and which are credited with an average life of from 11 to 13 years. While the possible new use of copper in this direction is extremely interesting, it is not a demand that can be created suddenly.

The insurgent crowd in the Stewart Mining Co. was unable to make any dent in the Heinze line of battle at the recent meeting held in Wallace, Idaho. The discontented shareholders, led by E. J. Carter, were recently soliciting contributions from shareholders for the purpose of paying court costs and expenses incidental to a suit for receivership. Evidently they were unable to accomplish anything within the company's breastworks and will be obliged to carry on their battle—if it is continued—from the outside. The shareholders of the Tuolumne Copper Co. are a rather disgusted lot. August smelting returns show a production for the Tuolumne of less than 250,000 lb., which, in view of conditions prevailing in the metal market, is not satisfactory. The president, Edward Hickey, is quoted in a recent interview as saying that the mine has developed a great deal of first-class ore, but that he considers it good practice to get rid of a large amount of second-class ore that can be worked now at a profit; that dividends will be resumed soon, and when resumed will be continued. A new contract has just been made by the Tuolumne with the Washoe smelter providing for the handling of the second-class ores of the mine, and under the new arrangement the Tuolumne tonnage output should be trebled.

W. B. Thompson, who is head of the Inspiration Copper Co., returned this week from a protracted vacation in Europe, and in an interview stated that copper conditions abroad are everything that can be desired; that there is no copper in storage on the other side, and that Europe is watching the copper situation in the United States carefully. He also says that one firm of bankers in Paris has accumulated 250,000 shares of Utah Copper and is still in the market. English and Continental investors have long ago been taught to appreciate the possibilities of mines that can be turned to manufacturing propositions. It is undoubtedly because Utah Copper is such a shining example in this class that its shares have such support in France, where frugality and safety of investment are always the prime consideration.

The movement which has been proceeding in El Paso Consolidated is evidently preparatory to a wide campaign

of distribution. It is announced that a deal has been made whereby the minority holdings of 400,000 shares of stock have been purchased by a syndicate, thereby removing all opposition to the management of Mr. Burris, the president. These minority shareholders have been fighting the present management for some time, and it is presumed that with this opposition out of the way, the plans for taking some of the adjacent properties in Cripple Creek will be carried through. A meeting is to be held in Denver next week for the purpose of increasing the par value of the stock of the company.

The Nipissing Mines Co. is taking advantage of the primary market for silver in London, and is making its shipments direct to England. Some of the silver sold during last month netted more than 64c. per ounce. Nipissing is one of the Cobalt companies that is in a strong position financially, and notwithstanding the fact that its new mill for treating its low-grade ores has all been—or will all be—paid out of earnings, the company still has a surplus larger by $100,000 than the surplus in the treasury this time last year. The new low-grade mill will go into commission in November, and thereafter the Nipissing will be a shipper of silver bullion only.

Hayden, Stone & Co. announces that the shares of the Alaska Gold Mines Co. were greatly oversubscribed at the initial offering, and allotments were generally cut down. The list of Guggenheim dividends, including Guggenheim Exploration, Yukon Gold, Utah Copper, and Nevada Consolidated, has been declared as usual without increase. It is expected that this line of securities will increase disbursements for the next quarter, and within a short time there will be some added dividend-payers. When Braden, Chino, Ray Consolidated, and Alaska Gold Mines are added the Guggenheim enterprises will have a very formidable front.

LONDON

MOUNT MORGAN REORGANIZED.—BURMA MINES, LTD.—MEXICO MINES OF EL ORO ISSUES FAVORABLE REPORT.

The Mount Morgan Gold Mining Co. has been passing through a critical period during the past twelve months, but, owing to the fact that the bulk of the shares are held in large blocks by Australian owners, little has been heard of the crisis here, and not much in Australia. The trouble apparently began when the smelting of the auriferous copper ore was inaugurated, but it became acute when the pyritic ore from Many Peaks was substituted for the barren ironstone flux previously brought from Iron Island. The services of A. L. Dean, of the Mount Lyell mine, were requisitioned, and Robert S. Sticht has also been on the spot. The smelting plant has been organized, and the celebrated 'mundic works', where the pyritic gold quartz has been chlorinated for years, is to be abolished. It has never been known outside the works whether this chlorination process was an economic success or not, for no figures relating to the original content or percentage extraction have been published. Two years ago the gold ore of the oxidized and leached zone was exhausted, so in future the ore is to be treated solely by smelting. A great deal has been said from time to time about the high costs at this mine. For instance, during the last financial year the yield of gold and copper was worth 53s. 3d. per ton and the cost 44s. 5d. With the new management it is hoped to vastly increase the margin between these two figures. We are now informed that G. A. Richard has resigned as general manager and that Robert S. Archer, previously chairman of the board of directors, has been appointed managing director. Though copper has been an important factor in the output of recent years, and though in future the ore is to be treated by the methods of copper smelting, the mine is still a gold mine. During the past twelve months the gold output was 133,867 oz., and the copper output 4520 tons. This was from the Mount Morgan ore itself. In addition 2068 tons of copper and 718 oz. of gold were obtained from the Many Peaks fluxing ore. The ore reserve has been re-estimated, with the remarkable result that the gold content is now given at a substantially higher level. The figures on May 31 last were: 1,499,000 tons averaging 3½% copper and 10 dwt. gold, and 2,207,000 tons averaging 2½% copper and 5 dwt. gold per ton. A year previously the figures were: 1,543,000 tons averaging 3½% copper and 8 dwt. gold, and 2,070,500 tons averaging 3¼% copper and 2½ dwt. gold.

The company called 'The Burma Mines, Ltd.' is one of the most interesting projects in London. It was formed by Bewick, Moreing & Co. in 1906 for the purpose of acquiring ancient silver-lead mines and slag heaps at Bawdwin, near Lashio, in Upper Burma, not far from the frontier of China. The mines had been worked previously by the Chinese for the silver content of the ore, and the lead was an unconsidered item, to judge by the fact that the slag averages 45% in that metal. These workers had confined their attention to the oxidized zone, and the sulphides disclosed through development by the present company contain a large proportion of zinc. Two years ago I mentioned that the expectations on flotation had been by no means realized, and that the company had had to be reconstituted on a new basis by drastically reducing the nominal capital, and at the same time assessing the shareholders. The affairs of the company are still being rearranged with the object of putting it on a sounder basis. The smelter has been removed from Mandalay to the vicinity of the property in order to save the expense of transport; a refinery is being built so as to extract the silver and sell the lead in the Eastern markets, while prospecting and development have been actively prosecuted so as to give the company a source of ore instead of being dependent too much on the old slag heaps. The ore disclosed in the developments consists of mixed sulphides, running high in lead and zinc, with some iron and copper, and containing much silver. The ore varies greatly in content, but taking an average of the samples quoted in the report, it may be said to contain 8 to 20% lead, 10 to 33% zinc, 1 to 10% iron, 0 to 5% copper, and 5 to 25 oz. silver per ton. The gangue is mostly quartz. In view of the changed conditions due to the nature of the sulphide, large lots of the ore have been sent to London

EASTERN AUSTRALIA, SHOWING POSITION OF MT. MORGAN.

for the purpose of determining the best methods of beneficiation.

As usual, the annual report of the Mexico Mines of El Oro affords interesting reading. The company used to be in control of the Exploration company. It was formed in 1904 to acquire from the Mexican Gold & Silver Recovery Co. a group of gold-mining claims situated to the north of the Esperanaza mine, which in its turn is to the north of the El Oro Mining & Railway Co.'s property. The same vein, the San Rafael, is found on the property of all three companies. In 1910 the control passed from the Exploration company owing to the opposition of the Pearson and French groups of shareholders. Before the change of control, the Exploration company had issued several gloomy reports prophesying a diminution of the grade of the ore and a reduction in the amount of ore raised. The yearly reports subsequently published have not so far confirmed these warnings, but have shown a maintained production and increased ore reserves. André P. Griffiths is consulting engineer and Fergus L. Allan is manager. The report for the year ended June 30 shows that 142,205 tons of ore was raised and sent to the mill, averaging 9 dwt. gold and 6 oz. silver. The bullion recovered was worth $1,555,095 or $10.89 per ton, being an extraction of 87.3%. The English accounts show an income from the sale of bullion of £317,329. The working cost in Mexico was £128,029 or $4.37 per ton; other current expenses absorbed £46,300. On capital account £14,985 was spent, and £10,000 was placed to reserve for income tax. The dividends absorbed £144,000, being at the rate of 80%. On June 30 Mr. Allan reported the ore reserve as 295,100 tons, assaying 9.14 dwt. gold and 5 oz. silver per ton. This is an increase of 76,000 tons as compared with the figures a year ago, and 110,000 tons more than at the end of June 1910. During the year a seventh tube-mill was added, and the drag-classifier has been adopted in place of the cones.

BUTTE, MONTANA

ELECTRIFICATION OF BUTTE, ANACONDA & PACIFIC.—BUTTE & SUPERIOR MILL.—DAVIS-DALY CO. FINDS ORE ON NEW LEVEL.—AIR-HOISTS DISPLACING STEAM.—'RUSTLERS' TO BE ABOLISHED.

Along the line of the Butte, Anaconda & Pacific railway the poles are now up, but wiring has progressed no farther than from Anaconda to the Silverbow county line. At this point the workmen demanded for this work the wages which prevail in Butte. As these are higher than the wages paid by the mining companies for linemen around the mines, the work was stopped and the men are on strike.

D. C. Jackling, general manager for the Butte & Superior Copper Mining Co., accompanied by George Bradley, mechanical engineer for the Utah Copper Co., F. J. Janney, F. J. Janney, Jr., T. B. McCormick, and R. W. Salisbury, all of Salt Lake City, are in Butte on a tour of inspection of the company's property. The concentrator will soon be in shape to run at its full capacity of 2000 tons per day, but the mine will be unable to deliver this amount until the new hoisting-engine, now being installed, is ready. This will mean a delay of about two months. It should be remembered that the name 'copper company' as applied to this organization is misleading, as the mine is developing zinc sulphide ores almost entirely. At Mr. Jackling's suggestion, some of the jigs in the mill have been replaced by Garfield tables.

The Davis-Daly Copper Co. has cross-cut one of its known orebodies on the 1900-ft. level. The orebody is of about the same width and grade as on the 1700-ft. level above.

The Anaconda Copper Mining Co. is rapidly displacing its steam hoists by those operated by compressed air. Twelve hoists of the new type for use in the manway compartments of the shafts have recently been ordered, and one of them has just been installed at the Tramway mine. Nearly all of the big hoists for handling ore are already of the air type. The 12 new engines are of Nordberg manufacture, direct-acting under air-pressure of 85 lb. per square inch. As the air-pressure is about 25 lb. less than that for the old steam-engines, the cylinders are of larger diameter, being 28 by 48 inches.

A common sight in the past around the foremen's offices of all the mines has been the long line of 'rustlers', or men looking for employment, who collect around the surface workings waiting for the appearance of the foreman, thus delaying surface operations and frequently endangering their own persons. Furthermore, the system which permitted each foreman to select his own men has been unquestionably subject to abuse in certain instances, the men securing employment having to pay various 'rake-offs' to those instrumental in employing them. These objections are to be overcome shortly by the establishment of a centrally placed employment bureau for all the mines, where applicants will register. The foremen will then secure their men from this office.

KALGOORLIE, WESTERN AUSTRALIA

STAMPEDE TO KURNALPI.—LAKE VIEW IMPROVES.—GREAT FINGALL LOSES IN AFRICA.—LABOR UNIONS AND ITALIANS.

Renewed interest has suddenly been centred on the Kurnalpi field, situated some 55 miles northeast from here, from the fact that three weeks ago two prospectors, Routledge and Graham, deposited in the Western Australian Bank at Kanowna, 718 oz. of gold won from a narrow vein at a depth of 40 ft. A week later excitement was increased when Geissner and Huffa deposited 400 oz., said to have been got at a depth of 4 ft., from a similar lead 2½ miles north of the previous find. In the first-named consignment there was one slug of 46½ oz., and in the latter another of 230½ oz. A big rush immediately set in, and already some 70 claims, comprising 1500 acres, have been applied for, on which the Government has drawn some $3500 in rents and fees. In addition to this, nearly four times the area has been staked, the owners playing a waiting game, before the legal ten days expire, during which they must pay up or quit. As the journey by motor car can be done in three to four hours from here, it is needless to say all the mine managers around, beside hundreds of other speculators, including all doctors who own their motors, have been out and staked claims. There are fully 500 men on the spot, most of whom are camped in the old postoffice and police barracks, which have been vacant for ten years. The solitary hotel, which would have been vacated in another fortnight, is doing a roaring business in drinks, beside supplying 100 meals two or three times a day. The ground in question was well prospected in 1896-97 by the Octagon Explorers, Ltd., a London company, which has a cash working capital of $250,000. Eight shafts were sunk to various depths down to 100 ft., and a lot of cross-cutting done, but without any profit. R. S. Black, now general manager at the Kalgurli mine, was in charge at that time. No work is being done at present, not even by the prospectors, but this state of things cannot last much longer, as work must start 30 days after application has been made. Of course this regulation can be dodged, as was the case at Bullfinch, by two or more parties staking the same ground, or at least overlapping each other. In such cases work must be suspended till the ground is surveyed, which may mean a respite of anything up to six months. It is impossible to predict how the field will turn out, but the general impression is that it will never be any good except to small operators; in fact, that there is little chance of any big profitable lodes, such as those at Kalgoorlie, ever being discovered.

The Lake View & Star is now earning a profit of $200,000 on its nominal capital of $1,000,000, or 20% per year, and dividends of 15% per year are foreshadowed for some time to come, and any surplus is to be retained as a reserve fund. The company is now running its treat-

ment plant by electricity provided by the Kalgoorlie Electric Light & Power Co., and it is estimated that by erecting a suction-gas plant and producing its own electricity, a saving of $30,000 per year could be made, which would pay for the plant in two years. However, nothing is to be done immediately. Ore reserves are estimated at fully two-years supply on present output with large probable reserves. This can easily be seen, as in the Star mine no ore below 400 ft. is included, although three lodes aggregating 50 ft. in width have been partly opened down to 1100 ft. The main shaft on the Lake View, which has been at a standstill for seven years, has been re-started, and levels will be opened at 2000 and 2100 ft. when these points are reached. Since the mill was overhauled and extended a year ago, the duty per stamp has been increased from 5.58 to 7.18 tons per 24 hours, and costs reduced from $4.52 to $4.27 per ton. Even in the upper levels of the Lake View mine new orebodies have been discovered,

THE GOLDEN MILE.

since H. E. Vail, an American engineer, took control two years ago, and prospects have vastly improved since then.

The directors of the Great Fingall showed very poor judgment when they invested $375,000 of the company's money three years ago in the Tarkwa Main Reef, a West African mine, which had been fruitlessly run by a London company for nine years without producing any gold. After exploiting this mine for three years, they now tell shareholders that they have had to use a portion of their profits from the Great Fingall mine to write off the West African investment as a bad debt. Judging from results, Bewick, Moreing & Co., the consulting engineers of the company, have done badly in all their ventures since the early days of Coolgardie. With regard to the Great Fingall, the mine has been opening up well after being a blank for 450 ft. between the 13th and 16th levels. At the 17th level there is a shoot 308 ft. long by 60 in. wide, worth $9.30 per ton, and at the 18th level the shoot is 316 ft. long by 50 in. wide, worth $11.25. This can only be mined through a blind inclined-winze from the 13th level, which makes it wholly unprofitable. It is reckoned that an expenditure of $100,000 will be required to get over the difficulty. The company's balance is still $390,000 in spite of other ventures.

Although the labor unions must give notice next month as to whether the current wages agreement is to continue or be abrogated after September 30, they appear to have taken no definite steps in the matter so far. At least the rank and file appear to have no inkling as to what is to occur, and naturally the Chamber of Mines is lying low. The latest phase of the Labor party's madness is to legislate against more than a fixed proportion of Italians and Austrians being employed on the mines. The question has been brought up in Parliament, and a letter was also written to the Chamber of Mines on the subject, but got no encouragement. A meeting was convened by the mayor of Kalgoorlie, to be held in the town hall, but ended in a fiasco, as none of the responsible leaders of the party would face the music. There is no question that the best Australian miner has no superior in the world, but an industry which employs 16,000 men must have a large percentage of 'ne'er-do-wells' and wasters, and these howl longest and loudest. All the best men are employed at Kalgoorlie, and little is heard of the Italian here, but elsewhere they must be employed wholesale or the industry will be paralyzed, as it has been at Lawlers and Lancefield. It is practically moribund at Laverton. The Sons of Gwalia, after every pay-day, has several machines stopped owing to men not returning after their fortnightly spree. If at such times Italians are employed, there is a cry against foreigners taking the bread out of the mouth of the Australian. The slackness of a small percentage of the latter is the cause of the whole trouble, and if the present Labor Government legislates on behalf of these wasters, they will do irreparable damage to the mining industry. Even the wood-chopping industry, which is almost monopolized by foreigners, is to be included in the restrictive legislation suggested by the malcontents, although no self-respecting Australian will go 100 miles or more into the bush, as all have to do now to chop wood.

During its past financial year, the Kalgoorlie Electric Power & Lighting Co. made a profit of $121,000, against $90,000 for the previous term. The cyclone which blew down the transmission lines, cost the company $15,000 for repairs. No dividend was paid on ordinary shares.

BOSTON

SILVER MINES OPENING.—BUTTE CENTRAL PLANS.—ALASKA GOLD MINES.—BRASS TRADE ACTIVE.

The high price of silver is becoming an important market factor. Recently there has been good buying of Nipissing with a substantial advance in the price, attributed to investors looking for an increase in the dividend. In Butte there are said to be over 100 abandoned silver mines and workings, many of which the higher price will bring back to a producing basis. The Butte Central Copper Co. is hurrying the first two units of its new mill to completion this month. The Butte Central mill is exclusively to treat the low-grade silver ore capping the copper vein. The constructor, John Rothwell, of Denver, expects by concentration to recover from these ores 63.9% of the gold and 39.44% of the silver. By cyanidation he expects an additional recovery of gold and 43.35% silver, making the total extraction 99.22% of the gold and 82.79% of the silver. Should Mr. Rothwell's estimate hold good, the interests behind Butte Central expect to go largely into the treatment of low-grade precious metal ores in Butte.

Boston has to date paid little or no attention to silver properties, but now that it has taken up zinc and gold issues supplementary to copper, interest even in silver is expected. Not long ago Nevada Hills was listed on the Curb here, but it has not yet attracted the attention it has in other markets. Premature trading on the Curb in Alaska Gold Mines Co. stock, pending the allotment of subscriptions by the banking house having the campaign in charge, has resulted in a number of shorts being confronted with the probability of a squeezing. The subscriptions for this issue were unprecedented in mining annals, coming from all over the United States, together with England, France, and Germany. The amount of stock represented in the preliminary offering was subscribed for many times over, and fully 2000 shareholders were enrolled. The success of the Alaska Gold Mines flotation is following the success of the Butte & Superior as a zinc issue, and has started Boston toward becoming a general mining-share market.

At the present time the unprecedented activity of the brass manufacturing business is easily the leading factor of the copper trade. The American Brass Co., which is the largest consumer of copper in the world, is said to be short 1000 operatives. As the result of the strong domestic demand for copper, recently reinforced by renewed buying from Europe, Boston speculators look for 18c. copper this fall, with the strong probability of 20c. before the end of the year.

General Mining News

ALASKA

Valdez

It is reported that the Tyee Smelting Co. of Ladysmith, British Columbia, is to re-start its smelting plant, and send a man to Alaska to contract for ore. This plant was shut down two years ago. The production of copper ore from Prince William Sound in Alaska is increasing. The Kennicott Mines Co. is building a mill; the Great Northern Development properties near Kuskulina will soon be ready to ship ore; the Beatson mine at Latouche is shipping steadily; and the Ellamar mine will have an output of 3000 tons per month when improvements are finished. The Fidalgo-Alaska company has 250 tons ready, and W. A. Dickey is shipping about 500 tons per month from his property on Landlock bay. News comes from Iditarod of a new find of dredging ground in the Kuskowim country, 90 miles above Bethel, opposite the Tulicsak river. It has been staked everywhere, and the gravel is only two to eight feet to bedrock, but is very wet. On Cleary creek, near Fairbanks, 35 men are working and doing fairly well.

ARIZONA

Cochise County

The Copper Queen company will probably take up its option on the claims of W. Reid, of Tucson, and also make payments on the Ramsdell, and nine claims of the Leatherwood, all being near Apache Camp. The August output of the Calumet & Arizona was 4,514,000 lb. of copper, against 4,748,000 lb. in July. In the latter mine two good discoveries of ore have been made on the 1300 and 1500-ft. levels of the Junction shaft. During the past year the Shattuck-Arizona company did 4942 ft. of development work. Important work was done on the 400 and 500-ft. levels. The carbonate of lead deposit is between the 300 and 400-ft. levels, while copper ore, high in silver, has been opened at these levels. It is proposed to add a lead furnace to the new smelting plant to be built at Douglas. During the year, ore shipments were valued at $213,654, while development and ore shipping cost $152,103; office expenses and taxes, $17,118, leaving the gross profit at $48,465.

Gila County

(Special Correspondence.)—The Miami Copper Co. produced in August 4322 tons of concentrate assaying close to 36% copper, which will yield about 2,900,000 lb. of fine copper. The mill recovery is reported to be 70%. There was mined during the month 97,890 tons of ore, and 4802 ft. of development work was done. About 30% of the ore came from development work, 25% from the shrinkage stopes, 35% from square-set mining next to the capping, and 10% from the stock-pile. The second 500,000-gal. mill-water storage tank has been erected, making a total capacity of 1,000,000 gal. A 600-hp. Babcock & Wilcox water-tube boiler is being installed in the power-house at Miami, making a total of 2400 boiler horse-power. When the installation is complete, the second 4000-cu. ft. Nordberg air-compressor will be operated. Foundations are being laid for the new steel and concrete change-house, and the construction of the new hospital, jointly with the Inspiration company, has been started. It is designed to accommodate 40 patients, and will be equipped with the most modern appliances. Two churn-drills are steadily at work developing the northeastern part of the property, and diamond-drilling continues on the 570-ft. level.

About 600 men are employed at the Inspiration Consolidated mines in underground development and construction work. Mine development is proceeding through five shafts and two adits, and two main working-shafts are being sunk. The main east shaft is over 180 ft. deep and was sunk 172 ft. in August, which is claimed to be the record for a standard 3-compartment shaft in the United States. The main west shaft is over 350 ft. deep and was sunk 146 ft. in August. They are being sunk on contract by J. Harrington, who is working three shifts, five men on a shift, in each shaft. The company has made a contract with the U. S. Reclamation Service to take 7500 kw. of electric power from the Roosevelt dam, about 40 miles distant, and survey for the transmission line has been started. The Government does not guarantee a continuous service, however, and the company will build an emergency steam-power plant capable of generating 7500 kilowatts.

Churn-drill holes 6, 7, and 8, at the Southwestern Miami, are 925, 927, and 880 ft. deep, respectively, and are to be enlarged by under-reaming preparatory to drilling deeper, so that it will be a week or two before further depth is made in any of them. Hole No. 8 is reported to be yet in chalcocite-bearing schist, which it first cut at 720 ft. and which was reported to be of a profitable grade at 820 ft. Hole No. 7 is in silicified, iron-stained schist, and hole 6 is in schist slightly mineralized. Churn-drill hole No. 3, at the South Live Oak, is over 425 ft. deep in leached, silicified schist, the silicates and carbonates of copper no longer appearing, though some samples show small amounts of native copper. It is proposed to acquire a second churn-drilling machine and drill three more holes before the end of the year, near and in line with the one now being drilled. John Gibson, superintendent for the Globe-Ray Mining Co., of the old Independence mine, 12 miles southwest of Miami, has just completed the shipment of three cars of ore containing gold, silver, and copper to the Old Dominion smelter at Globe. The ore was carried on burros three miles to the summit of Pinal mountain, thence 9 miles by wagon to Miami, whence it was shipped 9 miles to Globe over the Arizona-Eastern railroad. It is estimated to average 7% copper, 4 oz. silver, and $4 in gold. The mine workings are badly caved and mining has been discontinued.

W. D. Fisk and Henry Snell have taken a lease on the Black Warrior mine near Miami, and will start work immediately. The Warrior has been a famous producer of copper silicate ore, averaging over 10% copper, and was last worked by the Warrior Development Co., a Hovland-Smith corporation. Ore is exposed on the fifth or lowest level. Mr. Fisk promoted a deal whereby the Magma Copper Co. acquired the now famous Queen mine at Superior, and Mr. Snell is a mining engineer with long experience in this district. The Copper Hill shaft at the Arizona Commercial is now completely retimbered and enlarged to three compartments, from the collar down to the fourth level, where a pump has been erected, and is being operated by compressed air from the Old Dominion power-house. The shaft and workings below that level are now being unwatered, preparatory to retimbering and enlarging the shaft below the 400-ft. point. At the Iron Cap mine, on Copper hill, the drift east from the Williams shaft on the 650-ft. level has for the last 20 ft. been in a shoot of ore about 4 ft. wide and is reported to average 8% copper and 50% iron. A car is being loaded preparatory to shipping to the Old Dominion smelter at Globe.

Globe, September 5.

CALIFORNIA

Calaveras County

The Calaveras Copper Co.'s smelter is nearly finished and will be started as soon as fuel oil can be delivered. The mill is temporarily shut down. At present shipments of ore are being sent to the Kennett smelter. The railroad survey from Chinese Camp has been completed, and a line can be constructed at low cost.

Modoc County

(Special Correspondence.)—It is said that the Modoc Mines Co. is contemplating sinking its 75-ft. shaft to a depth of 500 ft., according to apparently authentic statements. Three feet of pay-ore has been opened so far.

The company is composed of Chicago people, headed by William Wrigley, Jr. L. H. Patrick is manager. The 10 stamps of the Consolidated mill are crushing ore from the Sugar Pine claim. It is claimed that the extraction has been increased from about 47 to over 65% by alterations to the plant. It is expected to increase the efficiency of the mill by a few minor changes. R. R. Binns is in charge of the plant. Development continues in the Mountain View and Sugar Pine claims, and results are said to be encouraging. About 30 men are working. A. J. Cummings is manager. The Spearmint Gold Mining Co. has secured the Lucky Dutchman lease on the Yellow Jacket. It is stated the consideration is on the basis of part cash and part stock in the new company. The lease was originally operated by Mack and Schrott, and ranks among the best in the district. The Spearmint people also con-

BIG FOUR MINE, HIGH GRADE.

trol the Spearmint claim and Yukon group. A recent run on low-grade ore was made by the Big Four mill. The shipment averaged about $8 per ton and it is said that the extraction was 75%. The ore regularly going to the stamps from Big Four workings ranges from $25 to $40 per ton. Several finds have been recently reported by lessees, but all of these were made near the surface. Most of the companies are making preparations for the winter season, which sets in early here.

Ft. Bidwell, September 6.

Sierra County

Work has been stopped for the winter by Manuel and Cadman on their gravel claim south of American hill.

Siskiyou County

(Special Correspondence.)—William Werst and G. W. Nickerson are developing the Sugar Hill quartz claims near Callahan. The main 120-ft. adit is being extended 30 ft., and from this point a cross-cut will be driven across the vein to the old 60-ft. adit. The vein is reported to be over 90 ft. wide, assaying $4 to $8 per ton. The owners intend to erect a crusher and cyanide plant next spring. The same men own the Sugar Hill placer property on Fox creek. Derricks and pipe-lines have been placed in position and everything is in readiness for two giants to operate with the early rains. It is rumored that negotiations are pending for the transfer of the Beaudry hydraulic mines to a syndicate of San Francisco, Oakland, and New York capitalists. The price involved is said to exceed $200,000. The property embraces about 3000 acres and was located about 50 years ago. It has been intermittently operated of late. Equipment includes two complete placer-mining plants. The Shasta Mining Co. is developing a massive orebody in its property five miles southwest of Callahan. In places the lode is said to be 100 ft. wide, worth about $5 per ton. A new adit is being driven 175 ft. below the old levels. James McKeene is superintendent. The Foster mine continues to produce 15 tons per day. Arrangements are being made to increase the working force, as conditions are said to be particularly encouraging. The vein ranges from three to five feet wide, and is worth about $20 per ton. The mine lies in the Trail creek region. Most of the hydraulic mining companies are busily preparing for the winter season. The water has been low during the past few weeks, and save in favored localities, little placer mining is going on.

Yreka, September 7.

Trinity County

The Trinity Dredging Co.'s dredge, costing $125,000, was started on the river five miles above Lewiston, last Sunday. This work has been under way for about two years. Chico people are much interested in the undertaking.

COLORADO

Clear Creek County

(Special Correspondence.)—A shipment of 50 tons of ore, averaging $40 per ton, was made this week from the Boston mine to the Linn mill, and as a result the Kelly mill will be started next week. Work has been resumed on the Lake property on Lincoln mountain, W. Aldred having been awarded a contract to drive 50 ft. The old Shively mine on Brown mountain is again being developed. The shaft will be sunk 100 ft. to connect with the adit-level. On an average, two cars of heavy lead ore are being shipped each week to the Salida smelter from the Santiago mine in East Argentine, the average grade of the product being $60 per ton. Bramer and party, lessees at the Gambetta mine, started a 100-ton shipment of zinc ore this week which will be treated at the Mineral Chief mill. Ramonde and party, lessees at the Seven-Thirty mine, have uncovered an 8-in. vein of silver ore assaying 250 oz. per ton. Shipments have been started. Work has been resumed on the Hidden Treasure mine in East Argentine, owned by Carl Johnson. The Geneva property, on Alpine mountain, is receiving attention. A small vein of $90 ore is showing. A 3-in. streak of glance assaying high in silver has been uncovered in the Harris mine near the top of Argentine pass.

Georgetown, September 4.

Gilpin County

Drifts are out 100 and 132 ft. respectively, east and west, from the 400-ft. level of the Castle Rock. On the latter drift there is 6 in. of smelting ore, and 36 in. of mill ore, assaying 1.2 oz. gold, 6.6 oz. silver, and 20% of lead. On the east side the lode is 12 in. wide. On the 1300-ft. east level of the Topeka, an ore-shoot has been opened 200 ft., for 48-in. width, worth $10 per ton. Water is receding in the Phoenix-Burroughs group at the rate of 9 in. daily. The Chase mine shipped, during August, 41 tons of ore for net returns of $1068. Another lot from the 600-ft. level is ready. The Pittsburg mine made five shipments. A machine is working on the 1000-ft. level, and two electric pumps are lifting 60,000 gal. of water daily.

Lake County (Leadville)

Shipments for the month of August amounted to several thousand tons more than in July. The Western Mining Co. hoisted about 12,000 tons, while there were increases from the Yak, Iron Silver, and Colonel Sellers. L. F. Miller, professor at the Golden School of Mines, has been in Leadville observing work in the mines, mills, and smelters, in order to arrange his lectures in a practical way. He has already visited Pueblo, Salida, Florence, and Breckenridge, and will next visit other important centres.

Ouray County

(Special Correspondence.)—During July the mill at the Wanakah mine worked 29.5 days and treated 1246 tons of ore with an extraction of 91%. The net value of the concentrate was $19,472, and of 213 tons of crude ore shipped, $4551, making a total of $24,024. Operating expenses were $7287, leaving operating profit at $16,736. Development covered 225 ft. during the month.

Ouray, September 7.

There are 90 men working at the Revenue mine. Low-

grade ore has been milled in the past, but better ore is expected to be treated. Work at the Sweepstakes is being pushed as fast as possible to be ready for winter. The Telluride Power Co. is erecting poles for the transmission line. California people have purchased the Humboldt, and $60,000 will be spent in general work. The Red Mountain Railroad, Mining & Smelting Co., owning 100 claims, which has been in the hands of a receiver for a year, was sold for $175,000 to J. F. Thompson. At the Congress mine, once worked by T. F. Walsh, F. C. Goudy and H. B. Maris have cut six feet of ore assaying 30% copper, on the sixth level, or 410 ft. below the surface. Work is progressing with machines on two shifts. A raise will be driven to connect with upper workings, and regular shipments made.

Teller County (Cripple Creek)

Water has been reached in the Mary McKinney mine at 118 ft. below No. 9 level, and a pump is being fitted to allow further sinking. During August 40 cars of ore were shipped, 34 from the company averaging $35 per ton. On No. 9 level ore has been opened for 600 ft. in length, and nine machines are working. From the Elkton mine 3000 tons was shipped worth $50,000; while the C. K. & N. sent out 25 cars worth $20 per ton; the Victor mine, 35 cars of medium-grade ore; 25 cars of $20 ore from the Ajax on Battle mountain; 75 cars of $25 ore from the Granite; and 20 cars from the Jerry Johnston. There are 25 sets of lessees at the Granite, employing 170 men, and 37 machine-drills are at work on the property. Lessees on block 239 of the Stratton estate have cut rich ore at 150-ft. depth. One ton was settled at 44 oz., while another lot brought 72 oz. per ton. One carload recently averaged 2½ oz. per ton. A syndicate of New York and foreign capitalists has bought 400,000 shares in El Paso company.

IDAHO

Coeur d'Alene

(Special Correspondence.)—Notwithstanding that he was blocked in his effort to make an amendment to the article of incorporation which would permit the purchase of stock in other companies and disposing of stock, F. A. Heinze is satisfied with the result of the annual meeting of the Stewart company. The judge, before whom the receivership question is to be heard, stopped Heinze's efforts in this direction. It is understood that W. O. Allison, of New York, will become president, and M. W. Bacon will continue as secretary and general manager. The auditor, engaged by E. J. Carter to examine the company's books, may be able to make a statement in about 30 days. The company's earnings for July were $49,350, and net profits $43,600.

Wardner, September 5.

MICHIGAN

Houghton County

Shipments from No. 1 shaft of the Allouez mine average about 800 tons per day. Stoping is being done from levels 9 to 13; and 25 machines are working from levels 8 to 17. The Osceola is hoisting 500 tons per day from No. 4 Kearsarge shaft. The cross-cut on level 34, at the Hancock, is in ore 640 ft., the last 130 ft. carrying copper. The shaft is down 3860 ft. in trap-rock. At the Franklin, underground workings are capable of producing 1200 tons of ore per day. No. 1 and 3 shafts are to be connected at level 23, the latter now being down to level 17, and a drift is to be started from level 23 of No. 1 shaft to the latter. It is reported that the Calumet & Hecla company has decided to erect an electrolytic plant, in connection with the smelting works at Hubbell. The building will be about 150 by 250 ft., and should be finished early in 1913.

For August the following outputs of copper are published: Baltic, 1,970,000 lb.; Champion, 2,196,000 lb.; Tri-Mountain, 950,000 lb.; Franklin, 414,000 lb.; Mohawk, 1,251,000, and Wolverine, 930,000 lb. When present plans are carried out there will be 18 tube-mills for the Champion, 15 for the Baltic, and 12 for the Tri-Mountain. These mills will be fed with certain tailing which contains copper that cannot be profitably extracted by present methods. Wilfley tables will deal with the tube-mill product. The mills will be driven by motors, which derive their power from a 2000-hp. turbo-generator driven by exhaust steam from the stamps at the Baltic mill.

MISSOURI

Jasper County

The trend of zinc ore prices was downward during August, starting with $60, the month closed at $56 per ton for best grades of blende. Calamine prices did not vary so much, the average for the month being $30.41. During five weeks a total of 27,732 tons of blende was shipped, and 2262 tons of calamine. Shortage of cars has been felt to some extent. Lead ores shipped averaged 822 tons per week.

MONTANA

Cascade County

Montana coal miners and operators are in conference at Great Falls, and will sign a working agreement for the next two years. There are no signs of changes in the wage scale or any serious differences. Local capital has been organized to drill for oil under the town of Great Falls, and plant has been ordered.

Silverbow County

(Special Correspondence.)—Production of the Anaconda company for the past two months has been lower than usual, owing to improvements at the Washoe smelter. No. 1 section has been completed, and the September output should be 27,000,000 lb. of copper, compared with 24,800,000 lb. for July and August. North Butte production will not be increased, but there may be an increase from the Tuolumne. The East Butte continues with a yield of about 1,125,000 lb. The St. Louis company will erect a cyanide plant of 1100-ton capacity. This property is situated in the same district as the Piegan-Gloster mine, recently bought by the Barnes-King company, and includes the old Drum Lummond mine. There is renewed activity in the district, and all companies have made an arrangement with the Missouri River Power Co. to use electric power from its plant.

Butte, September 6.

NEVADA

Esmeralda County

(Special Correspondence.)—The estimated production, in August, for the Goldfield Consolidated company is 32,480 tons yielding bullion worth $426,000. Operating expenses were $195,000, leaving net profit at $231,000. At the meeting of the board of directors of the company, held at Reno on September 3, the regular quarterly dividend of 30c. per share was declared, payable October 31, to stockholders who are of record on September 30.

Goldfield, September 5.

At Goldfield, development of the Blue Bull, Booth, Combination Fraction, and Sandstorm-Kendall mines is under the supervision of K. M. Simpson. Enlarging and retimbering the old main shaft of the first-named has been finished, and sinking is under way to 700-ft. depth. From this point cross-cuts will be driven to explore the Blue Bull, and the eastern half of the Victor claim of the C. O. D. Consolidated. The shaft of the Sandstorm-Kendall is down 500 ft., and opening out will be started from here. The debt of the property has been reduced to $35,000, and cash on hand at July 31 totaled $8136. Chicago capitalists are to sink the shaft 1500 ft. deep at the Silver Pick. It is now down 350 ft., is in good condition, and fairly well equipped. Lodes exposed by the old lessees on the 250 and 350-ft. levels, averaged $16 per ton.

Lyon County

The Nevada-Douglas company has finished sampling the Bluestone mine, and results are satisfactory. The price put on this property is $1,500,000, but there is a large

quantity of 3% copper ore opened. The Thompson smelter is running one furnace at present, while the other is being enlarged by 60 in., and should soon be started, when the first one will be enlarged by 120 in. in length, giving the whole plant a daily capacity of about 1900 tons. A number of small mines along the Southern Pacific line will soon be shipping ore to the smelter.

NYE COUNTY

During August the Tonopah Extension mill treated 4767 tons of ore for bullion valued at $64,800; 878 ft. of development was done in the mine, and the new main shaft sunk to 545-ft. depth. The condition of the mine is highly satisfactory. At the Montana-Tonopah, 4808 tons were

MONTANA-TONOPAH MILL.

treated yielding 34.5 tons of concentrate, and 56 bars of bullion shipped. This is a record production to date. The West End Consolidated treated 3650 tons, but details are not yet published. The mine hoist is to be increased from 75 to 100 hp., and the compressor plant of 10-drill capacity will be added to by another of 5-drill size. The cross-cut from the 600-ft. level is out 50 ft. to the lode; and the station is being enlarged. Last week the Belmont shipped 68 bars of bullion weighing 118,372 oz., to the Selby works, at San Francisco. The mill is now treating 500 tons daily. A 25c. dividend has been declared, amounting to $375,000, making the total to date $3,593,000. On its 970-ft. level, the Tonopah Merger has cut ore in a cross-cut 60 ft. from the shaft. The new electric hoist will be at work next week, and also the new two-stage, 100-hp. compressor. The MacNamara sent out bullion valued at $17,000, being the result of 19 days' run of the mill.

STOREY COUNTY

An inspection of the pumping situation at the Comstock has been made by members of the Pumping Association from San Francisco. They went down to the present water-level at 2150 ft. in the Ward shaft, and then saw the temporary pumping plant at the C. & C. shaft. The pump and motor are doing good work. Eventually there will be three pumps in the sump of the shaft, and they will be lowered as it is cleaned out to the 2500-ft. level, when opening out will be started from that point, with permanent gear. The general situation at the north end of the lode is held to be more favorable, especially as co-operation is assured along the line.

UTAH

JUAB COUNTY

A mill is to be erected for the Knight mines in the Tintic district, and will be large enough to deal with ore from other mines. It will have a capacity of 100 tons and will cost $35,000; but it is intended to increase the plant to 500-ton capacity. This will enable low-grade ores to be treated locally, instead of going to the smelters. The Iron Blossom mine will hold back its low-grade ore on this account. The Opohongo mine sent out 24 cars of ore during August. On the 400, 500, and 600-ft. levels there is plenty of ore averaging 3 to 12% copper, $2 gold, and 12 to 15 oz. silver per ton.

SALT LAKE COUNTY

(Special Correspondence.)—Close relationship between the Utah Copper Co. and one of the principal consumers of the red metal, the General Electric Co., is shown in a recent deal in which the two interests are closely associated. Hayden, Stone & Co., bankers for the Utah Copper, have joined with General Electric interests in the purchase of control of the Telluride Power Co., and the new control is planning extensions and developments throughout the entire intermountain region. One of the possible results of this transaction is the electrifying of the Bingham & Garfield railroad and the supplanting of steam by electricity in the shovel work at the mine in Bingham. Furthermore, the Utah Copper Co. has an expensive steam-plant at Garfield generating electricity for the Magna mill, and the prospects are that this will be abandoned for electric power, which has always been used at the Arthur plant. As a preliminary step toward the adopting of electricity at the mine, one of the steam-shovels has been equipped with a motor and is being operated by this power instead of by steam. Thorough tests will be made of the two methods, and if the new way is found satisfactory, the electrification of the entire equipment will follow. The steam-plant at the Magna mill was erected when the Utah Copper Co. could not agree with the Telluride Power Co. as to rates, and this has always been the foundation for criticism by opponents of the present management. It was claimed that the cost of generating power by steam was higher than the rates offered by the Telluride Power Co. Now the Utah Copper interests and associates have bought control of the power company and can fix their own rates.

That the market in Salt Lake City for mining shares is 'not dead but sleeping' is shown by the response to the call for subscriptions to the Alaska Gold Mines Co. Immediately after the public was invited to subscribe, Salt Lake City offered to take over 200,000 shares at $10 per share, or more than $2,000,000 of the stock. Great was the disappointment, and in some cases anger, of the Salt Lake people when word was received from Hayden, Stone & Co. to the effect that 'insiders' would take the entire original offering, and that the public would have to pay a premium to get in. Salt Lake people followed D. C. Jackling into Utah Copper, Nevada Consolidated, Chino, and Ray Consolidated, and there is something of an uproar over the failure to get into Alaska Gold Mines, which is recommended by Mr. Jackling and A. F. Holden, both Salt Lake men.

Optimistic reports are being given out in regard to Ohio Copper Co. It is stated that the mill recently has been handling 2700 to 2750 tons per day and is steadily improving. This, however, means an occasional spurt, and does not as yet represent steady production, the average being nearer 2000 tons per day. The second payment on stock in the reorganization is due September 16. When this is paid the company hopes to be clear of floating debt and to have about $350,000 in the treasury for working capital. Salt Lake shareholders are generally anxious to eliminate the Heinze interest, but they are not very hopeful on that score at present. W. G. Sharp, A. F. Holden, and other officials of the United States S. R. & M. Co. have recently made an inspection of the company's new coal properties in Utah. They predict that early next year the properties will be producing at the rate of over 1,000,000 tons of coal per year.

Salt Lake, September 5.

SUMMIT COUNTY

The mines in the Park City district shipped 201 cars, or 7020 tons of ore during August, of which the Silver King contributed 2474 tons, the Daly-West 2226, and the Daly Judge 1523. In its summary of this district, the U. S. Geological Survey report shows that it is situated at an eleva-

tion of 7200 ft., in the Wasatch range, 25 miles from Salt Lake City. The district was discovered in 1863, and has since produced about 100,000,000 oz. of silver and 300,000 tons of lead, beside much gold, copper, and zinc, production of the last named having increased rapidly of late.

AUSTRALIA

New South Wales

During July the Broken Hill Proprietary treated 18,621 tons of crude ore from the mine and 16,964 tons of dump tailing, producing 4255 tons of lead concentrate and 4670 tons of slime. The flotation plant produced 7107 tons of zinc concentrate, assaying 46.62% zinc, 6.97% lead, and 12.90 oz. of silver. The slime flotation plant yielded 1756 tons of concentrate, assaying 35.96% zinc, 16.62% lead, and 35.65 oz. of silver. The sulphuric acid plant yielded 414 tons of strong acid. At Port Pirie, three blast-furnaces were worked, and a fourth has just been blown in; also three Ropp roasters and five Dwight-Lloyd machines were in operation. The Hegeler roaster is doing good work. Six zinc-distillation furnaces were under fire for the month. The refinery produced the following products:

Silver from company's ores	128,564 fine oz.
Silver from purchased ores	217,318 fine oz.
Lead from company's ores	2,160 tons
Lead from purchased ores	5,018 tons
Antimonial lead	35 tons
Contents of 7107 tons of zinc concentrate:	
Silver	92,324 fine oz.
Lead	495 tons
Zinc	3,313 tons

The capital of the company has been increased to pay for the iron and steel works to be erected. Block 10 mill, at Broken Hill, treated 7674 tons of ore, assaying 11.5 oz. silver, 12.7% lead, and 14.5% zinc, for 1039 tons of concentrate worth 38 oz. silver, 64.7% lead, and 6.9% zinc. The Sulphide Corporation's central mill treated 17,446 tons of ore for 2887 tons of lead and 5247 tons of zinc concentrate. The Cockle Creek works yielded 847 tons of lead, containing 3785 oz. gold and 79,959 oz. silver. The Amalgamated Zinc Co. (Da Bavay's) flotation plant dealt with 45,280 tons of tailing, which produced 11,881 tons of zinc concentrate assaying 48.8% zinc, 6.6% lead, and 9.6 oz. silver. The estimated value from all sources was $170,000, and profit $64,000.

Queensland

During July the Mt. Morgan smelters treated 32,116 tons of ore yielding 847 tons refined copper and 9907 oz. gold. The gold reduction works (chlorinating plant) yielded 1285 oz. gold. The estimated value of the whole output was $489,000.

Tasmania

At the Mt. Lyell works during July, 22,432 tons of ore was smelted with a yield of 432 tons of blister copper, containing 427 tons copper, 29,685 oz. silver, and 576 oz. gold. The Briseis Tin Mining Co. removed 46,000 cu. yd. of overburden at the Ringarooma, sluiced 4500 cu. yd. of drift from there; and 21,000 cu. yd. of drift and overburden from the Briseis, with a yield of 45 tons of black tin. At its Wallace property in Victoria, 118,000 cu. yd. was dredged, yielding 865 oz. of gold.

KOREA

The June output of the Oriental Consolidated was valued at $140,255, from 28,483 tons of ore treated. The new cyanide plant at Taracol is working well, and treated 2228 tons of concentrate for bullion worth $50,237, the extraction being 90%. Screen analyses show that 90% of the ground material will pass a 200-mesh screen. The circulating pumps for the Merrill precipitation presses have been speeded up, in order to get a more complete contact. A. E. Drucker expects 94% extraction when all is in proper order; if not, the time of agitation will be lengthened. Erection of the Chosen mill has been suspended pending further work underground.

MEXICO

Mexico

For the year ended June 30, the Mexico Mines of El Oro treated 142,844 tons of ore averaging $9.02 in gold, and 6.1 oz. of silver per ton, from which bullion totaling $1,555.095 was recovered. The extraction averaged 87.30% of the gross contents. Working costs, including 91c. per ton for development, 48c. for state and Federal taxes, and over $10,000 for repairs and renewals, totaled $4.37 per ton. Four dividends, amounting to $710,000, were paid. Ore reserves now stand at 395,000 tons valued at $11.65 per ton.

Sonora

(Special Correspondence.)—The rebel invasion of Sonora has not been a successful campaign. The railroad is open again to San Blas, and up the Yaqui as far as La Dura.

A FIELD OF MAGUEY, IN SONORA.

Tucson, Arizona, September 4.

The July production of the Cananea Consolidated smelter was 6,100,000 lb. of copper, and for August it will be nearly 7,000,000 lb., due to the two new converters of the Great Falls type being at work for part of the month. The Democrata smelter has been shut down temporarily. The new 250-ton capacity smelter should be at work in about 40 days. The incline shaft at the Calumet & Sonora is being widened from the surface to the 400-ft. level, to permit working another skip. Both the wet and dry mills are working one shift each.

It is reported that platinum ore in fair quantities has been discovered by A. Jahnke, four miles west of Nacozari.

Zacatecas

The Mezquital mines in this state have been bonded by Philadelphia people, and it is also said that the Amparo company, of the Etzatlan district, is interested.

PHILIPPINE ISLANDS

Manila

The steamer *Sotolango* brought a shipment of gold valued at ₱43,000 from the Colorado mine at Aroroy, Masbate. Of this amount ₱30,000 is from an ordinary fortnight's run, the balance being in slag, which goes to San Francisco. This mine has been a steady producer since the mill was put into commission seven or eight months ago.

PERU

Interviewed at Lima during the latter part of August, W. F. Stevens, manager of the Ferrobamba mines, stated that development progress for the past six months had been far greater than in any similar previous period in the company's history. There has been about 8300 ft. driven in adits, beside churn-drill holes. About 9 miles west of the main camp, extensive deposits of copper and iron sulphides are being opened. Prospecting is being carried out along a range of hills which run west from Ferrobamba, about 13 miles long. As a lack of sulphide ore has been a drawback to the success of the mines, this discovery is very important, and work is being concentrated on that section.

Personal

Professional men are invited to send news of their engagements and travels. Such news is interesting to friends.

HOWARD D. SMITH has gone East.

A. E. BARLOW is in British Columbia.

T. INOUYE was in New York recently.

CHARLES KIRCHEN was down from Tonopah.

R. C. BENNER was in Ontario through August.

J. M. BELL is expected at Porcupine, Ontario.

R. B. LAMB has returned to Toronto from London.

JOHN G. KIRCHEN was in San Francisco this week.

H. C. HOOVER has taken a house in San Francisco.

W. L. FLEMMING is back in New York from Cobalt.

R. M. THOMPSON has returned to New York from Stockholm.

HOWLAND BANCROFT is examining properties in western Colorado.

J. MORGAN CLEMENTS is in the San Juan district of Colorado.

ADOLPH KNOPF is in Inyo county for the United States Geological Survey.

J. D. HUBBARD returned to California from Korea on the *Nippon Maru* this week.

F. L. GARRISON has returned to Philadelphia, but expects to come West late in September.

R. K. CLANCY, general manager at the Craig mine in Trinity county is very ill at his home in Berkeley.

C. V. GROHOVSKY, general manager for the Upper Amur G. M. Co., was in San Francisco and has gone to Nome.

YUSHIO TSUBOI and YOICHI KATSURA, of the Fujita company, have been at Butte and have gone to Utah and Colorado.

OLIVER B. FINN, general manager for the Pan-American M. & E. Co., is spending September at the property of the company in Quebec.

R. J. PROVINES has returned to Grass Valley from Inyo county, California, where he has been in charge of the Renard Mining Co.'s mill.

NORMAN B. ROPER, formerly with the Cerro de Pasco M. Co., but now with Backus & Johnson Co., Casapalca, Peru, is visiting the United States.

WALTER J. RADFORD, elder son of W. H. RADFORD, has joined a large exploration company and is on his way to Brazil to do extensive work.

J. A. L. HENDERSON sailed from England on the *Laurentic*, August 31, for New Brunswick, Canada, where he will be engaged for about three months.

HENRY H. ARMSTEAD has finished his inspection of the properties of the Colmena M. Co., at Guanajuato and has gone to New York. He will return to Mexico in November.

Obituary

THOMAS LANE CARTER, who died while examining the Polaris mine near Dillon, Montant, September 3, was born in Louisiana and graduated in engineering from Tulane University. He began his professional work on the staff of the Crown Deep at Johannesburg, and later went to the Robinson Central Deep. He spent some time in Central Africa in exploration, and from 1905 to 1908 was manager of the French G. mine, one of the Eckstein properties. Later he was in Nicaragua and other Central American countries, and at the time of his death was a member of the firm of Osgood, Carter & Co. of Chicago. Mr. Carter was an easy graceful writer and found time not only to contribute frequently to the literature of his profession, but to write an interesting series of sketches of life in Africa. He was one of the valued members of the staff of special correspondents of the *Mining and Scientific Press.*

Market Reports

LOCAL METAL PRICES

San Francisco September 12.

Antimony	11—11½c	Quicksilver (flask)	$42.50
Electrolytic Copper	18—18½c	Tin	50—51½c
Pig Lead	5.35—6.30c	Spelter	8—8½c

Zinc dust, 1400 lb. casks, per 100 lb., small lots $9.50—9.75; large $7.50—8.50

METAL PRICES

(By wire from New York.)

NEW YORK, September 12.—Copper remains quiet but firm. There is fair domestic demand, but European buyers are still holding off. Lead is strong and advancing. Spelter firm. Average daily prices for the past week, in cents per pound, based on wholesale transactions, standard brands, are given below.

Date.	Electrolytic Copper.	Lead.	Spelter.	Silver, per oz.
Sept. 5	17.55	4.85	7.35	62⅝
" 6	17.55	4.85	7.38	62⅝
" 7	17.55	4.85	7.38	62⅝
" 8	Sunday.	No market.		
" 9	17.53	5.10	7.40	—
" 10	17.53	5.10	7.43	62½
" 11	17.53	5.10	7.43	62½

LONDON QUOTATIONS

(By cable, through the courtesy of C. S. Burton & Co., New York.)

	September 12.
Camp Bird Ltd	£ 6½
El Oro	3½
Esperanza	8⅜
Oroville Dredging	1½
Santa Gertrudis	7⅜
Tomboy	6⅜

COPPER SHARES—BOSTON

(By courtesy of J. C. Wilson, Mills Building.)

	Closing prices, September 12.		Closing Prices September 12.
Adventure	$ 7¼	Mohawk	$ 67½
Allouez	45	North Butte	33½
Calumet & Arizona	80½	Old Dominion	60¼
Calumet & Hecla	545	Osceola	112
Centennial	20	Quincy	88
Copper Range	58	Shannon	15½
Daly West	4½	Superior & Boston	1⅜
Franklin	9⅜	Tamarack	41
Granby	65½	Trinity	5½
Greene Cananea, ctf.	9⅜	Utah Con	11
Isle-Royale	34½	Victoria	2¾
La Salle	5½	Winona	4½
Mass Copper	6¾	Wolverine	88½

NEVADA STOCKS

(By courtesy of San Francisco Stock Exchange.)

San Francisco, September 12.

Atlanta	$ .24	Mexican	$2.75
Belcher	.30	Midway	.59
Belmont	9.87	Montana-Tonopah	2.20
B. & B.	.04	Nevada Hills	1.87
Big Four	.46	Ophir	.60
Booth	.06	Pittsburg Silver Peak	.97
Chollar	.09	Round Mountain	.40
Combination Fraction	.15	Savage	.04
Con. Virginia	.44	Tonopah Extension	2.80
Florence	.84	Tonopah Merger	1.10
Goldfield Con.	3.17	Tonopah of Nevada	6.50
Jim Butler	.72	Union	.64
Jumbo Extension	.39	Vernal	.11
MacNamara	.24	West End	1.65

MINING STOCK QUOTATIONS—NEW YORK

(By wire from C. S. Burton & Co., New York.)

	Closing Prices. September 12.		Closing Prices. September 12.
Amalgamated Copper	$ 86⅜	Miami Copper	$ 29½
A. S. & R. Co.	84⅞	Mines Co. of America	3
Braden Copper	6⅝	Nevada Con	22
B. C. Copper Co.	5¼	Nipissing	8¼
Chino	42	Ohio Copper	⅞
First National	2⅛	Ray Con	21½
Giroux	5¼	Tenn. Copper	43½
Goldfield Con.	3½	Tonopah Belmont	10
Greene-Cananea	10	Tonopah Ex.	2¾
Hollinger	12½	Tonopah Mining	7⅛
Inspiration	18½	Trinity	6¼
Kerr Lake	2⅜	Tuolumne Copper	2¾
La Rose	2¾	Utah Copper	64
Mason Valley	12⅜	West End	1½
McKinley-Darragh	1⅞	Yukon Gold	3⅜

Book Reviews

Any of the books noticed in this column are for sale by, or can be procured from, the MINING AND SCIENTIFIC PRESS.

HIGH EXPLOSIVES. By W. R. Quinian. 209 pp. Critchley Parker, Melbourne, 1912. For sale by the *Mining and Scientific Press.* Price $8.

This is a posthumous volume, its author, who had spent many years in the study and manufacture of high explosives, having died shortly after the preparation of his manuscript. Though written in treatise form, it is scarcely that, being rather a collection of essays, some of them profoundly theoretical, on high explosives. During 16 years as superintendent of the California Powder Works and later (since 1900) as general manager of the Cape Explosive Works, Ltd., Mr. Quinian devoted much time to the study of the theory of high explosives, as well as to the more practical phases of their manufacture, and in this volume the amount of knowledge the reader is supposed to possess is so great that the general reader will be likely to find the plane of the discussion above his head. But to the members of the chemical engineering profession who specialize in the field of high explosives this little volume will be of the greatest interest.

MODERN COPPER SMELTING. By Donald A. Levy. 243 pp.; ill. Chas. Griffin & Sons, London, 1912. For sale by the *Mining and Scientific Press.* Price $3.50.

In one of Stockton's delightful stories a young woman continually discoursed upon the desirability of each person cultivating his own individuality, and the results of the too literal application of the doctrine serve to contribute to the humor of the tale. A desire for individuality must have inspired Mr. Levy in his appropriation of a title used by Peters many years ago, and a similar characteristic appears in his rendering of the names of persons and places and of titles of papers. The volume is so amateurish that it would be hardly worth while to attempt a review of it, were it not that, like the curate's egg, it is quite good in places. The general outline and method of treatment is good, and much of the data included is recent, but it is unfortunate that the execution is so poor; many of the statements are inacurate, and others give inaccurate and misleading impressions because only incompletely stated (and apparently incompletely understood) by the author. Mr. Levy is evidently quite unfamiliar with the mineralogy of the ores of copper and repeats the common misstatement that "chalcopyrite is by far the most widely distributed ore of copper and furnishes the greater proportion of the world's supply," and is evidently of the impression that the ore of the Butte district is chalcopyrite. As is well known, chalcopyrite is quite subordinate at Butte, the copper occurring in the form of chalcocite and enargite. Chalcocite, to which the author attaches also Nicol's old and unused name of redruthite, he says "is much less important," as indeed it would appear to one unaware that about three-fourths of the production of the Butte district and a large part of the production of Utah, Arizona, and Nevada is derived from that mineral, while enargite and chrysocolla are not even mentioned. A similar lack of complete information is exhibited by the succeeding chapters, and in the descriptions of equipment and practice the author does not clearly distinguish between what is antiquated or obsolete and what has been recently developed. A totally disproportionate amount of space has been accorded to Anaconda smelting practice which, though excellently adapted to Anaconda conditions, can scarcely be considered to cover the whole field of copper metallurgy. The chapter on the converting of copper matte is a compilation of recent articles on the subject, so badly compiled as to be of little value. The good features of the volume indicate that in five or ten years from now Mr. Levy might produce an excellent treatise; it is to be regretted that he did not wait that long before issuing his first edition.

T. T. R.

THE HYDROMETALLURGY OF COPPER. By Wm. E. Greenawalt. 494 pp.; ill. McGraw-Hill Book Co., New York, 1912. For sale by the *Mining and Scientific Press.* Price $5 net.

There can be little doubt that one of the most important metallurgical developments of the near future will be the use of wet methods for the treatment of low-grade copper ores and tailing. Such methods are attracting general attention, and Mr. Greenawalt's book is correspondingly timely. The author is well known to the metallurgical profession by his work on roasting and chlorination, and is able therefore to add much material from his private notes to what would otherwise be largely a compilation of existing material. Unfortunately, he displays throughout the common fault of inexperienced authors in introducing material that has no appearent bearing on the topic under discussion, thereby causing the reader to lose whatever thread of argument may exist. Thus chapter III is largely composed of descriptions of experiments on the roasting of the gold telluride ores of the Cripple Creek district; an interesting subject, but one which has no visible bearing on the hydrometallurgy of copper. The style of the author is peculiarly obscure, both as to single sentences and whole paragraphs; thus the chapter on fuel conveys to any ordinary mind that the best practice in roasting consists of the use of bituminous fuel in gas-producers, burning the resulting gas in the roasting-furnace. This will come as a surprise to most metallurgists, as will the suggestion that, "If wood has to be transported any considerable distance, it might be profitable to convert it into charcoal at the forests and then burn it in the roasting-furnace, after having converted it into producer-gas." To still be able to burn wood after having converted it into gas is certainly a feat that should produce high fuel economy. Looseness of expression frequently leads to erroneous statements, as that on page 82 that the current in a thermocouple is proportionate to the heat applied. It is too much, of course, to expect any metallurgist to spell the name of McDougall correctly, but a higher average of correct renderings of the other proper names throughout the book ought not to present unusual difficulty. Indeed, to find a reference to the "Bayone plant of the Oxford Copper Co." in a book published in New York City, makes one wonder if proof-readers are no longer necessary. Typographical errors in a journal have some excuse, but the more leisurely preparation of a book ought to eliminate the more obvious ones, at least. The general principles of metallurgical operations have already been adequately treated in any one of several texts that are generally available, and Mr. Greenawalt might well have omitted Part I of his book and devoted a correspondingly greater amount of attention to the study of hydrometallurgical processes for the extraction of copper, in Part II. This part is good and will be of much service to all who are interested in the hydrometallurgy of copper but have neither time nor facilities for going through the scattered literature of the subject. While the subject is in so uncrystallized a stage as at present, it would have been well to make the treatment as comprehensive as possible, and at least brief references to the Mackay, Braxeres, and other processes might have been made, though the number already covered is very great. Not only the various processes for the extraction of copper are given, but also the extraction of precious metals from copper ores, the treatment of zinciferous ores, of nickel ores, and the precipitation of copper from mine waters. The concluding chapters deal with the refining of copper precipitate, making of bluestone, apparatus and appliances, power data, and economic considerations. The second part of the volume is as admirable as the first part is faulty, and readers who begin at the middle of the book will be most grateful to Mr. Greenawalt for his timely treatise.

T. T. R.

Concentrates

Most of these are in reply to questions received by mail. Our readers are invited to ask questions and give information dealing with the practice or mining, milling, and smelting.

VENEZUELA provides in its present mining code that one-third of the net proceeds of a mine should go to the owner of the surface ground; this has deterred investment of foreign capital in development of mines. At the suggestion of the Attorney-General, the Supreme Court of Cassation has rendered a decision, in which articles 40 and 42 of the Mining Code, the ones containing the above provisions, are declared to conflict with the National Constitution. It is expected that this decision will awaken more interest in mining.

FLUORSPAR is used in the manufacture of glass and enameled and sanitary ware, the electrolytic refining of antimony and lead, the production of aluminum, the manufacture of hydrofluoric acid, and in the iron and steel industries, where it is used as a flux in blast-furnaces and in basic open-hearth steel furnaces. It is estimated that about 80% of the American fluorspar output, mainly in the form of gravel spar, is consumed in the manufacture of basic open hearth steel. The use of fluorspar is increasing in practically all these industries.

QUARTZ occurs in many different forms, such as sand, tripoli, sandstone, and quartzite. In some forms, such as rose and smoky quartz and amethystine quartz, it has a gem value. Massive crystalline quartz and flint are used in the manufacture of pottery, paints, and scouring soap and as wood filler. Considerable quantities of ground quartz are used in the manufacture of paint, in some cases as much as one-third to the total pigment consisting of this material. Quartz crushed and graded to various sizes is used in the manufacture of sandpaper, sand belts, as a scouring agent with sand-blast apparatus, etc. Blocks of massive quartz and quartzite are used in the chemical industry and as a flux in copper smelting. Ground quartz is also used in filters and in tooth powders and by dentists as a detergent.

MICA is used principally at present in the manufacture of electric apparatus. In the early days of the industry in this country the chief demand for mica was for use in glazing, principally in stoves. This is now one of the less important uses. The value of good sheet mica that is suitable for glazing is greater than that of the material suitable for electric purposes. The demand for glazing mica is insufficient to use all the sheet mica produced, so only the best quality and larger sheets are used for this purpose. 'Micanite,' or built-up mica board, for the manufacture of which much smaller sheets can be used, is an amply good substitute for large sheet-mica in much electric work. Waste and scrap mica when ground have a wide application in the manufacture of wall-paper, lubricants, and electric insulating material.

DRILLING contests of an unusual character took place at Calumet on August 24. Eleven mine captains acted as judges, and prizes were from $25 to $100. In the machine contests eleven rules governed the rigging of machines and drilling. The Ahmeek team won, taking only 1.42 minutes to assemble the machine, and 3.42 minutes covering the two minutes' drilling and assembling. The Calumet & Hecla Amygdaloid team took 3.43⅘ minutes, and a team from the Wolverine finished in 3.47 minutes. Twenty teams entered, and an Ingersoll-Rand machine was used. Seventeen men entered the one-man contest, which was won by Calumet & Hecla in 4.33⅗ minutes, Alluez second, in 4.42⅕; and Wolverine third, in 4.45 minues. In the contest between a hammer and drill team, and a one-man 'butterfly' machine, drilling in granite for 15 minutes, the former drilled 49 in., and the latter 60 in., with one minute to spare.

Decisions Relating to Mining

Specially reported for the MINING AND SCIENTIFIC PRESS.

OIL PIPE-LINE—DAMAGE FROM LEAK

Where an oil company so defectively constructed its pipeline that oil leaked therefrom, and mingling with the percolating waters on adjoining land, rendered a well theron unfit for use, the oil company is liable to the owner of the well for the damages he has suffered during the time he was deprived of its use and resulting from such deprivation.

Texas Co. *v.* Giddings, (Texas) 148 Southwestern, 1142. May 25, 1912.

IRON MINES—FLOWAGE OF ADJOINING LANDS

Where defendants were operating an iron mine, and so negligently constructed, arranged, and allowed the embankment about the slush pond into which the refuse from the iron washers passed to remain of insufficient height and thickness, that the embankment gave way and plaintiff's adjoining land was flooded, defendants were held liable for damages measured by the difference in the value of plaintiff's land just before and just after the injury.

Sloss-Sheffield Steel & Iron Co. *v.* McCulloch, (Alabama) 59 Southern, 210. June 4, 1912.

COAL MINE LEASE—CONSTRUCTION

Where, under a coal mining lease, the lessee agreed to pay a fixed minimum royalty if the minimum tonnage were not mined by him each year, provided that the charge should not apply if the lessee were prevented from mining by reason of strikes, lockouts, fires, floods, or any other cause beyond the control of the lessee, the fact that the mine became so dangerous to operate that the lessee could not secure miners willing to undertake the risk, would not excuse him from payment of the minimum royalty.

New York Coal Co. *v.* New Pittsburg Coal Co., (Ohio) 99 Northeastern, 198. June 5, 1912.

PATENT CONCLUSIVE AS TO COLLATERAL ATTACK

Where a non-mineral patent has been issued to a railroad company, and the land was subsequently alleged to be mineral in character in a petition for the institution of a suit to cancel by the United States, it was held that the land department has no jurisdiction to inquire into and determine the rights of one claiming adversely to the patentee. Any proceeding instituted after patent by the Department being solely for its own information to determine whether proper ground exists for a suit to cancel the patent, one claiming adversely to the patentee is not entitled to be heard in such a proceeding. Such a suit will not be advised by the Land Department unless it appears that some interest of the Government, or of some party to whom the Government is under obligation, has suffered by the wrongful issuance.

Heirs of C. H. Creciat (Land Department), 40 Land Decisions, 623. March 21, 1912.

OIL PLACER WITHIN NATIONAL PARK—INSUFFICIET DISCOVERY

A placer mining location within the limits of lands withdrawn from the Glacier National Park, upon which no discovery had been made at the date of the act of May 11, 1910, creating said park, was invalid and did not except the land covered thereby from the operation of the act. A small seepage of oil upon the surface of a spring of water, and a slight flow of natural gas, insufficient for commercial purposes and without value, from a drilled well, which failed to develop oil, are not sufficient to constitute such a discovery of oil as would support a placer location. Permission to prosecute further development work with the object of making a discovery denied. The claims being invalid at the date of the act creating the park, the lands embraced therein became a part of the park, and a later discovery of oil would be of no avail.

Butte Oil Co., (Land Department) 40 Land Decisions, 602. March 25, 1912.

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EDITORIAL

NATAL is worried by the high cost of living, and commodity prices in Durban are said to have increased 25 per cent in the last few years. "Oh for a lodge in some vast wilderness."

COINAGE of gold has been resumed at the mint at Medellin, Colombia. The adjacent region is one that has been productive of gold for many years by native methods, and the development of dredging operations by American and French capital is now well under way.

AMONG our new exchanges is *The Nation's Business*, published in the city of Washington by the Chamber of Commerce of the United States. Its opportunity to furnish a comprehensive survey of the constructive progress of the nation is a great one. It is to be hoped that it will be devoted to "progress and organized promotion," rather than 'big business.'

TROUBLE is on foot in the affairs of the Crown Chartered Gold Mining Company, of Porcupine, and a writ has been issued charging the directors with conspiracy to dispose of valuable claims belonging to the company. Of the true merits of the affair we are not informed, but the incident serves to indicate that directors do not always keep clearly before their minds the elementary conception that their true function is to serve as trustees of the interests of shareholders.

KATALLA oilfields were described by Mr. Arthur Thompson, in our issue of August 10. Since then the Amalgamated Development Company has found a flow of oil in an 850-foot well, recently drilled, 40 barrels of oil having been bailed out in one day. In another well, which has reached a depth of 80 feet, a rotary drill is being used and an increase in depth of one foot per hour obtained. The outlook is decidedly encouraging and the citizens of Katalla are properly jubilant.

WORK of the Bureau of Manufactures and the Bureau of Statistics, of the Department of Commerce and Labor, has been consolidated as the Bureau of Foreign and Domestic Commerce. In addition to the former activities of the old Bureaus, the new one will undertake investigations of the factors which enter into the cost of production of articles at home and abroad. If the investigation is made sufficiently comprehensive and is carried out by competent men a useful service will be performed.

TELEGRAPH rates in China have been materially reduced. Messages to any part of the republic are now transmitted at the rate of 5½ cents per word, and at half that rate for press messages. Messages within a province are transmitted at half the national rate. It may surprise many to learn that telegraphs extend to all parts of China, and are supplemented by the telephone in all important cities. The service, developed by the Imperial Maritime Customs, is now under Chinese supervision, and is excellently managed and well patronized.

COPPER and copper manufactures imported into and exported from the United States are expected to reach a value of $150,000,000 in 1912, almost 2½ times that of a decade ago. Nearly three-quarters of this sum will represent exports, the imports chiefly consist of blister, matte, and ore sent to the United States for smelting and refining. Europe furnishes the great market for American copper, Germany alone taking nearly 160 million pounds in the 9 months ended March 1912. Copper is fifth among the articles of export in the United States, being exceeded only by raw cotton, iron and steel, meat and dairy products, and breadstuffs.

LOW costs are easily made when no limit is set to capital account, but many a good venture has been wrecked by failing to pay a fair part of expense out of earnings. Rand companies are just now loud in their protests over the impossibility of raising additional capital and explain decreased profits as due to the resulting necessity of charging to earnings much that had formerly been paid from capital. On the other hand, the International Smelting & Refining Company, which it will be remembered has paid dividends from the start, has announced that additional construction amounting to $2,000,000, equivalent to 20 per cent of the capitalization, will be paid for out of earnings. At the Alaska Treadwell mines the new central shaft and hoist, as all other improvements, are likewise financed out of earnings. Too great dependence upon the capital account is the easy road to "phantom profits."

SUBSCRIPTIONS to the land fund of the American Institute of Mining Engineers are being made by many who can afford to give but small amounts. One young engineer writes: "I have given $10 and am prepared to repeat the subscription next year, provided most of the outside members subscribe this year. I regard this as an assessment of an extra year's dues and would rather pay a few such assessments than to have dues permanently increased to $15." This point of view is reflected in other letters. In case the total of subscriptions and of funds made available by the proposed economies in administration does not meet the payments as they are due, an increase in dues will be necessary. We believe that a small temporary addition will be approved by the membership, provided that the time and amount be definitely stated and the funds applied only to the one purpose. In the meantime no one need hesitate to subscribe because he can not give a large sum. Not much is needed if every member will give.

THE lead market is one of the most interesting in the list of metals just at the moment. Pig lead is selling at about 5 cents per pound at St. Louis; notwithstanding the duty of 1½ cents per pound, pig lead is selling here and abroad at about the same price. If foreign quotations are based on fundamental conditions, a further rise in lead prices may soon be expected, as the price abroad would be equal to about 6.35 cents here. There are several elements that go to the making of increased activity in the lead market. One of its principal uses is in paint, and while the high price of linseed oil has been an adverse factor for the past two or three years, present indications are that there will be a bountiful crop of flaxseed, which will make oil paints relatively cheaper; at the same time lumber has advanced so greatly in price that its preservation by means of paint becomes much more necessary, making a larger increased consumption of lead. Evidently lead producers are about to experience a boom, and mining districts, such as Joplin, Baxter Springs, and the lead producing regions of Oklahoma, may look to see a much better market for mining properties.

ALONG the Mexican border the acute situation continues to affect mining adversely. It was reported this week that Mr. Walter Douglas, son of Mr. James Douglas, of the Phelps-Dodge company, had been captured by rebel forces at or near Nacozari. It was later learned that Mr. Douglas got through to Douglas safely, but had a very exciting trip from Nacozari in a motor car. While newspaper despatches have been sensational, the price level in such enterprises as Phelps-Dodge and Greene-Cananea has not suffered, and evidently the private advices do not portray so serious a state of affairs as a reading of the newspapers would warrant one in believing. Notwithstanding the disturbed conditions, the Phelps-Dodge company made a new high record at the Montezuma mine in August, turning out 3,229,389 pounds of copper. The Douglas smelter made a high record of 11,270,263 pounds, this including ores from the Copper Queen, the Montezuma, and custom ores. The entire output of the Phelps-Dodge properties for the month was 13,152,552 pounds, which has never been exceeded except once, in December 1911, when the output was larger by about 40,000 pounds.

BOLIVIAN goldfields are a sore subject with some engineers and prospectors just now. In a private letter a prospector now in the country relates some further complications which have arisen. The prospector and his party had taken up 200 *pertenencias* on the Negos river in Caupolican, and were proceeding to develop it. Meanwhile the Bolivian Government had taken in charge a party of American miners, brought in by the misleading Ferguson letter, and sent them out with a guide to take up 10 *pertenencias* each along the Negos river in Muñecas, but the guide led them to the larger river of that name in Caupolican, where the alluvial ground is much richer. While negotiations were in progress two agents of one of the most influential men in Bolivia arrived, together with the *superfecto* of Muñecas province, the justice of the peace, and the *corregidor* of the nearest town, and a squad of soldiers, and proceeded to take possession of the Negos and adjoining rivers. The original locators had no redress, as they had not taken possession of the river, and were glad to sell their equipment to a neighboring enterprise and leave the district. With the buoyant spirit of the prospector, the writer concludes, "Our consolation is that we are now headed for God's country."

Wet Methods of Copper Extraction

Perhaps the most confidently expected advance in the art of metallurgy is the devising of a wet method for the extraction of copper from its ores upon a large scale and at a good profit. Legions of methods have already been devised, but none which meet the governing conditions of applicability upon a large scale, and yield of a satisfactory profit. How great a demand exists for such a method can be readily realized from the fact that in Utah 4,500,000 tons of material carrying 10 pounds of copper per ton is escaping through the tailing launders of the copper concentrators, in Montana an equal amount of even richer material is similarly escaping, while in Nevada, Arizona, and other states the losses probably serve to bring the total up to 200,000,000 pounds of copper annually run to waste in the tailing from ore-dressing plants treating sulphide ores. Ore dressing is a highly developed art, but it is one that is not well adapted to extract small quantities of a valuable mineral from a large quantity of gangue unless the valuable mineral is free from the gangue and of much greater specific gravity, as in the case of gold-bearing gravel. Metallic ores are commonly intimately associated

with the gangue, the difference in specific gravity is often not great, and, most unfortunately, ores are frequently so friable as to yield, during crushing, considerable amounts of material which is in so finely divided a state as to bid defiance to all ordinary ore-dressing methods. While it may be reasonable to hope that the losses in tailing may be decreased, for example, from 10 pounds per ton to 6 pounds per ton by improvement in ore-dressing methods, there can be little doubt that the ultimate 5 or 6 pounds of copper in the tailing from the concentration of sulphide ores will forever continue to resist all efforts for its recovery by mechanical concentration.

The ease with which a part of the copper in ores can be extracted by wet methods has stimulated efforts to discover a commercial method, and in a few cases success has been attained. But, as a general statement, it is safe to say that wet methods for the extraction of copper from its ores have not yet been successfully applied on a large scale. Some of the difficulties are those common to all wet processes, others are peculiar to the treatment of copper minerals. Before the cyanide process had reached its present development the hope of ultimate success was much more slender than now. The cyanide operator has largely solved the many mechanical problems incident to the handling of crushed ore and solutions, and their separation, and the metallurgist who wishes to treat copper ores by wet methods has, therefore, an accumulated fund of experience and achievement which forms an invaluable asset. Cyanidation experience cannot be applied *en bloc,* however, for the richest silver and gold-bearing material which has been treated by cyanidation carries only 85 ounces of precious metal per ton. Treating material worth $1.50 per ton carrying 160 ounces of metal offers a decidedly different problem from the treatment of material worth $500 per ton and carrying 85 ounces of metal.

The chemical problems involved in solution methods for the extraction of copper are the most baffling. The tailing previously mentioned consists largely or entirely of sulphides, and no feasible method has yet been devised for the treatment of raw sulphides. The material must first be roasted, and even where this can be accomplished for less than 50 cents per ton, it forms a heavy addition to the total cost of treatment of material worth only about $1.50 per ton. After roasting, the ore may be treated by solutions of alkaline cyanides, sulphites, sulphates, or chlorides. The alkaline cyanides have the advantage of extracting the precious metals present along with the copper, but the consumption and mechanical loss of cyanide, and the cost of the heat required in boiling out the ammoniacal copper solution has so far proved a bar to its successful use. Similarly, in the case of sulphurous acid and sulphites, the dilute solutions obtained and the difficulty in securing complete precipitation of the copper are serious disadvantages. The use of sulphuric acid or sulphates is perhaps the most promising of the chemical methods. It is not practicable here to go into the difficulties involved in the various special cases in which this method has been tried. But, speaking generally, the action of sulphuric acid on the bases other than copper present in the ore, the difficulties due to the formation of -ous and -ic compounds, the difficulty of securing complete solution and precipitation, and the whole group of problems centring around mass action, have so far prevented the profitable operation of the many processes which have been devised for the use of sulphuric acid or sulphates as a solvent for copper. The use of chlorides offers many of the same problems in accentuated form, since the other bases present are more easily attacked by chlorides than by sulphates. A mechanical difficulty of all such chemical processes not shared by the cyanide process is the attack by solutions upon the apparatus used. Iron and steel are the common materials of construction, and chemicals which will attack copper will more vigorously attack iron. Possibly some chemical will be found that, like potassium cyanide, is more effective in dilute solutions, but so far it has been found necessary to use strong solutions which are chemically active toward the vats and pumps necessary for treatment. None of these difficulties are insuperable, but each adds to the cost of treatment and the margin for profit is perilously small.

After the copper has been taken into solution, its precipitation and subsequent conversion into marketable form is a necessary operation that cannot be performed without cost. Elsewhere in this issue reference is made to the precipitation of copper from mine water at Butte by the use of scrap iron, and its precipitation at the Besshi mine with iron and coke. Pig iron costs 1¼ to 1½ cents per pound at Birmingham and Pittsburg, and its cost at a copper mine is enormously increased by freight charges. In the average case the cost of pig iron for precipitation of the copper would possibly be 4 to 6 cents per pound of copper produced, a heavy item in the cost of operation. Electrolytic precipitation offers advantages in remote places, and it is stated that it will be adopted in the leaching plant at the Braden mine, Chile. But there are many difficulties in the electrolytic precipitation of copper from dilute and often impure solutions, and a universal solution has not yet been found. The task of finding a profitable wet method is like that which faced the small boy sent to dig out a woodchuck, it must be accomplished. Able investigators are at work upon the problem in many laboratories and plants, and it is not too much to hope that a satisfactory solution will before long be found.

Publicity and the Press

By T. A. Rickard

Legislation recently proposed in Congress to secure publicity in regard to newspaper ownership is a step intended to check the insidious power of corporations, whereby the fountains of public opinion are polluted at their source. A clause inserted into the Post-Office Appropriation Act would require newspapers to file twice in each year a statement of circulation and the names of the managers, besides a list of the shareholders (if a company) or the name of the proprietor (if privately owned). Furthermore, it was proposed that this information should be published by the newspaper itself. These provisions were eliminated from the bill before final passage, however.

We welcome such legislation, deeming it altogether desirable that secrecy of ownership shall not be a cloak for an insidious misuse of the press. It is common knowledge that certain newspapers and magazines are owned by individuals or groups having a purpose in moulding public opinion. That purpose may be good or bad; it is well that it should be disclosed by publicity. The greater evil, however, of anonymous ownership arises from the use of newspapers by individuals or corporations for the purpose of deceiving their readers by posing as impartial critics or sincere advocates while under the control of parties interested in moulding opinion for specific business or political purposes. The time was when anonymity was the rule in journalism. Even Alexander Hamilton had to go through the form of signing his easily recognizable writings with the pseudonym of 'Pacificus' or 'Camillus'. The foremost of all editors, John Delane, maintained a policy of self-erasure that enhanced the dignity of *The Times.* Yet even the greatest of all newspapers in later days has departed from its ancient custom,

finding it advisable to publish special articles signed by men whose names offer a guarantee of peculiar fitness to enlighten the community on given subjects. In technical journalism it was ascertained long ago that it is well to publish signed articles, so that the readers may know on whose authority definite statements are made and on whose experience definite opinions are based. In some cases the editor thinks it desirable even to tell the readers something concerning a writer's special qualifications, as enhancing the value of his writing. In other words, the technical public likes to know who is 'the man behind the gun.' Similar tendencies have caused publishers to place the name of the responsible editor on the title-page of their periodicals. The 'leaders' or 'editorials' are customarily unsigned, hence the publication of the name of the man who either writes them or assumes direct responsibility for them. In technical journalism we had the example of Richard P. Rothwell, who made *The Engineering and Mining Journal* for many years the leading authority on the technology of mining. When Dr. R. W. Raymond wrote a leader, he affixed either a star or his initials, finding it advisable to dissociate himself occasionally from the views expressed by his colleague. When these two great men ceased to control the *Journal*, the names of the editor and his assistants appeared on the title-page, for I, then editor, and part-owner, considered it proper to give them credit for participation in a work that was deemed honorable and useful. Besides doing this, I introduced the custom of publishing, under the names of the editors, a list of 'Special Contributors,' that is, mining engineers, metallurgists, and geologists of proved capacity who undertook to contribute an important article at least once each year. By carrying their names on its title-page the *Journal* did these men an honor, and they in turn, by allowing their names thus to appear, were giving the *Journal* the support of their reputation as distinguished practitioners. This expression of a policy of publicity was not maintained after I ceased to be editor of *The Engineering and Mining Journal*, but it was adopted in my subsequent control of the *Mining and Scientific Press*. Since January 1906 we have given not only the names of the editors, and those of the special contributors, but it has been stated frankly who was, and is, in control of the paper. This last admission or assertion has proved useful in stultifying various rumors regarding the control of the paper by the Guggenheims, the Standard Oil, or any one of the many big business interests that exercise a preponderating influence in American mining finance. When the *Mining and Scientific Press* undergoes a change of control, the fact will be recorded on our first page, for we need no congressional legislation to induce complete frankness in this regard. We believe that it is well to make these things plain, and we have found ample reason to believe that the engineering profession likes to know who are the men behind the pulp that makes the Press, especially the one that they call, for short, the 'M. & S. P.' Further, we have never made any secret as to the identity of our shareholders. Besides the controlling owner, the shares are divided among members of the staff and the special contributors. Our share-register is, and has always been, open to anyone having a serious motive for caring to examine it.

Apart from personalities, in themselves not wholly uninteresting to our readers, it is well for all good citizens to support any enactment that operates for sincerity in journalism. At its best, journalism is a criticism of life; at its worst, it is a social scavenger. In matters of industry, of technology, and of finance, the power to mislead and misrepresent is palpable. To have no press at all is better than to have one that is subventioned or suborned. In financial matters appertaining to mining the control of papers is a powerful agent of deception. New York and London can supply plenty of examples. The maintenance of papers as the organs of 'houses' or syndicates has been an easy means of playing upon the share-market and upon the gullibility of the general public. It has been a fruitful method of bolstering iniquitous schemes and of blackmailing some that were good but weakly supported. In matters of the purse it is absolutely essential that the critic—that is, the editor—should stand aside from the game. He should know something about it, either by observation or past experience, but he must not be trammeled by participation. It is human to err; it is peculiarly human to be prejudiced through self-interest. Reliable comment requires mental detachment. No assurance of such detachment is possible unless it is known, to all whom it may concern, who is the editor and who is the controlling owner. Publicity is the policeman of chicanery. Frankness is the gauge of sincerity. The ways that are dark and the tricks that are vain in finance and in the business of mining will prosper least when most exposed to the light of free criticism. The pen is indeed mightier than the sword, but too often it is but the sword of a mercenary open for hire by anybody able to pay the price. It must be as the sword of the man who fights only for a cause he loves and only for a commander he trusts. In practice this is best consummated by the editor being also the owner. Undoubtedly when this identity obtains it affords a guarantee of direct responsibility. If this ideal condition cannot be created, then it is well for the publisher to be wholly detached from the matters on which the editor has to comment, for this gives a reasonable probability that the editor will be accorded a free hand to express himself in print. When papers are owned by financiers or are dependent upon their bounty, then the editor is but a hireling; and when he writes to order, he prostitutes journalism. It is a miserable part to play and it is easily unmasked. Among well informed men the real control of most papers is known. The secret is hard to keep, for it discloses itself by damnatory coincidence. In technical journalism the atmosphere, on the whole, has been untainted, for the simple reason that this class of periodical permits of the construction of water-tight compartments. The editor writes to interest the reader who is a likely purchaser of the machinery or material offered for sale on the advertising pages. The goodwill of the paper is based on the fact that it reaches the special person whom the advertiser wants to attract. Anything that diminishes the trustworthiness of the information given in the reading pages must injure the value of the advertising pages as a means of publicity. 'Puffs,' 'write-ups,' and 'reading notices' are not only dishonest but they are intensely stupid, in that they diminish the value of the paper as an advertising medium. An advertiser who bullies the management into inserting any of the insincerities of a 'write-up' into the reading pages is injuring himself; he is directly lessening the efficiency of the display for which he pays. Our reading pages are not for sale at any price; our advertising pages are for sale at a fixed price. The two must be kept distinct and separate. It then remains only for the editorial staff to issue a paper that shall be read because it is interesting, and interesting because it states the truth. Of the several ways of telling the truth, it is the aim of serious journalism to select the one that is most useful for the purpose in hand. In the case of the *Mining and Scientific Press* it is our aim to tell the truth, in an interesting and convincing manner, with a view to furthering the best interests of the mining industry and the honor of the mining profession.

The Besshi Mine and Shisaka Smelter

By H. Foster Bain

Among the great copper mines of the Far East is the Besshi, which is on Shikoku island in southern Japan. Travelers to and from the Orient pass within a few miles of the property as they go from Moji to Kobe through the wonderfully beautiful Inland sea. The mine is the property of the Sumitomo family by right of discovery and has been in their possession for more than 200 years. It was found in 1690 and after being successfully worked by native methods through the intervening years was opened according to modern plans in 1874 under the advice of a French engineer. It is credited with a total production of 475,250,000 lb. of copper to the close of 1910, and in 1911 yielded 15,145,070 lb., ranking thereby second only to the Ashio among Japanese copper mines. The mine has long been wholly under Japanese direction, and the family owning it is one of the most progressive in the Far East. Baron Kichizayemon Sumitomo, the present head, is a younger brother of Prince Tokudaiji and Marquis Sainoji, having been adopted into the family in 1892 at the age of 28. He resigned from the House of Peers in order to devote himself entirely to the business affairs of the family. Aside from the Besshi mine, the holdings include the smelter at Shisakajima, the Tadakuma colliery in Chikuzen, the Sumitomo Electric Wire & Cable Works, and the Japan Steel Mfg. Co. works at Osaka. On the occasion of the recent visit of the American engineers to Japan the party enjoyed the hospitality of Baron Sumitomo at his villa near Osaka, and visited the smelting works at Shisakajima. Lack of time prevented a visit to the mine and rolling mills. The following description, therefore, so far as it relates to the mine, is based principally upon published data, generously supplemented by information given by Keijiro Nakamura, superintendent of the smelting works and an accomplished engineer familiar with the best mining practice both in America and Japan.

The Besshi mine is in an area of crystalline schists grouped by Japanese geologists with the Archean. The system of schists is indeed considered to form the upper part of the Archean and to be pre-Paleozoic in age, though in places the rocks are distinguished with difficulty from the oldest Paleozoics. Probably in the United States the rocks would in the main be considered to belong to the Algonkian. At the mine the schists are described as chloritic and graphitic. Piedmontite is abundant and serpentinized dikes are found some distance from the vein on the hanging-wall side. The ore proper occurs in a body of 'quartz schist' that conforms in strike and dip with the general formation of the country, and which, accordingly, has been commonly considered to be a bed. This quartz schist has been mineralized by the addition of pyrite and chalcopyrite; the latter occurs in streaks in the pyrite, and the whole probably represents a replacement of the quartz. Formerly considered a bedded deposit, it is now spoken of as a vein and is thought by some to represent a fissure filling; the more brittle quartz having been broken while the schist bent under pressure. The vein is known about 6000 ft. along the strike and the single great ore-shoot is 5000 ft. long. The orebody is 2 to 25 ft. wide, with an average of about 7 ft. It has been followed to a depth of 2150 ft. without diminution in size or decrease in value. The ore averages 3 to 4% copper and is believed to be primary. Any possible zone of secondary enrichment was probably mined through over a hundred years ago. One peculiar feature is that the ore carries practically no gold, silver, antimony, or other accessory metals. This is the more striking since the beautiful stibnite crystals seen in mineral cabinets around the world come from the same region. So free, however, is the copper ore from other metals, that it is not refined electrolytically, and to avoid contamination barren rock is quarried for flux instead of buying the usual silicious gold ores. The refining of the copper, in fact, is conducted according to the usual Lake Superior practice, and in the London market K. S. ingots command a slight premium, just as Lake copper does in New York.

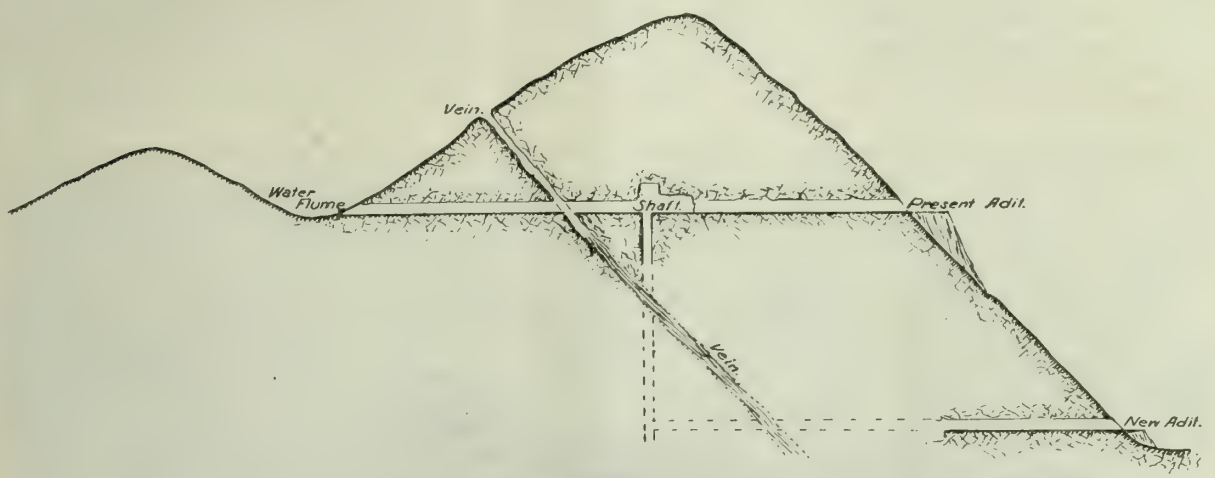

Fig. 1. Cross-section of Besshi mine.

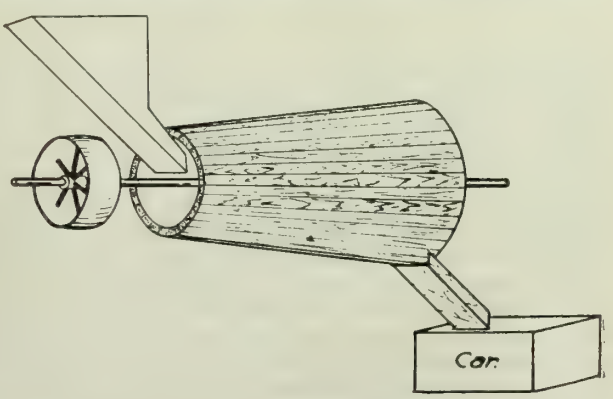

Fig. 2. Nakamura nodulizing machine.

The mine is situated about ten miles from the ocean and about 4000 ft. above sea-level. The vein dips into the mountain at about 50°, and, under direction of the French engineer already mentioned, was opened by means of an inclined shaft which extended 1782 ft. down the

dip. Various adits have been driven to connect the workings with the surface. The 'Third' adit is the upper one shown in the subjoined sketch. It is 6000 ft. long, 10 by 11 ft. in cross-section, and is used as a main haulage and drainage level. Recently a connection has been driven through to the other side of the mountain as shown in the sketch. A stream has been diverted so that it now flows through the mine, thence by ditch about two miles to a convenient site, whence the water is dropped 1800 ft. and by means of Pelton wheels 6000 kw. is generated. A fourth adit is now being driven from Hateba, the end of the private railway used to convey ore from the mine to the docks. It is 10 by 13 ft. in cross-section and will be 16,000 ft. long. Last fall about 2000 ft. had been driven and the face was advancing 200 ft. per month. Power drills are used, and the whole face is blasted in one bench. To meet this adit a shaft is being sunk from the present adit, starting 500 ft. in the hanging wall. This is to be a round, brick-lined shaft, 16 ft. in diameter, and will be 1875 ft. deep. It will cross the vein and meet the new adit in the foot-wall. It is interesting to note that this deep-level work is being carried out without preliminary drilling. The persistence of the ore-shoot to a depth of 2000 ft. undiminished in size or value, leads to confidence in its continuance for 1800 ft. more.

Methods of working at the mine, which is under the charge of K. Arai as mining engineer, consist of the ordinary driving of levels and overhand stoping. Schram, Leyner, and pneumatic drills are used with Rand, Leyner, and Schram compressors. Westinghouse electric locomotives gather the ore-cars, and Knowles pumps handle the water—about 40 cu. ft. per minute. Owing to the character of the water, phosphor-bronze pump parts are necessary. Aerial tramways carry the ore to the railway. No concentrator is necessary, but in sorting-houses the mine product is separated into 10% waste, 70% lump, and 20% fine material. As in most Japanese copper mines, great pains are taken to purify the mine-water before running it to waste, and particularly to precipitate all copper. There are two cementation plants, and both scrap iron and coke are used to throw down the copper. About 180 tons of cement copper is saved per year. The precipitation plant is described as follows in a report issued by the Bureau of Mines:

"The mine water from the third adit is sent to 90 wooden boxes, each 8 ft. in length, 3 ft. wide, and 1 ft. deep, which contain scrap iron; the slope being at the rate of 1 in 5.5. The average production of the precipitate is 35 tons per month which contains 50% Cu. The water which has passed through these boxes is conducted by launder to another plant about 1900 ft. below which is made up of 152 boxes each 12 ft. in length, 8 ft. in width, and 4 ft. 6 in. deep, sloping at 1 to 44. These boxes are arranged in four series, in each of which the water flows up and down. In this case scrap iron and coke are used as precipitants, consumption of the former being 23% of the precipitate produced. The precipitate taken is on the average 50 tons a month which contains 8% copper. The coke, in which the precipitate is absorbed, is produced to an amount of 200 tons per month which has 1% copper. All these products are sent to the smelting works at Shisakajima."

The cement copper from inside the mine, where boxes are placed at convenient points, averages 80% Cu; that from the outside boxes is of lower grade, owing to the presence of dust and iron oxide. From the precipitation plant the water is conducted by flume 9½ miles to the sea, so that there may be no possible chance of injury to crops growing below the mine. The ore is loaded on barges which are made into trains and hauled by tugs about ten miles to Shisakajima (Shisaka island), to which in 1904 the smelting works were removed in an effort to avoid danger from smelter fume.

SUMITOMO SMELTING WORKS, SHISAKAJIMA, JAPAN.

At the smelter about 600 tons of ore per day is handled, containing 30 to 33% S. With this is used 7% of gneiss as flux, and 4 to 5% coke.

The fine ore was formerly briquetted, but Mr. Nakamura has developed an alternative process which is now used. Noticing that some of the fine ore which had become wet while being transported, showed a tendency to 'ball up', he experimented by allowing the ore mixed with varying amounts of moisture to roll down a slope. This led finally to the device shown in Fig. 2. It consists essentially of a conical wooden cylinder revolving on a horizontal axis. It is 8 ft. long, 3 ft. in diameter at the upper end and 5 ft. at the lower. Into the upper end is fed a mixture consisting of fine ore, 100 parts; flue-dust, 20; silicious flux, 40 to 50; water, 6 to 7%. The exact amount of water necessary was determined by experiment and seems to be important. The mixture as it rolls down to the delivery end agglomerates; the individual balls being half to three-quarters of an inch in diameter. The effect of the water seems to be purely mechanical, but it forms a bond sufficient to hold the mass together and permit successful pot-roasting, which is conducted in the pot shown in cross-section in Fig. 3. It also saves about 30% in the time necessary to conduct the operation. The pots used are essentially circular grates with shallow sides. They are made of steel and are set over firebrick-lined pits into which a blast is directed from a Root blower. They are covered by a

heavy sheet-iron hood luted at the sides with sand. In the top of the hood is a conical-bottom trap-door, similar to the top of an iron blast-furnace, through which additional material may be introduced during the roasting process. Below the trap are baffle-plates to scatter the charge. At the sides of the pit, above the grate, are outlets for the air and gases.

The fine ore which is roasted in this device contains about 2½% Cu and 30% S. With it is mixed, as noted, the gneiss used for flux, and the flue-dust, which contains about 2% Cu and 10% S. The first material placed upon the grate is burning pyrite, which is spread about 1½ in. deep. Over this is placed a layer of hot dust from the pot last dumped, and then three tons of the fine-ore agglomerate. The pot is then covered, and the blast (about 40 mm. pressure) turned on. At intervals during the next four hours three additional charges of three tons each of ore are fed into the pot. In all, about 12½ tons is roasted in four hours. On completion of the roast the cover is

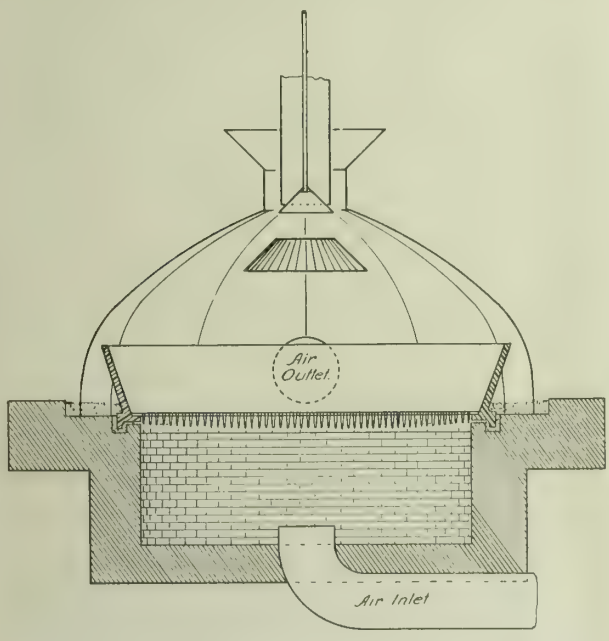

FIG. 3. NAKAMURA ROASTING POT.

lifted and the pot raised and turned, dumping the charge upon iron domes so as to break the sintered mass into convenient pieces for handling.

The roasted fine ore, with lump ore and coke, are fed to the first blast-furnace. This produces a matte containing 20% copper and a slag with 0.2% copper. The matte is smelted a second time, bringing it up to 30 or 35% copper and making a second slag assaying 0.3%. This matte is roasted in stalls and then smelted in a cupola furnace, bringing it up to 60 or 65% Cu. The slag from this furnace, assaying 0.8% Cu, is sent back to the first blast-furnace. The white metal is delivered to a reverberatory furnace, where a strong air-blast is blown over the top while a slag is rabbled off which is returned to the cupola. The product from this reverberatory is 98 to 99% copper. It is cooled in the air, no fresh water being available on the island, and finally melted, and poled in a refining furnace, from which it is cast into ingots. In all about 7000 metric tons per year is produced. Of this, about one-fourth is made into sheets and wire at the Sumitomo works at Osaka. The remainder is shipped in the form of ingots to Hamburg and London.

The Shisaka works are well and substantially built. They include coke-ovens from which the waste heat is utilized in boilers, and all modern devices and conveniences. The company provides homes, schools, and hospitals for its 4800 employees and brings fresh drinking water from the mainland. Wages are equivalent to 40 or 50c. per day, but it is to be remembered that houses, including water and baths, are rented to employees at a rate of 7½c. per month, and that rice, wood, and other supplies are sold at fixed rates less than their cost. With free medical and hospital service, here as at other works in Japan, mere statements of wages do not measure costs to the company or benefits to the men. The people look prosperous and happy. They were evidently well fed and cared for, and the company is known to be making an excellent profit. The American engineers steamed away from the hospitable harbor to the accompaniment of salutes and daylight fireworks, with the comfortable feeling of having seen good work well conducted.

The Sicilian Sulphur Industry

By ARTHUR GARRELS

*In 1911 in all of Sicily there were 476 sulphur mines and 13 refineries in operation. Adult mine workers receive an average of 3 lire ($0.579) per day; boys, 1.50 lire ($0.289). The scale of daily wages in the refineries varies from 3.50 to 9 lire ($0.675 to $1.737). The methods employed in mining sulphur in Sicily range from the most primitive to the latest and most improved. In smelting, the sulphur itself is used as fuel, and, according to the device and method employed, 25 to 40% of the mineral is thus consumed.

All crude sulphur produced in Sicily must be sold to the Consorzio Obbligatorio per l'Industria Zolfifera Siciliana (Compulsory Society for the Sulphur Industry in Sicily), the Government monopoly. The price paid by the Consorzio is fixed each year, in July, and for 1911 was as follows per metric ton of 2204.6 lb: Buying, $17.466; selling, $18.225. Export prices per 100 kg. (220.46 lb.) f.o.b. Catania for crude and refined and milled sulphur, ranged as follows:

Kind of sulphur.	High.	Low.
Crude	$1.93	$1.775
Second crude, ground, best	2.196	2.161
Second crude, ground	2.161	2.123
Refined	2.103	2.084
Refined, ground	2.354	2.316
Rolled, refined	2.161	2.123
Sublimed	2.895	2.895

According to the report of the Consorzio Obbligatorio per l'Industria Zolfifera Siciliana, the total production of sulphur during the fifth working year, ended July 31, 1911, was 391,978 tons, against 396,737 during the preceding year. The decrease of 4759 tons was due to general conditions, and in particular to the destruction, by an explosion, of one of the more important mines, producing an average of 30,000 tons per annum.

Aluminum Prices Fixed

The International Aluminum Syndicate has now fixed the price of the metal for next year's delivery at 160 marks per 100 kg. ($380 per metric ton of 2204.62 lb.), with the usual increase for special brands. The syndicate, however, will not dispose of the entire output for 1913 at this price, there being a general view among members that production during the next twelve months will not be able to keep pace with consumption, and that still higher prices will be possible. On the other hand, the syndicate has all along been emphatic in asserting its intention of in no way handicapping the development of the aluminum-consuming industries by unduly raising prices. At $380 per ton manufacturers have quite a good margin of profit, though the price cannot be considered at all excessive in view of the present levels of metals generally, and particularly of copper and tin. It is understood that manufacturers are making arrangements to increase production should demand warrant it.—*Manchester Guardian.*

*From a consular report.

Prospecting for Vanadium

By Frank L. Hess

*It is comparatively few years since the average prospector looked only for ores which carried gold, silver, copper, lead, or zinc. Within the past few years, however, he has been examining carefully all strange rocks and minerals in the hope that they may carry one of the 'rare metals.' Some of the forms in which the rarer metals occur, such as carnotite and vanadinite, at once attract attention, but many are so similar to minerals of no value that they are scarcely noticed. For instance, the vanadium deposits of the Placerville region, Colorado, were unsuspected of value for years after gold deposits had been worked in their immediate neighborhood. It may be worth while, therefore, to tell something of vanadium and its value and to describe some of the vanadium minerals and their manner of occurrence.

Vanadium has been known about a hundred years and was first found in lead ore—vanadinite—from Mexico. There was, however, little market for vanadium ores until after the demand for alloy steels was created within the past ten years through finding that remarkable qualities are imparted to steels upon the addition of comparatively small quantities of some of the less common metals. Vanadium, it is claimed, when added to certain steels, greatly increases their resistance to shock and their durability under torsional strains. It is also claimed that tool steels are made much harder. So well have these claims been substantiated that large quantities of automobile and engine parts, gears, and other mechanical appliances are now made from steel treated with one-twentieth to one-fourth of one per cent vanadium. Vanadium is also used in tool steels in percentages reaching to 1½. In the milder steels, vanadium is thought to act as a scavenger, ridding the steel of oxygen, nitrogen, sulphur, and possibly other impurities. In larger quantities it is said to act both as a purifier and as a hardener, but for this purpose it is used in connection with chromium, generally tungsten, and sometimes manganese. It is also used in babbit metals and in bronze. Considerable quantities of vanadium oxide are used in dyeing cotton black, a little is used in giving a yellow-green color to pottery glazes, and small quantities go into other uses. One 'solution of vanadium' is being advertised as a sort of cure-all.

The vanadium used in steel is introduced as ferrovanadium, an alloy of iron and vanadium containing from 20 to 50% vanadium. It is made by two methods, electrolytic smelting and the thermit process. In the latter the heat is generated by the rapid oxidation of finely crushed aluminum, and a very high temperature is obtained. Metallic vanadium is prepared with very great difficulty, owing to its affinity for oxygen and nitrogen and has never been obtained except in small quantities.

The price of vanadium has dropped in the past two or three years from $5 per pound for the vanadium contained in ferrovanadium until it can be bought at the present time for $2 per pound, and prophecies are heard that it will go even lower, owing to the quantities now being mined in Peru and Colorado.

Vanadium is found in minute quantities in most, if not all, igneous rocks, in many clays, in the ash of some coals, in asphalts, peat, sandstones, and veins of various kinds. The minerals in which it occurs in commercial quantity, however, are few and sparsely distributed.

Carnotite, a complex variable compound of vanadium and uranium with potassium and calcium, is ordinarily a powdery canary yellow mineral. It is now mined in quantities in standstones of western Montrose county, Colorado, in Paradox valley and vicinity, where it forms an impregnation in the sandstone and coats crevices. In places it shows no crystal form even under a lens, but in other places it can be seen with the unaided eye to be in crystalline plates, generally standing at right angles to the surfaces which are coated by it. Rarely it is found in a bright yellow mass which cuts like talc. The material as mined may contain 4% or even more of V_2O_5, and the percentage of uranium oxide (U_3O_8) present is usually in the ratio of about 3 to 1. The area is 50 miles from a railroad, and heretofore the ore could not be mined profitably if it contained less than 3% V_2O_5, and it probably must be richer since the price of vanadium has reached its present low mark, unless the uranium is also sold. The pure carnotite contains from 19.85 to 21.09% V_2O_5 and 58.75 to 61.53% UO_3[1]. The origin of the ore is at present unknown. Carnotite is also being mined 15 miles west of Greenriver, Utah, on the San Rafael river; in Professor valley south of Cisco; near Richardson; 8 miles south of Thompsons; in White Horse canyon; and other parts of the La Sal mountains. Considerable quantities are said to exist in Rio Blanco and Moffat counties, Colorado, and Uinta and Carbon counties, Utah. In each of these places it has been found in friable sandstone which is probably mostly of Triassic age. A little carnotite is found in South Australia in a pegmatite dike, where it occurs as a decomposition product from a uranium-bearing titanium mineral called davidite. Carnotite is highly radioactive, as would be expected from its high uranium content, and is being used in several laboratories for the extraction of radium.

Calcium vanadate, a red mineral in small red columnar crystals, reminding one of finely divided redwood bark, though a richer red, occurs with the carnotite in Paradox valley; south of Thompsons; and in Wild Horse canyon in the southeast part of the San Rafael swell, where some carnotite occurring with asphaltic material has been mined. It is also found at Minasragra, Peru, in connection with patronite in asphaltic material.

Patronite, the sulphide of vanadium, is found in large quantity at Minasragra, near Cerro de Pasco, Peru, in connection with asphaltic material and is shipped in large quantity to this country. The material as mined is a dark, almost black, structureless mass. It is easily set afire with a match, and advantage is taken of this property to burn out a large part of the sulphur before shipping. The roasted product contains about 25% vanadium. Patronite is not known in any other part of the world, though it seems possible that it may be found in this country, as vanadium occurs in connection with asphaltic material at several places. Near Page, Oklahoma, a material often referred to as coal is really an asphalt related possibly to grahamite. It is hard, brittle, and shiny black, and contains about 0.8% ash of which one-eighth to one-fifth is vanadium pentoxide (V_2O_5), equivalent to about 0.1 to 0.19%[2] of the whole. It has not yet been utilized for vanadium. Brief reference has already been made to the Wild Horse canyon deposit in the southeastern part of the San Rafael swell, Utah. There carnotite, calcium vanadate, and possibly other vanadium and uranium minerals occur in a sandstone impregnated with a shiny asphaltic material. Deposits more or less similar to those at Page, Oklahoma, occur in the Yauli district, Peru, at San Rafael, province of Mendoza, Argentine Republic, and other places. Some effort has been made to burn the material and extract the vanadium from the ash.

Roscoelite, a dark green vanadium-bearing mica, is the mineral from which the larger part of the vanadium produced in this country is obtained. Though found in small quantity in gold mines on the Mother Lode, California; at Baker City, Oregon; and in Boulder county, Colorado, the only place it is known to occur in commercial quantity is in San Miguel county, Colorado, in a belt about nine

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[1]Hillebrand, W. F. U. S. Geol. Surv. Bull. 262, p. 27. In commercial work uranium is usually determined as U_3O_8, but the figures above are as given by Mr. Hillebrand.

[2]The latter figure is given by D. Foster Hewett, *Trans.* Amer. Inst. Min. Eng., Vol. 40, 1909, p. 280.

miles long by one-half to two or three miles wide. Here it occurs in a fine-grained sandstone known as the La Plata, of Jura-Trias age, in general nearly white, but which is stained in places a dull green by roscoelite. The sandstone has a parting which is possibly due to a nonconformity, and along this in many places is a dark green to brownish black shaly material, one-half to three-fourths of an inch thick, which is really a vein of roscoelite with a little quartz. The mica scales are so small that they cannot be seen by the eye. Above or below the seam or both above and below, the sandstone is impregnated with still more minute scales of roscoelite for a thickness of a few inches up to more than 30 ft. Roscoelite carries between 13 and 14% vanadium, the impregnated sandstone up to about 4%, and the vein more than 8%. In color, the vanadiferous sandstone, though somewhat duller, is much like the green sandstone found in the Coast Range from Colusa county, California, to Washington, which is used for building in San Francisco, Tacoma, and elsewhere.

Vanadinite, a vanadate and chloride of lead, is the commonest of the vanadium minerals. This mineral occurs in many colors and outward forms and is one of a family of minerals varying considerably in composition. Perhaps red is the color most often met with in vanadinite. It is also reddish brown, hair-brown, yellow, gray, pearly, and colorless. The crystals are six-sided, many are barrel-shaped, and many are hollow ended. Cross-sections are very apt to show growths of various colors. It is a soft mineral with a hardness of about 3, is heavy (specific gravity of 6.66 to 7.23) and so is easily saved by panning. It is found at many places, especially in the southwestern part of the United States in the oxidized portions of lead-bearing veins. The properties named are almost characteristic, the only minerals which might be mistaken for it are pyromorphite and mimetite, the phosphate and arsenate of lead, to which it is closely related. The test for vanadium is necessary for differentiation from these. Endlichite, in which arsenic largely takes the place of vanadium, is a clear yellow variety found at Hillsboro, New Mexico, and at other places.

Descloizite is a mineral of much the same characteristics and composition, but it crystallizes in the orthorhombic system, generally in very small crystals, and contains zinc. It occurs under the same conditions as vanadinite, but is generally in small quantity. Descloizite is found in the Clark mountains, California, and at a number of places in Nevada, Arizona, and New Mexico. A copper-bearing variety is green and is called cuprodescloizite.

The lead vanadates are mostly confined to the dry areas, though some vanadinite is found in Montana and less quantities in other regions of large rainfall. Mexico, Argentina, and Spain produce considerable quantities of vanadinite.

Mottramite, a lead-copper vanadate, has been mined in a small way in England, but is unimportant, and unknown elsewhere.

There are other vanadium-bearing minerals, but up to the present time these are the only ones known to be of direct commercial importance. As is well known, the iron ores of Taberg, Sweden, carry vanadium, and from the slags of the Creusot iron works in France large quantities vanadium oxide are said to have been recovered yearly. The titanic iron ores of the Adirondacks (New York) carry small percentages of vanadium, but there is little present prospect of a recovery from that source.

From the brief description of minerals and occurrences given it follows that from present knowledge the prospector for vanadium appears to have more chance for success in the drier part of the United States; that is, the Great Basin and southwestern states. The following substances, unless of known composition, may well be tested for vanadium: Dull green sandstones and other rocks *not igneous,* especially where only certain parts of a bed are so colored; hard asphaltic material, either impregnating sandstones or in veins; bright yellow coatings and stains; hexagonal minerals of various colors which are easily crushed and have a specific gravity somewhat higher than pyrite, shown by the way they hang back in panning; resiny coatings on crevices in rocks; and dull green micas.

Luckily the qualitative tests for vanadium are so easy that any prospector can ordinarily make them for himself. An analysis to show the quantity present, however, must be made by one with some chemical skill who also has the requisite apparatus. To test for vanadium the powdered mineral may be digested with either dilute or concentrated nitric acid, and if vanadium is present a greenish solution generally results. If hydrogen peroxide be added to the resulting liquid a brown color will appear if vanadium is present. Some vanadium minerals are also attacked by hydrochloric acid and by dilute sulphuric acid. If concentrated hydrochloric acid is used, vanadium minerals generally give a green solution the color of which becomes faint or disappears on dilution. The addition of hydrogen peroxide to either the hydrochloric or the sulphuric acid solution gives a brown color, as when nitric acid is used. Metallic zinc may be added after hydrogen peroxide and a bright green or blue color will be given by the reduction of the vanadium compounds. The same effect can be obtained in a nitric-acid solution by adding sulphuric acid, evaporating to white fumes, diluting, and adding metallic zinc. If preferred, hydrochloric acid instead of sulphuric acid may be added to the nitric-acid solution, but in that case evaporation must be carried almost to dryness at least twice to get rid of the nitric acid. The liquid may then be diluted and more acid added, followed by zinc as described.

At times the tests given above are not wholly satisfactory. In such cases, if the apparatus is at hand, through a filtered solution made alkaline with ammonia pass hydrogen sulphide (H_2S) gas until the solution is saturated. The solution will take a fine garnet or deep wine color if vanadium is present. Copper, if present, is precipitated as a sulphide and does not interfere with the test.

Extensions of the Lake Copper District

Speaking before the Lake Superior Mining Institute, F. W. Denton, in his presidential address, alluded to the fact that developments of the past year or more give rise to the expectation of a considerably enlarged area of mining operations, although the greater part of the district has not yet been systematically explored. At present, attention is mainly concentrated on economies to be effected in mining and milling methods, with the numerous special problems incident thereto. Among the foremost are greater efficiency in the work underground, including improvements in machine drills; the perfecting of safety devices; the use of concrete to replace mine supports and shaft timbering; the cheaper generation and application of electric power, particularly in connection with low-pressure or mixed-pressure steam turbines; better extraction of copper from the mill through fine grinding, etc.; along all of these lines noteworthy progress is now being made

Tin Statistics

In a report by L. Vogelstein & Co., on the August tin statistics, published by the Metal Exchange on September 4, it is said that the statement is more favorable than anticipated. The visible supply was 11,285 tons, a shrinkage of 2061 tons, mainly due to large London, Holland, and Continental deliveries totaling 4300 tons, following the small July deliveries of 3000 tons. Since the beginning of the year the visible supply has decreased 5229 tons, including four Banka sale months, and four non-Banka sale months. At the present ratio of decrease, the supply at December 31 will be very low. The previous low record was 9839 tons, on April 30, 1907, the price at that time being £195 in London, and $42.80 in New York. The financial crisis of that year prevented further rise in prices, and stocks increased to 23,000 tons on January 31, 1910.

Outcrops of Precious Metal Veins

By Frederick H. Morley

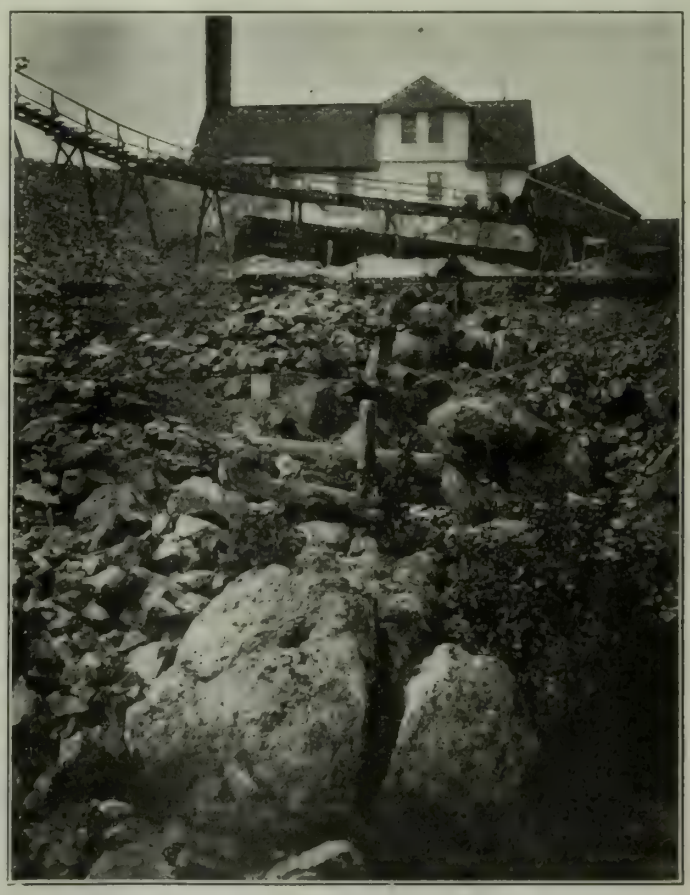
The physical features of the outcrops of precious metal veins are of great interest to prospectors, practical mining men, and field engineers, for the outcrops usually determine the location of mining claims, often lead to the discovery of orebodies, and usually indicate the size, direction, and continuity of the vein. The average prospector cares little about ore genesis or the chemical features of the superficial alteration of mineral veins, but he is always much impressed by bold outcrops. He is usually hunting for prominent projecting vein outcrops which can be readily seen and easily traced on the surface. There is a strong popular feeling that the finding of a 'true fissure' vein having a marked continuous outcrop must lead to the discovery of rich ore deposits. In a large number of cases, the valuation which an owner places upon an undeveloped prospect is proportional to the boldness and length of the vein outcrop, irrespective of its chemical composition or the actual presence of ore minerals. It is almost an axiom among many miners that the depth of a vein (presumably in commercial ore) will be at least equal to the distance on the surface over which its outcrop can be traced.

OUTCROP OF A STOCKWORK, WENATCHEE, WASHINGTON.

Although the presence of bold outcrops affords the prospector the greatest assistance in the discovery and location of veins, yet such outcrops cannot be relied upon as indicative of the presence of orebodies, nor of the size and continuity of the vein in depth. While it may be perfectly true that few valuable precious-metal deposits would have been found had it not been for the existence of some conspicuous outcrops, yet it seems to be equally true that a large proportion of the most productive precious-metal veins of North America are not characterized by such outcrops, and that their discoveries were largely fortuitous.

In the very interesting and instructive paper on 'Outcrops of Orebodies,' in the *Mining and Scientific Press*, December 4 and 11, 1909, W. H. Emmons gives a classification of outcrops based upon the chemical and mineralogical composition of various kinds of ore deposits and their enclosing rock formations. According to general superficial features and aspects, outcrops might be rudely classified as: (1) bold or projecting, (2) level or flat, (3) depressed, (4) concealed. Or a still more general classification might designate outcrops as: (a) conspicuous, (b) obscure, and (c) concealed. The character of the outcrop would, of course, depend upon the composition of the vein and the country rock, and also upon climate, topography, etc., as shown by Mr. Emmons; but the general superficial aspects and characteristics are of considerable interest to prospectors and locators of new mining properties.

The composition of the vein and the climate of the region are the most important factors in determining the character of the outcrop, since bold outcrops are only possible in regions which have been subjected to intense and rapid erosion, where the veins are more resistant to decomposition, weathering, and erosion than the enclosing rocks. Bold projecting outcrops are generally silicious, and are most frequently found in arid regions. In moist climates erosion is often hindered by soil and vegetation, while in regions that have been glaciated, veins and country rock have been equally eroded. Bold outcrops are most often composed of solid quartz, silicified rock, or other resistant substances, with little or no admixture of the easily decomposed ore minerals. They are, therefore, likely to be barren, although some valuable orebodies may be found in connection with such barren outcrops—for example, the silicious outcrops or 'combs' of the Goldfield district. Outcrops may be obscured or concealed by soil, talus, or vegetation, or may be covered by rock formations which are later than the veins. Those of this type are probably the most numerous of all, but discoveries have been greatly hindered on account of the more or less complete concealment of the apex of the vein. In many cases a portion of a vein may appear at the surface at some point, from which the concealed apex of the vein can be traced by trenching or underground workings. Most of the veins of the Cripple Creek district are concealed by detritus; and those of the El Oro district are



OUTCROP OF STRATTON'S INDEPENDENCE.

concealed by a capping of later andesite that covers them.

It seldom happens that the entire outcrop of a vein will belong to one of the classes mentioned, since local conditions may vary greatly along the strike of the vein. One part of a vein may be covered by detritus, another part may outcrop boldly, while the ore-bearing portion of the vein may have depressed outcrops due to the more rapid erosion and decomposition of the ore minerals. Undoubtedly the large majority of precious metal veins have obscure outcrops which are not easily identified except at a few isolated places along the course of the vein, if at all.

In general, it may be stated that the importance of bold outcrops as a factor in the discovery of valuable metalliferous veins and ore deposits is greatly overestimated. If one takes a list of the most productive and valuable precious-metal mines or districts of North America, he will find that a large majority of the veins have obscure outcrops, and that their discovery was largely fortuitous. The histories of most of these mines or districts are singularly silent regarding the vein outcrops, and little mention is made of them in connection with the discoveries. Such a list as has just been mentioned would include mines such as those of the Comstock Lode; the Homestake; Goldfield Consolidated; Ontario; Silver King; Daly West; Alaska Treadwell; Bunker Hill & Sullivan; Esperanza; El Oro; Valenciana (Guanajuato district); San Rafael (Pachuca district); Portland (Cripple Creek district); and Nipissing. This being a representative list of a number of the most important precious-metal mines of North America, general conclusions reached from the study of the histories and geological reports with respect to the outcrops of these veins should be interesting and instructive.

The ore deposits of the Alaska Treadwell and Homestake mines do not occur in veins, consisting at the former of mineralized dikes intrusive into black slates; and at the latter of impregnated crushed zones of slate. The orebodies of the other mines occur in veins or lodes, or in connection with them.

The Homestake ore-zone showed a great extent of iron-stained rock at the surface which carried gold, but the ore deposits evidently had no bold outcrops, although they may have been rather conspicuous on account of their coloring on the surface. The northern part of this ore-zone is completely concealed and covered by later formations. The Alaska Treadwell orebodies consist of mineralized dikes. A. C. Spencer[1] says that "in the greater part of the intruded area exposures are few, and only small dikes outcrop on the side toward the centre of the island." The quartz veins in the black slates which have been prospected show some mineralization, but their value is doubtful.

Bold outcrops are found in only two or three of the mines enumerated, such as the veins of the Tonopah Mining Co., and the silicious ledges or 'combs' of the Goldfield district. The great Comstock Lode showed scattered outcrops of quartz, but these were evidently not of sufficient prominence to attract the attention of the early prospectors, so that the discovery of this lode was largely fortuitous. The projecting outcrops of the Mizpah vein led to the discovery of the rich ore deposits of the Tonopah district, although many of the important veins were covered by a capping of later andesite. The rusty, silicious lodes of the Goldfield district were passed by and overlooked by prospectors for many years. In the Coeur d'Alene district the veins usually have flat or level outcrops, which are obscure. F. L. Ransome[2] states that "the outcrops of the largest lodes and orebodies are very inconspicuous and probably would not attract the attention of even a keen observer traversing the country in the ordinary way." In the San Juan region of Colorado the veins usually have depressed outcrops, but they are fairly conspicuous on account of their trench-like appearance and rusty color. The Camp Bird veins are partly covered by talus, but can be traced for considerable distances on the surface. In some parts of the San Juan region which are covered by the Potosi rhyolite the veins do not outcrop at all.

The Ontario lode, Park City district, has some outcrops, but they are very obscure. The discovery was made by finding "a little knob sticking out of the ground about two inches high,"[3] which is said to be the only cropping of this lode which was ever found. The Daly West mine is situated on the westward extension of the Ontario lode, but "croppings of the Daly West lode are not known, the probable position of its apex being masked by glacial deposits."[4] The rich orebodies of the Silver King mine did not outcrop, with the exception of the Mayflower shoot. This shoot was accidentally discovered when some isolated outcroppings showed rich ore at one point on the surface, but no extension could be observed.[5] In general, the lodes of the Park City district have obscure or concealed outcrops, largely due to the presence of extensive glacial deposits.

The Veta Madre at Guanajuato, and the Vizcaina vein at Pachuca, have rather obscure outcrops, although both veins have been traced for long distances. F. Beck[6] states that the Veta Madre "has a generally obscure outcrop," and is in part concealed by later flows of lava. Many of the veins of the Pachuca district have prominent outcrops which can be seen as white crests running across the surface for long distances. The Vizcaina lode, of the San Rafael mine, was discovered accidentally, being covered by a mass of detritus and having a generally obscure or depressed outcrop. Both the Vizcaina and Santa Gertrudis lodes are indistinct or concealed by detritus at the surface, the great orebodies having been found only at a depth of 100 metres or more. In the Cripple Creek district there are very few outcrops, on account of a heavy covering of soil or 'wash.' The vein croppings are usually obscure, if not entirely concealed. Some lodes, like the 'Captain system' of the Portland mine, apparently do not reach the surface at all.

The rich silver veins of the Cobalt district, being almost entirely covered by heavy deposits of glacial drift, were accidentally discovered through a railway cut. The veins and country rock have been equally eroded by glaciation, so that the vein outcrops are level. The principal veins of the Esperanza, El Oro, and Dos Estrellas mines in the El Oro district, Mexico, are completely concealed by a thick capping of andesite. The original discovery was made on the Descubriadora vein of the El Oro mine, which was an outcropping vein not covered by the lava capping,[7] but the San Rafael vein system (the principal one of the district) and the Dos Estrellas veins are completely covered by the andesite.

Of the veins enumerated, only some of those of the Goldfield and Tonopah districts, parts of the Comstock Lode, and some of the Pachuca veins appear to have bold projecting outcrops. The ore zones of the Homestake mine, and some of the veins of the San Juan district, Colorado, are conspicuous on account of their coloring, decomposition, or erosion. In the cases of all of the other veins mentioned, the outcrops are either obscure or concealed. The general conclusion is that the large majority of the important precious-metal veins of North America have obscure or concealed outcrops, and that bold outcrops are rarely indicative of valuable ore deposits, the popular impression to the contrary not being founded on evidence; and, like the fallacy concerning the 'true fissure vein,' more likely to prove misleading to the prospector than to serve as a useful guide.

[1] *Trans.* Amer. Inst. Min. Eng., Vol. 35, p. 486.
[2] U. S. Geol. Survey, Prof. Paper No. 62, p. 129.
[3] U. S. Geol. Survey, Prof. Paper No. 77, p. 115.
[4] *Op. cit.*, p. 153.
[5] *Op. cit.*, p. 185.
[6] 'Nature of Ore Deposits,' p. 266.
[7] *Eng. & Min. Jour.*, Vol. 79, p. 413.

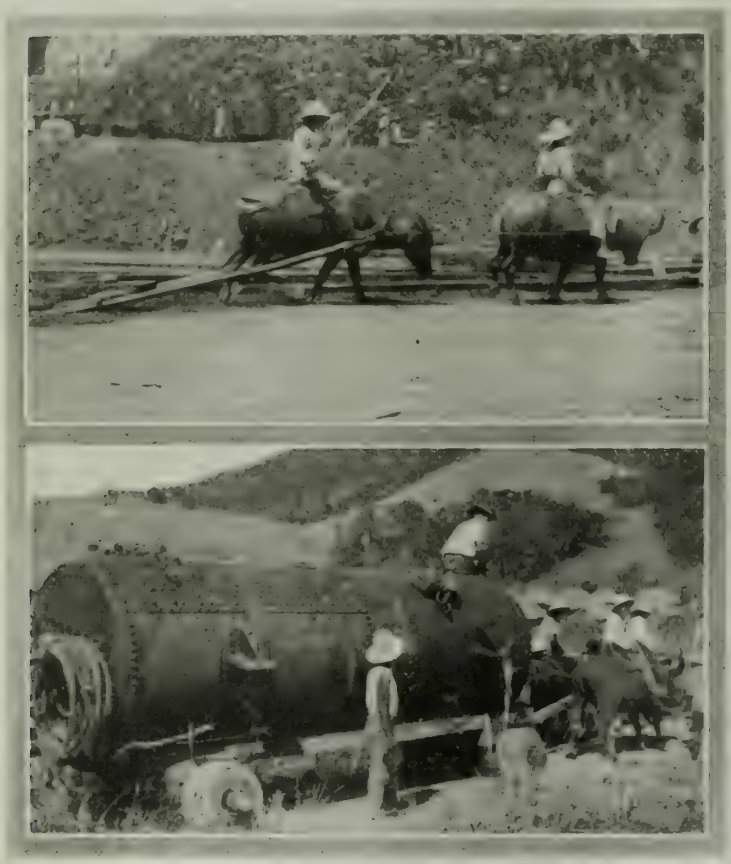
Pioneering in the Tropics

By C. M. Eye

Those who have never had to do with the development and equipping of mines in the tropics, remote from a base of mining supplies, and devoid of any supply of labor trained in the lines of work required, can have no realization of the many difficulties met, or of the many problems that have to be solved in order to attain success. Such difficulties and problems, unless anticipated, are sure to cause expensive delays. Having been 'up against' these problems, I hope, by contributing the results of my experience, to help others of the profession who may find themselves in a like situation.

'Cheap' tropical labor is usually slow, and has almost invariably to be trained for mining work. It is therefore important in opening up tropical mines to keep development work going steadily when once started, working every possible face. The cost of supervision is relatively high, another good reason for this policy, which if carried out intelligently will result in a low development-cost and a goodly reserve of ore, in most cases, by the time reduction is begun. As construction costs in the tropics are usually much higher than operating costs, as compared with similar work in mining centres, I consider that the equipment should be so planned that it will allow at least three, and better four years, to handle the ore in reserve at the time that construction begins, and at no consequent time to crowd the mine any closer than by added milling equipment.

In making estimates for construction in remote districts, where there are no available data as to costs, and no equipment or trained labor at hand, it is essential that a liberal allowance be made for unforeseen contingencies, and this is especially true in tropical situations. Whereas 5 or 10% may safely cover in older districts, an allowance of at least 20 or 25% has often to be made where the enterprise is a pioneer one. It is important to foresee, if possible, just what will be needed in the way of buildings and quarters, and to provide them at the outset of the equipment of a property with a reduction plant. They cost no more then than later, and the men get the benefit at once, which will in turn accrue to the benefit of the company in better service rendered. White men taken to the tropics must be well housed and fed. Such men are usually of a good class, men brought in to supervise, and are entitled each to a comfortable room alone, where he can do as he pleases without interruption when off duty, and to the best food obtainable. This does not imply that there need be extravagance, for the best food for a given locality is often the cheapest; but no pains or expense should be spared to get a good variety of food for the white force. I consider it good policy, in addition, to provide a club building furnished at the company's expense, with a pool table, phonograph, and subscriptions to the best magazines, and by all means the mining magazines and periodicals, all free of cost to the men. In providing living quarters for white men in the tropics, I have found it best to build a number of houses of not to exceed two rooms, communicating to a common veranda, rather than a lesser number of larger houses, for the reason that more quiet and greater privacy for each man is secured. Native workmen are usually more easily satisfied, for often they have homes near the work, and houses of native material answer their every need. They should all be housed so that they and their families are kept dry and not crowded, and I have obtained steadier work from them when they are housed on the property than when they come in from their own homes; the temptation to stay in on a rainy morning, or to sneak away to a cock-fight or other equally fascinating diversion, is not so strong when they are housed on the works.



CARABAO HAULING MILL TIMBERS, FRONT END RESTING ON 'PATALOI,' CORRESPONDING TO THE 'TRAVOIS' OF FRENCH CANADIAN; BACK END DRAGS.

100-HP. BOILER, EN ROUTE APRIL 1911. HOME-MADE HARDWOOD WAGON DRAWN BY 20 CARABAO.

Before beginning any construction work, it is quite essential to provide for a good supply of tools, and at the same time to provide ample store-house capacity, so that all tools be stored, when not in use, in tool-houses in connection. The store-house force can attend to checking and storing in connection with the foreman, and a strict enforcement of this rule will result in much less loss from thievery or carelessness. I have even found it necessary to require tools to be brought out and checked at the end of each shift in a mine, and reissued to the next shift. No new material should of course ever leave the *bodega* or warehouse except on requisition of a responsible foreman. A company sales-store should always be provided from the start for the convenience of the employees. This should be operated on a basis of very reasonable profit, and foodstuffs should carry the least profit. Under working conditions where goods are not likely to spoil or be otherwise lost, I should say that a profit of 10% on foodstuffs and ordinary clothing and 20% on all other goods is a reasonable basis for operation, and, in addition to providing for the wants of the men, will usually afford sufficient profit

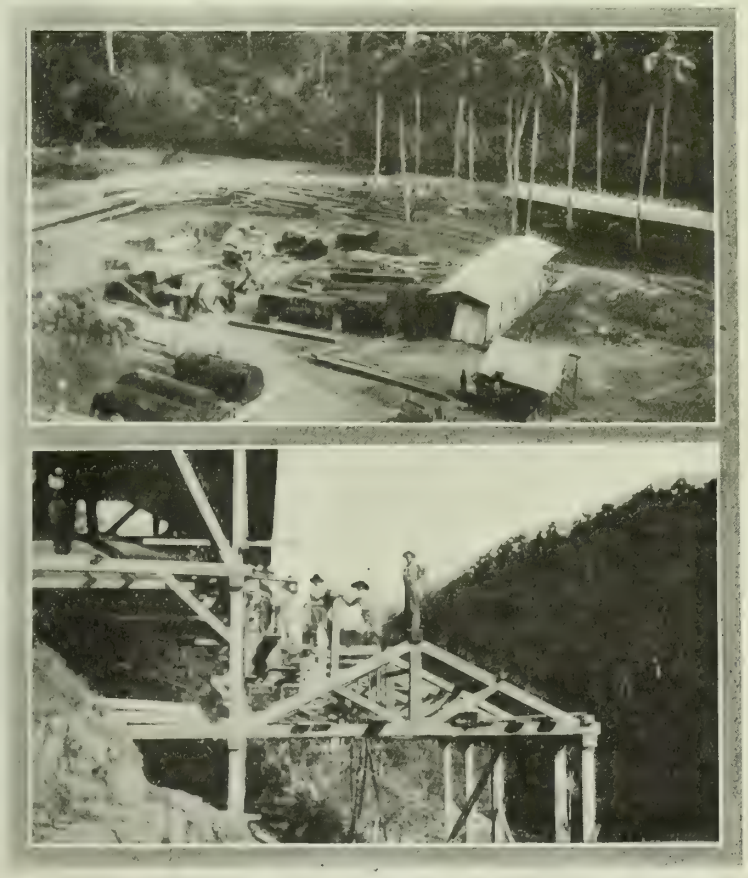
to pay for the clerical help on the job. This should be sufficient return, for the object to be kept always in view in a mining enterprise is to get low costs and good results in mining and milling, rather than to make profits from sales and rentals. Yet I have seen mining operations where these seemed of prime consideration with the management, with heavy losses going on apparently unnoticed in mine and mill. It is, of course, as essential in the tropics as elsewhere that a thorough system of accounting and cost-keeping be started from the very first, but it is seldom done. With many companies the cost of this seems too great, but by the operation of a well conducted store, as I have noted, the expense can be met without dipping into capital account for it.

It is very essential to prepare well at the outset for proper sanitary arrangements, and to provide a doctor and stock of medicines for a tropical camp, and to exercise an eternal vigilance regarding sanitary matters, especially with the natives, for they realize less than whites the importance of sanitation. The cost of a doctor and of medicines can usually be assessed to the employees in part, at least, but in any case it must be provided for. In the Philippines the Insular Government, wherever possible, gives the mining companies the benefits of the provincial hospitals at a very nominal charge, while the district health officers enforce sanitary regulations in the camps, which aids the operators greatly; but all governments are not so liberal nor so well provided for in this line. The best company provision for medical assistance for its employees that has come under my observation is that of the Oriental Consolidated company at Unsan, Korea. There the medical aid is ample, and is not only free to the people immediately employed, but to the people of the district as well. And I believe that it has proved to be a wise policy.

In providing materials for store-houses, living quarters, and offices, there is such a variety in use in the tropics and such a difference in different countries, that it would be waste of space to go into a description of them. Suffice it to say that where there are means for sawing timber, lumber is the most satisfactory, as a rule, for permanent buildings of this class, with corrugated galvanized roofing. I have utilized slabs to good advantage and even for floors of such buildings where lumber and money were rather scarce. A tight ceiling should be put in where the galvanized roofing is used, as otherwise it will be insufferably hot during the day. Where the supply of galvanized iron has to be brought to the property in sea-going boats and unloaded on the beach, the greatest care is necessary to prevent it getting wet with sea-water, which ruins it very quickly by converting the zinc to a chloride. Subsequently, when the iron becomes exposed, a galvanic action sets up which soon results in a hole and a leak. When a good grade and weight (not less than No. 24 gauge) of galvanized roofing is well laid, with a lap of not less than two corrugations and a run of eight or more inches with a minimum pitch of 26°, I know of no more satisfactory roofing for the tropics, and no sheeting is necessary with it, as there is none of the 'sweating' that is so troublesome in cold countries. I have also found that plain galvanized sheets of 24 gauge, or even lighter, make an excellent enclosing material for mill buildings, being easily and quickly put on studding and girts so spaced as to accommodate the regular-sized sheets. It makes an almost fireproof siding, and no other material is required beside it.

Excavation work should be begun as early as possible, owing to the slowness of natives, and should be pushed at all times. A competent and energetic white should be put in charge of the work, and under him the gangs should be so arranged that there will be a native *capitas* or boss to each 25, or each individual gang of less number. Thus the foreman has to deal only with the sub-bosses, but he must be 'on the job' all the time, not only to keep them going, but to see that their effort is well directed, for the average native has no interest as to whether his work is productive of results, and the *capitas* frequently seems to share this attitude. Properly organized, excavation in the tropics is not as expensive as elsewhere, per given quantity, but owing to the climatic conditions, there is usually a greater overburden to be removed and a greater depth of decomposed seamy rock to be cut to get a reliable foundation, and interruptions of the work from rain are likely to be more frequent than in more favored climes. Where timber for buildings must be hewn from the forest or whipsawed from logs in the woods, considerable delay may be experienced in getting it out, unless one begins early and keeps eternally after it, and then it is usually not well sized or selected, requiring much extra work on the part of the framers, so, unless it is practicable to put up a sawmill for the job, it is always better to get the timber from outside when possible. Of course, heavy timbers of specially hard and desirable wood for foundations and other limited needs, are often best cut out on the ground.

Whenever it is possible to obtain cement at a reasonable figure, it is always advisable to put in concrete retaining walls and machinery foundations and lower working-floors of the same material. Next in desirability comes cut stone laid with cement mortar. I have even had satisfactory dry stone walls laid by Japanese masons. If timber must



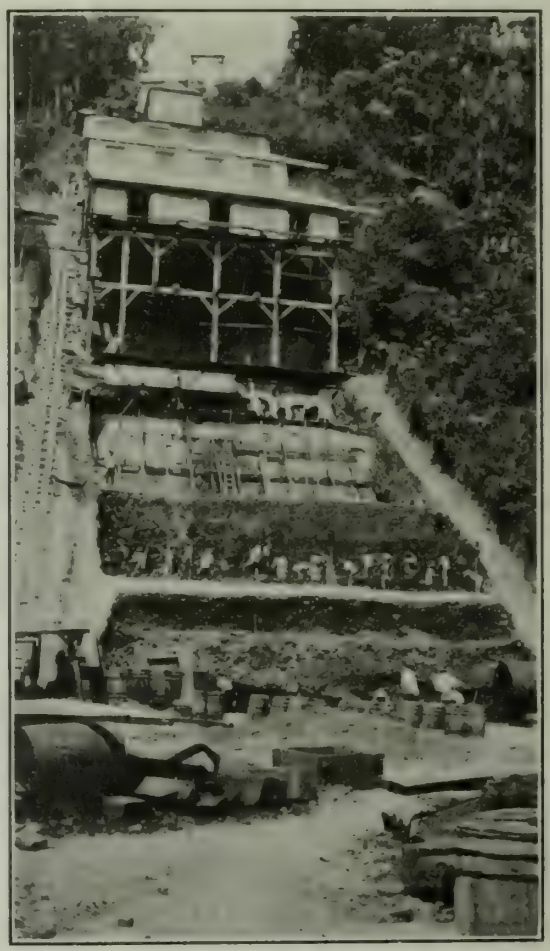
MACHINERY AND TIMBERS BEING ASSEMBLED IN YARD BELOW SITE OF COLORADO MILL, APRIL 1911. YARD MADE FROM MATERIAL REMOVED IN EXCAVATING FOR MILL ON THE HILLSIDE.

ERECTING COLORADO MILL. FOREMAN WITH JAPANESE CARPENTERS AND FILIPINO HELPERS.

be used, none but hardwood should ever go into foundations or any point in contact with the earth, for not only are vegetable decaying agencies unusually active in the tropics, but the festive *annai* or white ant is likely to get into and destroy any ordinary timber, and more especially pine. I have even known them to enter fairly hard woods, but if these are not in actual contact with wet soil the danger is not great. It is of the utmost importance to keep tankage piled well off the ground, even though it be redwood, for I have known of pine tanks, and sometimes redwood, to be completely ruined while awaiting erection. The supports must be watched and the covered runways of the ants destroyed as soon as begun. A white ant never voluntarily comes out into the light, but a single night will often suffice for ants to build several feet of mud runway up a post to gain access to a pile of timber above. A little coal-oil judiciously applied will act as a preventive of trouble in many cases. It is always safest to have a good supply of building material on hand before getting the framing and erecting force on the ground, so there may be no delays on this score. It should be well sorted and conveniently arranged in a yard ample in size for the carpenters to work without crowding and for storing the framed parts until the actual erection begins. It is best to have every piece of a given building or floor framed, marked, and piled before a start is made, and the bolts should all be out and ready. Then there will be no waiting for pieces when the erection gang starts. For erecting it always pays to provide a good double-drum erecting hoist with plenty of ½ and ⅝-in. steel cable on the drums, and in addition a liberal supply of new double and triple falls. The rope in these must be renewed very often in the tropics, as hemp deteriorates rapidly in use. The store-house should always have a stock, so that no rope need be used after it has shown signs of weakness. Steel-wire rope is always more dependable than hemp, but it must be well cared for by frequent 'doping' to last well. This applies to all steel and iron in the tropics; they must be protected by paint or grease, or rust will soon destroy them. Chains are not of as much service here as elsewhere for the reason that they are not so easily protected.

The machinery for a mill in the tropics should not be rushed on the ground too early, for it is difficult to protect it properly if it has to be stored outside awaiting erection. It is usually not practicable to unpack machinery until ready to erect, and frequently, on unpacking, it is found in a badly rusted condition. It is a common failing to rush the shipment of a plant unnecessarily, not allowing the manufacturer the time he should have to perfect the shipment, or the men on the ground time to get ready to receive it properly, with the too frequent result that in the hurry of shipment essential details are overlooked, and the man in charge of erection has it in the way for weeks before he needs it. Of course, where there are severe transportation conditions to be considered, it is best not to be behind in getting it off, for it often takes months to get a shipment to the site from the nearest port. As a rule, where water transportation is available, it is not a serious matter to transport machinery, but once the waterway is left, the trouble generally commences. Usually the roads are bad, especially in the rainy season, proper wagons are not to be had, and the draft animal of the country must be used for motive power. In getting the equipment of the Colorado Mining Co., at Aroroy, P. I., from the point of discharge of the lighters, half a mile from the mouth of a tidal river, to the millsite, two miles away, I first built a fair road and surfaced it with gravel, and built a low wagon entirely of hardwood bolted together, the wheels of which were 13 inches in width and 20 inches in diameter, with axles 5½ inches diameter, the wheels and axles being of *molave*. This, with a string of carabao or water buffalo, in pairs, was sufficient to handle the heaviest pieces (six tons) at the rate of a trip a day. After the first few trips the condition of the road was much improved by the passage of the broad wheels. The illustrations show this rig with a 100-hp. boiler aboard. The whole shipment was cleaned up in about a month. The cost of the wagon was less than $250 and it lasted out the job in good shape. Where boilers are the only really heavy portion of the equipment, and the shipment is delivered near the property by sea-going vessels, it is the frequent custom to plug the flues and float them ashore, but this should not be done where it can be avoided, for the reason that it gets sea-water in the seams and less accessible parts of the boiler, and this may cause leaks later on.

The erection of milling machinery in the tropics, as elsewhere, must be entrusted only to a good millwright to get good results. He must have the best mechanical



BUILDING, CONCRETING, AND EXCAVATING SIMULTANEOUSLY, COLORADO MILL.

help available, and it is always advisable to have thorough detailed plans prepared before work starts, by some one thoroughly conversant with local conditions as well as the needs of the process and plant being put in. Manufacturers, by realizing the special requirements of shipments to tropical countries, and making an effort to conform to them, can make the lot of the constructor a more happy one. All heavy pieces, and especially pulleys, should be well crated, and all pieces should be well marked with white paint. Tags are no good, as they get wet and fall off. All bearing parts and shafting should be painted, and all threads well oiled. Particular care should be taken that everything is well invoiced and that contents of packages correspond exactly to invoice. As an example of an ideally packed shipment, I recall a consignment received several years since in the Philippines from a well known firm of cyanide supply people of London. Not a single item was missing or a single part broken or injured. The gross weight exceeded the net by over 25%, if I remember correctly, but the satisfaction of getting the machinery in such good shape more than

made up for the additional expense in first cost of packing and freight. While our American machinery exporters are not, as a rule, so painstaking as the English, yet most of them will manage to get shipments off in pretty good shape if they are not too hurried by the purchaser. The trouble is more likely to begin with the arrival in the foreign port, either from over-carriage by steamer, losses in lighterage, in customs, or in trans-shipment to local ports. The people who handle this business are usually unfamiliar with the class of goods and often indifferent to its fate. As an illustration of how a small matter of neglect may affect an enterprise, the 'story of the missing lugs' may be told. A number of years ago a San Francisco firm sent out a small stamp-mill and cyanide plant to an Eastern port and I went out to set it up, arriving on the same boat. After a week consumed in waiting for the parts of the shipment to filter into the customs house it was finally cleared, and I checked it into the train for the provinces and found a shortage of a barrel of patent malleable lugs. I verified this shortage by checking at the railroad terminal, where the shipment was stored until the rains should be over, and reported the shortage to the office of the mining company, received the assurance that it would be looked up, and went out to the mines. Six months later, when the shipment finally arrived at the mines, the lugs were still short, and inquiry only elicited the fact that after sending out a tracer the office had promptly forgotten all about them. After some more delay due to useless correspondence relative to advisability of making the lugs, a cable was sent off, only to arrive in San Francisco during the troublous times of the fire, in which the records of the shippers had been destroyed. When the lugs finally arrived, several months after the rest of the plant was ready for operation, they were of a smaller size than required. They were made to do, however, until another set could be sent for. The last stroke of fate came when, a year later, the original lugs were sold out of the customs house as unclaimed goods.

Prospecting in Nicaragua

By W. A. Connelly

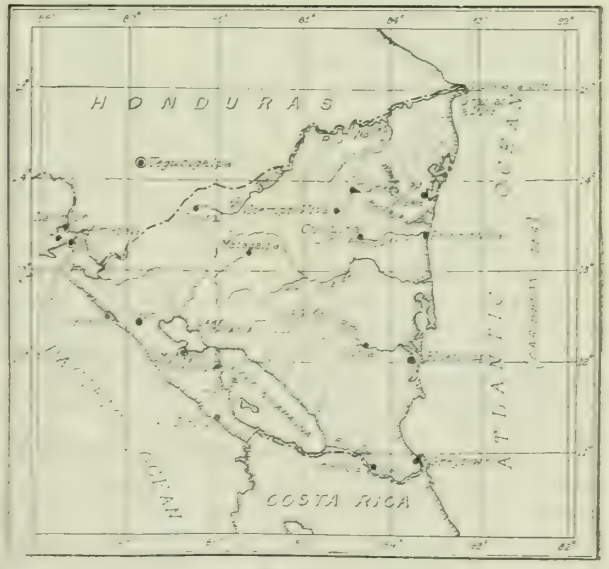
If the two concessions now covering the northern half of Nicaragua be finally cancelled, as the Nicaraguan Government proposes, this will throw open to prospectors one of the most promising gold-bearing areas in the world. Nicaragua can be reached from the United States on the Pacific side from San Francisco and Los Angeles, landing at Amapala or Corinto. On the Atlantic side the route is from New Orleans or New York by fruit boat to Bluefields or Cape Gracias. In going to the northern part of the republic it is more convenient to depart from New Orleans and land at Cape Gracias, at the mouth of the Wanks river. If one is going to the districts on the Banbana, Prinzapulca, Wawa, or Escondido rivers it is better to disembark at Bluefields. Boats leave New Orleans twice each month for Cape Gracias and frequently for Bluefields.

On the Wanks river a large steamer and several gasoline boats ply between Cape Gracias and the mouth of the Waspuc river. To reach the mining districts farther up it is necessary to take *pit-pans* (dug-outs) paddled by Indians. There is always a goodly number of these boats available, as they carry the freight and mail for the Piz-Piz district. There are also steamers on the Escondido river, going as far as Rama, and farther up by *pit-pan*. The first-class passage rate from New Orleans to either Cape Gracias or Bluefields is $50, and an additional $50 will cover the expense to any of the various districts from the port.

The trip across the Gulf and Caribbean sea requires four days to the Cape and five days to Bluefields. From Cape Gracias to the nearest mining district takes four days, and from Bluefields to the various camps is three to ten days. On Wanks river and its tributaries are the following districts: Moribela, Saloon, Umbra or Millers, and the Piz-Piz. On the Banbana and its tributaries are Tunky, Okunwas, and Bana Cruz. On the Prinzapulca is Cuicuina, and on the Escondido is the Rama district.

Before going to Nicaragua on a scouting or prospecting trip the prospector should understand that he must be self-supporting. The operating mines employ only a few white men, and these are usually engaged in the United States and taken to Nicaragua under contract. The labor in the mines is performed by native Spanish, Mosquito Indians, and Grand Cayman Creoles. As this labor can be had at from 50c. to $1 per day, it leaves little chance for a white man. A prospector should therefore take to Nicaragua sufficient money to finance his trip and to return if he so desires.

The outfit needed for one year's stay is about as follows: 2 pairs of 16-in. waterproof boots; 2 pairs of low shoes, heavy weight; 1 pair puttees; 2 dozen pair socks; 4 suits light-weight wool underwear; 4 suits of light-weight cotton underwear; 2 suits khaki; 2 suits of denim; 2 heavy, wide-brim felt hats; 2 pair double blankets; a pillow;



MAP OF NICARAGUA.

one suit of traveling clothes. These can all be carried in mail bags and this will save taking a trunk. An army cot is very handy. A good revolver with 100 rounds of ammunition should be a part of the outfit. As there is plenty of game, a shotgun is useful, as is also a rifle of small calibre. If a rifle is to be taken in, a special permit must be secured. The list of clothing is given with some detail, since so many prospectors and engineers have gone into Nicaragua carrying much useless clothing or not carrying the right kind. Many of the articles can be purchased in the country, but at a greatly advanced price. A prospector should take along a good compass, a pan, and mortar, also it would be economy to buy his tools in the United States.

Mining machinery and tools may be introduced into the republic free of duty, provided the operator first 'matriculates' with the political chief at the port of entry. This matriculation must be renewed every six months. American currency passes readily anywhere in Nicaragua, and in fact is often at a premium; small denominations are the handiest. No passport is needed, nor does the Government require a permit to allow the prospector to work.

The mining law is not complicated, but the prospector should posses himself of a copy of the English translation upon entering the country. As most Americans entering a Spanish-speaking country will need help in making denouncements and in securing titles, it would be well to retain a lawyer at the port of entry and give him power of attorney to transact all mining business.

This will be only a small item of expense and will be found to be a great convenience.

The best time to prospect on the Atlantic coast is from January to July, although after an American becomes acclimated he pays little attention to the seasons. The following is a record of the rainfall for the year 1910:

	Inches.		Inches.
January	8.73	July	20.56
February	8.21	August	14.08
March	3.98	September	14.06
April	5.87	October	12.79
May	8.85	November	9.19
June	17.45	December	10.46

It will be seen that the rainfall is greatest in July. While June of this particular year had 17.45 in. of rain, it is usually dry until late in the month. The greatest rainfall in any one year was in 1908, amounting to 145.61 in. The record from which this was taken had been kept for seven years. The prospector will always have a few months of delightful weather in which to do his scouting and selection of a place where he may do development work during the rainy season. From the record of rainfall it will be seen that a prospector need never worry about a supply of water.

Upon reaching the particular district decided on, the prospector should select a site on sloping ground and prepare a permanent camp. A clearing should be made and a bungalow built. A bungalow is a simple affair and can be built in a few days at a small cost. The only ironwork needed is a few nails and a pair of hinges. The natives will build a fair-sized house on contract for 100 *soles*, which is about $40 gold. From the main camp area enough for a season's work can be reached, and if it is desired to go farther afield in scouting for veins, a shelter for the night can be built in an hour.

The whole country is covered with tropical vegetation, and at first sight it appears to the newcomer to be a hopeless task to find anything in such a jungle, but prospecting is much easier in Nicaragua than in many parts of the Rocky Mountains. The country rock on the Atlantic slope is eruptive and generally supposed to be andesite. This andesite is easily weathered and eroded. The vein filling is quartz and pyrite, and erodes more slowly than the enclosing country rock, consequently the veins outcrop. The veins may be said to always have a *manta* or covering of broken and eroded ore which has been enriched by a process of mechanical concentration. Float is plentiful near all veins, and the prospector need only follow up one of the numerous creeks, watch for the float, and the vein will soon be discovered.

In tramping across country it is always advisable to have a guide. Former cutters of rubber are plentiful and can be had by the day for 2 *soles* and board. These men know the 'bush' well and are absolutely reliable. They will do any kind of work, are intelligent, often have a good knowledge of mining, and will gladly show an employer veins discovered in the course of rubber-cutting trips. In scouting over the country and in going to and from the base of supplies, a mule, saddle, and bridle are necessary. The mule can be purchased in the country for 150 to 200 *soles*, but the saddle and bridle had better be bought in the United States. The McClellan tree saddle is the one most generally used in the tropics.

The freighting is done with oxen, either 'pack' or 'drag.' Because of the high tariff, foreign foodstuff is much more expensive than in the Western United States, although never as high as in Alaska in the early days. The prospector will soon become accustomed to the use of native-grown food. The more common vegetables include plantain, cassava, yams, sweet potatoes, beans, and corn. The fruits are bananas, pineapples, limes, citronella, oranges, and papaya.

Nicaragua has an area of about 48,000 square miles, and I think that at least one-third of this territory will be found to be gold-bearing. There are more than twenty districts now in which there is machinery and which are producing gold. In many others pay-ore has been discovered and more or less developed. These districts are in the mountainous part of the country from the Honduras line to La Libertad, west of Bluefields. Because the country rock is altered from 100 to 200 ft. deep, and the veins outcrop, prospecting is easy and early development is cheap. The *manta* is usually soft and easy to mine and mill. Huntington mills are used in many districts, as their first cost is low, they may be sectionalized and quickly erected, and are not extremely heavy. Waterfalls are plentiful on the Atlantic coast, and hydro-electric power plants have been built in the older districts. Power can be bought at a cheaper rate in these districts than in Nevada.

The ore in the districts of eastern Nicaragua is free milling in the oxidized zone, and can be cyanided. While the ore is not of high grade, ranging from $6 to $20, with an occasional body of richer ore, the cost of operating is low and will be much lower when transportation is bettered. Nicaragua's great gold-bearing area, everlasting summer, plentiful supply of water, timber, fruit, and vegetables, comparatively cheap labor, simple mining laws, and accessibility, should be very attractive to prospectors.

American Smelting & Refining Company

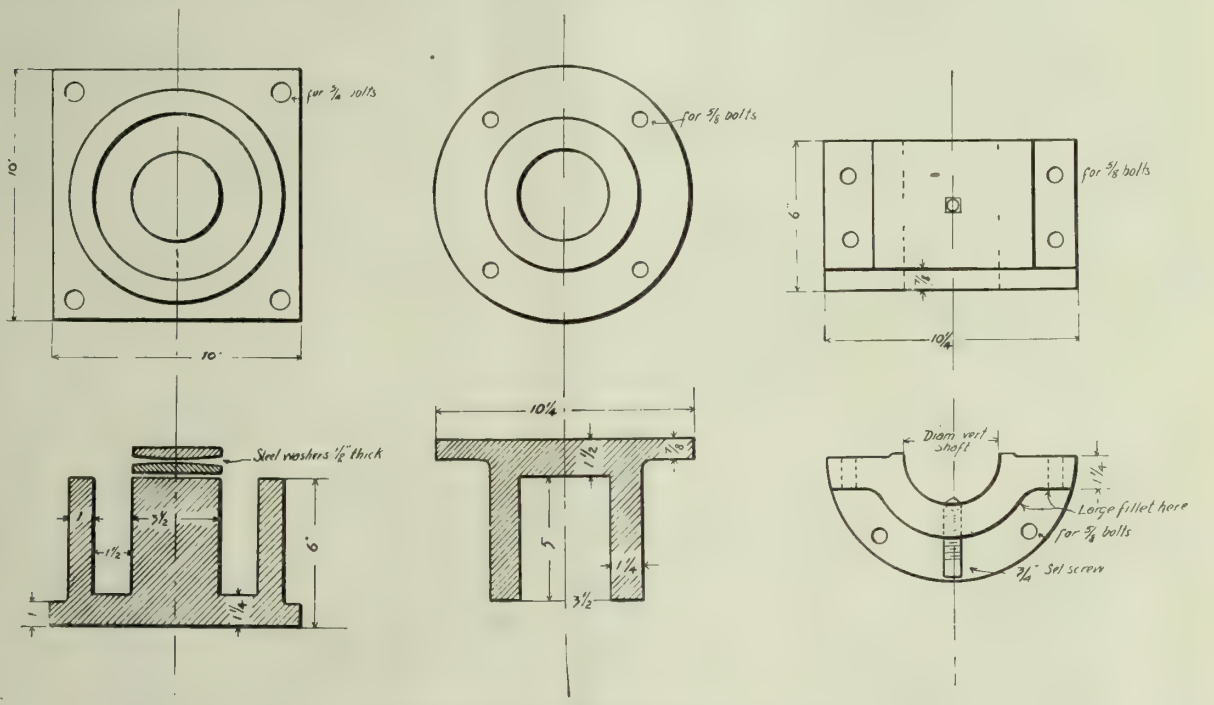
For the half-year ended June 30 the American Smelting & Refining Co. reports that the gross income was $7,587,943, of which $5,759,729 came from smelting and refining plants. The net income, after deducting $1,209,817 for depreciation and amortization of property, and certain other appropriations, amounted to $5,868,958. Interest, and dividends on preferred stock totaled $3,485,000, leaving a net income of $2,383,958. Out of this a dividend of $1,000,000 was paid on the common stock. The surplus for the term was $1,268,301; and total surplus at June 30, $14,968,027. On the new smelting plant at Hayden, in Arizona, there was spent $1,076,649, making the total of $1,622,692. The plant was blown in on May 29, and profits from it should accrue with the last half of the present fiscal year. On the refineries at Perth Amboy and Baltimore, $589,466 was spent; and $106,849 in developing mines owned by the companies. The period covered by the report has been one of great unrest in the labor market, and the Perth Amboy, Baltimore, and Murray plants have suffered therefrom. The strife in Mexico has considerably hampered operations in the Republic; but fortunately the company was not forced to close any of its smelting plants, and but a few mines.

SEIGNIORAGE, or the profit which has accrued to the Government from the coinage of silver, nickel, and bronze pieces during the last 40 years, has amounted to $205,385,272, according to the September circular of the National City Bank of New York. The cost of copper, from which cents are made, is now about 18c. per pound, and from each pound is coined 146 1-cent pieces. The cost of nickel, from which 5-cent pieces are made, is 33.85c. per pound, each pound being equivalent to 90 coined nickels. Thus the Government realizes about $4.50 on an expenditure of less than 34c. Fine silver is now quoted at 60 to 61c. per ounce and yields $1.38 in coin. The coinage of gold has entailed a small loss. A gold dollar contains 25.8 grains of standard gold, of which 10% is copper alloy. To depositors of gold bullion the Government pays $20.67 per ounce of fine gold, but makes a charge against the depositor of 2c. per ounce for the cost of the alloy used. The Treasury Department has now in its vaults gold coin and bullion to a greater value than ever before in its history, and nearly double that of any of the great foreign nations. The total gold in the Treasury on August 23, 1912, was $1,221,169,327, of which $1,008,197,179 was in gold coin and nearly $213,000,000 in bullion. Of the total, $150,000,000 is held for the redemption of United States notes and treasury notes of 1890, and $1,047,568,269 is held for the redemption of gold certificates outstanding.

Step-Bearing for Slime Agitator

By Douglas Waterman

The accompanying drawing shows an excellent form of step-bearing for mechanical slime-agitators in use at the Butters Salvador Mines, Ltd. Air-agitation for the treatment of slime is being widely adopted in the more recently constructed cyanide plants, but it would not always be good policy for an old plant equipped with mechanical agitators to make such a radical change in the treatment as the introduction of air-agitation would require. Moreover, the mechanical agitator still has many advocates among cyanide operators, and it will probably never be entirely supplanted by other methods. There is no doubt that it is an effective form of slime agitator. The chief complaint has been the high power-consumption due to the friction in the submerged step-bearing, and the excessive wear in the bearing itself, necessitating constant repairs and renewals.



AIR-SEALED BEARING FOR MECHANICAL AGITATOR.

These objections have been largely overcome in a step-bearing devised by W. G. Mosher at San Sebastian. I had an opportunity of examining a bearing that had been in constant use for three years without requiring the slightest attention. While the exterior of the revolving parts was worn fully ½ in. smaller than its original diameter by the continued attrition of the pulp, the interior faces were in perfect condition, even the tool-marks being still visible. Only the buttons were worn at the point of contact, but not enough to materially increase the friction. Its form suggests the well known principle of the inverted tumbler in a basin of water, the air entrapped within the cap preventing the rise of the pulp within the annular space around the stem. As an extra precaution against the entrance of the pulp, a sufficient quantity of mercury was introduced to effectually seal the air-space, but it is doubtful whether this is necessary. The two convex faces of the steel buttons form a contact of small area, even after considerable wear, and the power required to overcome the friction is low. It will be noted that the cap is secured to the foot of the shaft by means of the detachable collar. Thus the whole bearing can be removed and replaced without raising the shaft; a distinct advantage. It only remains to add that this device is not patented, and can be turned out by any foundry at small expense.

Mines in Southern Spain

By Edward J. Norton

From the days of the Phenicians, the first to discover its metallic wealth, eastern Andalucia has been a mining district. The remains of many old workings, some of them celebrated in antiquity for their lead and iron deposits, are still traceable in different parts of the three provinces; and one or two of the ancient shafts and adits, reopened after the passing centuries, are producing ore today.

Although many new claims are being filed, few mines are operating now on a large scale. Foreigners—French, Belgians, British, and Germans—control most of the best producing properties of the district, as Andalusian capitalists have always been unwilling to invest money in mining. A great deal of money goes out of Spain on this account, because the greater part of the ores are smelted abroad and the material goes to build up the metal industries of other countries. The total registered ore-bearing acreage, number of working mines, and the producing acreage of the three provinces, according to the latest official reports, is distributed as follows:

Province.	Acreage registered.	Producing Mines.	Producing Acreage.
Almeria	88,753	101	4,222
Malaga	16,706	28	306
Granada	48,854	20	1,368

The value of ore extracted from these mines annually represents approximately 3% of the total of Spain's mineral output. In the province of Almeria claims have been filed on 1533 properties containing iron ore and 808 claims covering properties carrying lead. In this province are also deposits of sulphur, zinc, and quicksilver. Claims filed in Granada cover 50 deposits of quicksilver, 2 of placer gold, 53 of zinc, 514 of iron, and 174 of lead. Coal, cobalt, and quartz-bearing gold have also been found in this province. The mining register of Malaga shows 175 claims filed covering iron mines, 19 of lead, and 23 of copper. Deposits of nickel and coal are known to exist in Malaga, but no effort has been made to bring them into production.—*Daily Consular and Trade Reports.*

The Elmore vacuum plant, at the mines of the Sulitelma company, Norway, produced 787 tons of copper concentrate during August 1912, according to a company report.

Metal Mine Production of California

The mine output of gold, silver, copper, lead, and zinc in California in 1911, according to Charles G. Yale, of the United States Geological Survey, was valued at $25,174,677, a decrease of $1,845,728 from the corresponding value for 1910, although the production for 1910 included no zinc. The total decrease was due mainly to a curtailment in the output of copper because of litigation over smelter fume.

The mine production of gold in 1911 was $19,738,908, an increase of $23,468. The output of silver was 1,270,445 fine ounces, valued at $673,336, a decrease of 569,640 oz. in quantity and of $320,310 in value. The production of copper was 36,316,136 lb., valued at $4,539,517, a decrease of 12,384,620 lb. in quantity and of $1,645,479 in value. The output of lead was 1,398,111 lb., valued at $62,915, a decrease of 1,472,866 lb. and $63,408. The output of zinc, however, none of which was produced in 1910, was 2,807,035 lb., valued at $160,001.

There were 1181 properties reported productive in 1911, of which 596 were deep mines and 585 were placers of various kinds. This shows a total increase of 102 producing mines for 1911. There were 522 gold mines producing, 11 silver mines, 31 silver-lead mines, and 30 copper mines in 1911. Of the placer producers, 169 were hydraulic properties, 65 were dredges, 141 were drift mines in ancient river gravels, and 210 were surface or sluicing mines. The dredges were operated by 34 companies, against 41 in 1910. There were 81 more deep mines and 21 more placers producing in 1911 than in 1910.

The deep mines of California produced 2,944,188 tons of ore in 1911, an increase of 246,303 tons. Of this output 2,443,274 tons was silicious ore (an increase of 479,978 tons), 494,281 tons copper ore (a decrease of 222,404 tons), 2008 tons lead ore, and 4625 tons zinc ore.

The total average value for all ore sold or treated in 1911 was $5.49 per ton, against $6.71 in 1910. At gold and silver mills in Califorinia in 1911 the tonnage milled was 2,156,950 short tons, yielding $9,709,331 in gold and 172,855 oz. of silver, or a total average value of $4.54 per ton, against $5.25 in 1910. Of this average value, $3.59 per ton was recovered as bullion in the mills in 1911. The smelting ores, 538,214 tons, produced all the copper and zinc, practically all the lead, 1,004,472 oz. of silver, and $641,495 in gold. There was also 249,024 tons of old and new tailing treated in California in 1911, yielding $401,555 in gold and 57,577 oz. of silver.

The placers of California yielded $8,986,527 in gold and 39,541 oz. of silver in 1911, an increase of $96,087 in total value over the yield for 1910. The dredges showed an increase in production of $116,207, and the hydraulic mines an increase of $39,988, but the output from drift and sluice mines decreased. The dredges produced 38.84% of the gold output of the state in 1911. The total dredge output of California from 1899, when the production from this source began and was only $206,302, to the end of 1911 has been $47,985,236. The following table shows the mine output of California by counties in 1911.

MINE PRODUCTION OF GOLD, SILVER, COPPER, LEAD, AND ZINC IN CALIFORNIA IN 1911

[By Charles G. Yale, United States Geological Survey.]

County.	Ore treated.	Gold.[a]	Silver.	Copper.	Lead.	Total value.
	Tons.		*Fine ounces.*	*Pounds.*	*Pounds.*	
Amador	692,806	$2,832,395	54,526	227,848		$2,889,775
Butte	2,575	2,323,396	9,627			2,328,498
Calaveras	482,983	1,112,315	126,476	5,681,200		1,889,497
Colusa and Lassen	522	2,837	530			3,118
Del Norte		1,743	13			1,750
Eldorado	11,444	133,967	1,905			134,977
Fresno	1,515	17,441	153			17,522
Humboldt	70	34,966	319			35,135
Imperial and San Diego	23,181	97,855	357			98,044
Inyo	101,662	574,945	86,185	29,504	1,329,756	833,759
Kern	180,687	557,471	11,005	33,224	600	567,484
Madera	310	1,958	145	24,488		5,096
Mariposa	18,196	172,532	2,623	13,528		175,613
Merced, Shasta, Stanislaus, and Trinity[b]		367,538	2,134			308,609
Modoc	1,186	19,875	685			20,238
Mono	33,469	261,232	66,996		44,289	298,733
Nevada	373,989	2,199,147	29,606			2,214,828
Placer	6,181	251,289	4,877			253,883
Plumas	47,470	228,785	2,123	1,328		230,076
Riverside and Los Angeles	4,875	20,623	4,002	7,000		23,619
Sacramento		1,812,826	5,749			1,815,873
San Bernardino	18,190	127,367	67,061	679,984	23,466	259,355
Shasta	520,795	1,059,881	730,171	29,618,032		5,149,126
Sierra	35,360	461,513	10,574			467,117
Siskiyou	9,747	422,297	4,832			424,558
Trinity	67,925	612,149	12,786			618,926
Tuolumne	308,652	1,093,484	24,987			1,106,727
Yuba	398	2,997,072	9,998			3,002,371
	2,944,188	19,738,908	1,270,445	36,316,136	1,398,111	[c]25,174,677

[a] Includes placer production.
[b] Includes only gold recovered by dredging in these counties; other output of Shasta and Trinity Counties given below.
[c] Includes value of 2,807,035 pounds of zinc.

Manganese in the Philippines

Manganese ore has been discovered in the Philippines, according to the Bureau of Science at Manila. But since an export wharfage charge exists on all ore, development is retarded. If the ore were taken in ballast to Japan, this charge would not be serious, but if it were shipped to the west coast of America, the freight rate would reduce profits to the vanishing point. The same is true in regard to iron ore. A geologist from Japan, in the employ of the Mitsui Bussan Kaisha, examined the iron deposits on a small island in Mambulao bay in Ambos Camarines, where iron ore occurs, but the royalty to be paid to the persons owning the land and the export dues would leave little for the expenses of mining and the profit. It is recommended that as soon as possible the law be altered, remitting these export dues.

Mineral Discoveries in Arabia

An Indian business man recently completed an extended prospecting tour of Oman at the instance of the Sultan. Only surface work was attempted, and it was found impracticable to visit the coal beds which are said to exist in the Sharkeyah district, but it is reported that a valuable chromium deposit, containing small percentages of lead and silver, was found about four miles from Sib, and that development will soon be undertaken. Tentative plans involve building a 30-mile tramway from Matrah to Sib.—Consular report by Homer Brett, Maskat.

NITRATE production in Chile for the year ended June 30, 1912, exceeded the consumption by 1,227,947 Spanish quintals, of 101.4 lb. each. The farmers of Chile used five times as much nitrate for fertilizer in 1911 as in 1908.

Discussion

Readers of the MINING AND SCIENTIFIC PRESS are invited to use this department for the discussion of technical and other matters pertaining to mining and metallurgy. The Editor welcomes the expression of views contrary to his own, believing that careful criticism is more valuable than casual compliment. Insertion of any contribution is determined by its probable interest to the readers of this journal.

Persistence of Ore in Depth

The Editor:

Sir—In T. A. Rickard's interesting article, under the above heading, in the *Mining and Scientific Press* of August 31, he says, "the miner has experience to justify him in his fancy that water is a favorable indication of ore." This reminds me of one little point noted at Kalgoorlie. The majority of the mines on the 'Golden Mile' are comparatively dry, those on the eastern side being the wettest; not many have to pump or hoist over a few thousand gallons daily. Just out of this area, and all around it, are mines which produce a great deal of water, having in the past supplied many mills. These outside mines have produced little ore, and have been opened fairly well. All water in this district is very salty. At the 1909 meeting of the Australian I. M. E. at Kalgoorlie, A. Montgomery said that the salt water was caused by the country being under the sea at one time; while J. M. Maclaren argued that the arid nature of the country would easily account for it.

M. W. VON BERNEWITZ.

San Francisco, September 4.

The Editor:

Sir—It affords me no little pleasure to read my friend T. A. Rickard's views on 'Persistence of Ore in Depth,' published in your issues of August 24 and 31, and to find his ideas upon this interesting and important subject in close accord with my own. My paper upon the subject, read at the recent Toronto meeting of the Canadian Mining Institute, was designed for the purpose of eliciting opinions and provoking a discussion that would be of practical value to the mining industry. I realized then, as I do now, I have little that is original and which throws light upon the subject, but it is worth an effort and may serve a useful purpose to collate whatever data can be found relating to the subject.

In the United States at least, we are rapidly approaching a period when we will have to seriously consider the exhaustion of our metalliferous deposits; it has been evident for some time that new discoveries are not equaling the depletion of those already developed, and the question arises, is it not likely that districts supposedly exhausted are in fact often not so, but might readily yield new sources of mineral wealth as the result of scientific prospecting? We all know that to a limited extent this general principle has been demonstrated in some instances, but often the exploratory work does not go far enough, being apt to be limited by preconceived notions and theories, lack of funds, and the admitted tendency of orebodies to become leaner with depth. I refer, of course, to quite modern conditions. Years ago water was a great deterrent in deep workings, now it is an obstacle readily overcome; in fact, as will be later explained, it may be regarded as a welcome guest.

A few old districts have a way of pegging along with a small annual production squeezed from dumps and abandoned stopes; others are completely abandoned, to be reopened at a later period or not at all. Now that development and underground prospecting are more systematically pursued, the total abandonment of a lode or even a district before exhaustion would seem to be less likely. The difficulty is to determine for certain when a deposit or lode has been finally bottomed and further prospecting hopeless.

It may be accepted as a broad and general principle that all mineral deposits or lodes of whatever character *decrease* in richness with depth. I do not believe this dictum can be successfully controverted, although there may be some temporary and apparent exceptions; but even these in the end will doubtless be found to conform to the general rule. Conceding this, or in other words that mineralized fissures cannot extend indefinitely toward the interior of the earth, the point is to determine approximately where the limit of profitable ore may be expected. For the sake of illustration, let us suppose two lodes to have originally contained ore to a vertical depth of 5000 ft. and of practically the same value in each instance. During the geologic period subsequent to their deposition one has had 4000 ft. eroded off and the other say 500 ft.; now when they have been both worked out or bottomed, it may be said one 'petered out' at 1000 ft., while the other persisted to 4500 ft. before exhaustion. In drawing such a conclusion we would thus fail to recognize that there remained, at the time the lodes were developed, in one case but a stump and in the other pretty much the whole vein. As a matter of fact, we cannot ever hope to know exactly how much has been lost by erosion, but we can arrive at some approximation of it by a thorough study of the local geology. I have in mind two famous mining districts about 150 miles apart, one of which has had from 2500 to 3000 ft. removed by erosion, whereas the other has lost in that manner comparatively nothing; if, on the contrary, the latter had suffered an equal amount of erosion, its 2500-ft. level would be about at the outcrop of the lodes in the eroded district and its greatest riches would have been lost because they occurred above the 2000-ft. level. While it is idle to discuss what a lode might have been had it not been subjected to erosion, it is important to determine the extent and depth of this degradation because, assuming that mineral fissures were not likely to have originally extended deeper than 6000 to 7000 ft., we would know that if 3000 to 4000 ft. had been lost by erosion our probable existing ore limits would be at depths not exceeding 3000 ft. I suppose in the majority of cases original lodes or veins ended at depths much less than 6000 or 7000 ft., and that is the reason why in areas which have suffered tremendous erosion, like the gold district of Nova Scotia, the Cobalt region in Ontario, and our Southern Appalachians, the deposits as we now find them are shallow and often too lean to be profitable except in a comparatively few instances where modified by secondary enrichment.

It is well known that deep mines tend to become progressively dry with depth, this fact cannot be successfully disputed, and it may be assumed as a general rule that the amount of deep aqueous flow is directly proportional to the extent of fissuring, in other words, fissures are a prerequisite to water circulation. But it will be said there are some deep mines in which the inflow of water has not naturally decreased, but rather increased. Such cases are, doubtless, exceptional, and probably if the workings be carried deep enough the rule will be found to hold.

It is reasonable to assume that wherever there is deep fissuring through and by which at one time there had been active aqueous or vaporous circulation, some of the fissures have become more or less filled with mineral depositions. Hence, if we assume that a strong flow of water at deep levels is an evidence of fissuring, we are justified in concluding some of these fissures may contain ore, and that deeper exploration under such circumstances is warranted. Of course in applying this reasoning to any particular case the mining engineer must be guided by his experience and sound knowledge of the principles of ore deposition, since it cannot be assumed that simply because there is a copious flow in the deep levels, one is certain or even likely to find ore. It is, however, to my notion, a good sign in cases where rich ore has been found on higher levels. We know from experience in tunneling and shaft-sinking for other than mining purposes that mineralization does not accompany fissuring in a country not affording the necessary conditions for ore accumulation and deposition. Again, fissuring and mineralization may be found unaccompanied by any aqueous flow, as in desert regions, but they are undoubtedly indicative of conditions which once existed; if

we are to accept the hypothesis that primary ore deposition, with the exception of magnetic segregation, must be the result of aqueous and vaporous circulation.

In conclusion, I would again emphasize the desirability of ascertaining in all cases where deep exploration is contemplated, the amount of erosion the district has suffered. As we are not likely to have to decide such questions except in regions which have been studied and geologically mapped, there need be no great difficulty in determining the extent of such erosion within approximate limits. Obviously, no exactitude can be expected in such instances, for mathematical deductions as applied to geology must of necessity be of a most general character.

F. Lynwood Garrison.

Andover, Massachusetts, September 6.

Foreign Trade and Panama Canal Tolls

The Editor:

Sir—Having learned during the days of T. A. Rickard to look to the *Mining and Scientific Press* for editorial comments untainted by special interest, I should very much regret to think that Mr. Ross had frightened you by his protest from your disposition to refer to vital matters not obviously connected with mining. In San Francisco there are few disinterested publications which are able, owing to their affiliations, to take an intermediate position between the defense of privilege and the defense of criminals. A point of view that coincides with that of a trained political economist, as Mr. Ross points out, is very welcome to such of us as have to depend for our colored political views, and our no less colored news of California mining operations, upon one of the San Francisco morning papers; and at evening time, have to imbibe the half-warm mixture of morality and tears, served up by one of the evening papers, if we cannot stomach the portion offered by the other.

The point at issue between yourself and Mr. De Kalb appears to me to be the fundamental difference between the advocates of democracy and the advocates of autocracy; between equity and strength; between privilege and equal opportunity; between the free trader and the protectionist; between radical and conservative; and between the motive force and the brake. The difference is almost as fundamental as the difference in sex. As a contribution to the discussion, I would suggest that the commercial neutralization of the canal is imposed upon the United States, quite apart from the treaty, by the Monroe doctrine, under cover of which we took from Colombia what we would not suffer anyone else to take. In addition to this, it would be well to realize the underlying motive of the Canal bill. The admission of foreign-built vessels to American registry; and the remission of tolls to vessels engaged in the coastwise trade are both only disguised forms of ship subsidy; and ship subsidies are desired by certain interests to offset the logical consequences of protection. This attempt 'to get the consumer both coming and going' has been a failure up to the signing of the Canal bill; but it seems to have been quietly accomplished at last. The unnatural exhaustion of natural resources, the passing of the merchant marine, the tendency toward merciless monopoly, and the alleged lack of interest in efficiency; these are all the degenerate children of protection, and nurse them as we may with conservation, ship subsidy, Sherman anti-trust laws, and the new efficiency, they will remain to cause us trouble until we get rid of the author of their being. The whole underlying motive of the Canal bill is ship subsidy; but the consumer who pays the bill has not yet been definitely informed.

In Downieville, to return to mining matters (as a concession to Mr. Ross), there lives a ne'er-do-well, a hard-drinking brother of a San Francisco merchant, who was sent up to be as far from his family as possible. He was subsidized for the sake of peace, but was not allowed any cash. Food, tools, and clothes were provided by the storekeeper, and the bills were duly honored in San Francisco. The old craving eventually overcame the outcast, and he repaired to the store, after studying the limitations of his treaty. To the storekeeper, he said briefly, "A quart of Scotch, please, and charge it to picks."

David Amins.

San Francisco, September 5.

The Editor:

Sir—One object in sending you the editorial from *The Public* was to show you how a 'trained political economist' could carry out the engineering maxim of getting the 'maximum results in the minimum space.' As the trained economist and yourself agreed, there was a chance to determine the question of 'saved space.'

Your statement of the Mother Lode is perfectly true: "In our judgment, fortified by that of several of the best experts who have studied the Lode in the past two years, *the Mother Lode district today affords one of the best opportunities in the world for the development of profitable deep gold mining.*" As a trained mining engineer and economic geologist who has the respect and confidence of his professional brethren and of the general public who are interested in mining, can you, Mr. Editor, think of a better or more worthy task than to help reduce the development of the Mother Lode mines to a sane business system? Get the mines and owners together. Show them the follies of the petty jealousies; the good that can result from the exchange of experience; the value of correct surveys; the full meaning of economic geology; tell them how easily they could combine in each district and secure the services of such a geologist, and show them from any of a dozen instances that are well known, what the particular instance could easily have been made had such advice been secured and acted upon. Show them the folly of a continued belief in their so-called secrets—business and professional—if they would but take time to look above the edges of the grooves they have dug for themselves they could hear the little children of their district using the terms of their deepest secrets in their play. Our good friends along the Mother Lode have so profound a belief in their secrets that the wayfarer is assured that if he has not heard one of the richest and best known Mother Lode operators tell the story of how completely he has exhausted his ore reserves and how utterly worthless the lower levels of his mines are, and how the fear of approaching poverty destroys the pleasure that he might otherwise get of a view of the happy and beautiful homes that surround him—if he has not heard all or part of this story, he has missed a rare treat. Show them how to keep correct mining and milling accounts and how they deceive themselves in their cost sheets. Many of these mines are owned largely by the public, and there is no excuse for any sort of secrecy in their accounts, and my dear Mr. Editor, if you do all or part of this for California and have then time and space for general economics, we will club together in some way and help you secure the services of a 'trained political economist,' who will give us, while treating such subjects, 'the maximum results with the minimum of effort.'

G. McM. Ross.

Stockton, California, September 1.

[It must have been a 'trained political economist' who condensed into one aphorism the much that might be said as to the excellent plan proposed by our correspondent for publicity along the Mother Lode—"You can lead a horse to water, but you can't make him drink."—Editor.]

Gold yield of Victoria, Australia, for July 1912 amounted to 36,733 oz. gross, or 33,880 oz. fine, valued at £143,914. Compared with the yield for July of last year a decrease of 11,060 oz. fine has occurred. The yield for the last seven months was 282,688 oz. gross, or 262,015 oz. fine, valued at £1,112,322. This shows a decrease of 26,280 oz. fine compared with the quantity produced during the corresponding period of last year.

Special Correspondence

NEW YORK

ALASKA GOLD MINES.—THE SHARE MARKET.—COPPER SURPLUS A MINIMUM.—A NEW CANADIAN BOOM.

The properties on Douglas island and the neighboring mainland are receiving an added share of attention, owing to the recent promotion of the Alaska Gold Mines Co. by the Guggenheim interests, and what is being accomplished by other neighboring properties is of especial interest to the public at the moment. The most important neighbor of the new company is Alaska Treadwell, whose report for July, together with that of the Alaska United and the Alaska Mexican was given in the August 3 and 10 issues of the *Mining and Scientific Press*.

The spectacular feature of the week's news in a market way was the apparently final collapse of the market in the shares of the U. S. Motors Co. This corporation has long been counted as one of the leading automobile concerns in the United States, and has always been looked upon as having been fathered, at least indirectly, by J. P. Morgan & Co. On the announcement that the company would be thrown into bankruptcy, the shares declined to nominal prices, and apparently another industrial has 'blown up.' Industrial issues have been in great favor marketwise recently, and the public is about to learn that such securities must be analyzed just as closely as mining issues. In mining circles the most important incident was the publication of the report of the Copper Producers Association covering the month of August. The huge production of the refineries might be considered a good argument for those who have been bearish on the copper situation, as justifying the predictions of a tremendously increased output. The output of 145,628,521 lb. breaks all records for any single month in the history of copper mining in the United States. The July output was a record breaker, but August bettered July figures by nearly 8,500,000 lb., and of even more significance was the record-breaking take-up of copper metal, domestic deliveries amounting to 78,722,418 lb.—more copper than was ever taken in any one month by domestic consumers, and nearly 600,000 lb. greater than the previous past record made in January 1910. Exports were 70,485,150 lb., which is not a record breaker. Another broken record is the figure for the surplus stocks on hand September 1, the surplus being 46,710,374 lb., an amount of copper on hand that will justify further efforts to increase production. The entire copper situation becomes very interesting. The natural question arises, is the present production the maximum for the new copper which has been talked about for so many months, or will it continue to increase, and in either event will deliveries continue to take care of the present or even a greater output? The present surplus is not even as large as the nominal trade conditions demand in the way of a balance; but it is undoubtedly true that consumers, if they could see production creeping up month by month, would immediately begin to refuse to carry copper stocks, especially at present prices, and this is true even though the present low surplus is far from any figure where it threatens to be a serious factor in the metal market. The most perverse factor in the situation is the fact that leading copper shares have diminished in price, in the face of greatly increased production at much higher prices. It is quite evident that traders in copper shares are inclined to discount the future a long way ahead.

The Kornkob Mining Co. has made its appearance in New York markets; the property is near Tucson, Arizona. Recent despatches state that good copper ore has been found at a depth of 350 feet.

W. C. Brown, president of the New York Central railway, has returned to New York after a protracted vacation, during which he traveled some 10,000 miles, spending eleven days in Alaska in the vicinity of Ketchikan, Wrangell, Juneau, Douglas, Skagway, and Sitka. Mr. Brown says: "The mining interests everywhere, representing copper, gold, and silver, are prosperous and there is great activity in the way of prospecting and new development. This is especially true in the neighborhood of Juneau and in the valleys southeast of Skagway."

The Hollinger mine at Porcupine is reported to have produced $200,000 in gold during the month of August, and is said to have enough ore developed to maintain this rate of production for the rest of this year, when further mill capacity will be provided and production increased.

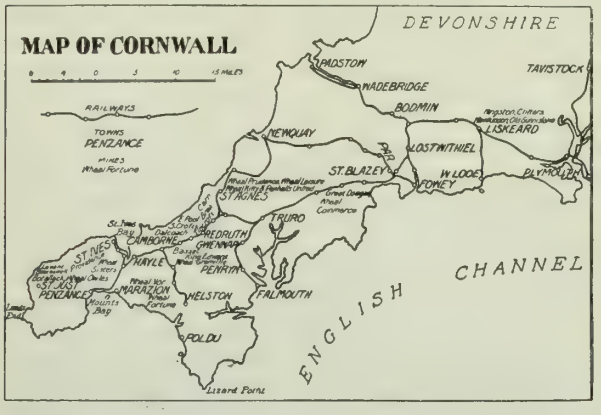
Some of the Eastern newspapers are predicting a revival in Cobalt, showing that a great boom, founded on real mining results, is about to be sprung upon the public. Telegraphic despatches state that within the past few days some silver-bearing ground, similar to that which has yielded so much in Cobalt, has been found in the township of Auld, some twelve miles from Cobalt.

The discontented minority in the Stewart Mining Co. were unable to make any headway against the Heinze forces, and an entirely new board of directors was named by the majority, consisting of Edward Hickey of Butte, who is president of the Tuolumne Copper Co., W. E. Cullen of Spokane, A. X. Bowie of Butte, and W. O. Allison of New York. W. A. Beaudry is resident director and mine manager. Mr. Allison is president of the National Reserve bank.

LONDON

NEWS FROM CORNWALL.—IMPROVED RESULTS AT DOLCOATH, CARN BREA & TINCROFT, AND GRENVILLE.—HOLMAN STAMPS.

The half-yearly statements issued by the leading Cornish tin mines are of unusual interest, for three of them, Dolcoath, Carn Brea & Tincroft, and Grenville, show improved results due both to the high price of tin and to more



energetic development. The report of Dolcoath for the first six months of 1912 shows that, as compared with the second half of 1911, the amount of ore raised was 2223 tons greater, the yield of black tin per ton 4½ lb. less, and the average price received £7 2s. 1d. per ton more. The sales of tin concentrate realized £97,730 as compared with £98,647, and the profit was £32,538 as compared with £35,581, so that the varying factors were fairly well equalized in the results. The tonnage crushed was 48,566, the black tin sold 796 tons, the yield per ton 36.73 lb., worth 40s. 2d., and the average price per ton £122 14s. 7d. Other items of revenue brought the total income to £100,428 or 41s. 4d. per ton. The working cost was £61,375 or 25s. 3d. per ton, and the lord's royalties £6515 or 2s. 8d. per ton, making a total cost per ton of 27s. 11d. The profit, as already recorded, was £32,538 or 13s. 5d. per ton. Out of the profit £4594 has been written off on plant, and £17,225 was paid as dividend, being at the rate of 15% per year. During the half-year, four more 'air-cushion' stamps have been erected, thus completing the new installation of 12 stamps; during the current half-year the output of the mill will be thereby increased.

In the early part of 1912 the floods interfered with the working of the lower levels, and made it impossible to increase the output to the capacity of the enlarged mill. For several months the old Cornish pumping-plant was used in conjunction with the new electric plant. Since the beginning of June the latter has handled all the water by itself and has given every satisfaction. The coal strike was responsible for a curtailment of development work, 1881 ft. being done, as compared with 2076 ft. during the previous half-year. A new compressor for 20 drills is being erected at the Williams shaft, and when it is completed it will be possible to increase the amount of development done. The ore disclosed during the last year or so has not been up to the average of recent years, so it is gratifying to find from R. Arthur Thomas' report that richer ground, averaging 56 lb. black tin per ton, has been found on the 490-fm. level. At the meeting of shareholders held September 3, Mr. Thomas had the pleasing duty to announce that on this level the last 72 ft. driven had been in ore overaging 100 lb. of black tin per ton. He also announced that a further four heads of air-cushion stamps were to be erected.

The report of the Carn Brea & Tincroft for the same period shows that 45,444 tons of ore was raised, and that 482 tons of tin concentrate was recovered. The tonnage of ore was the largest on record, comparing with the previous highest, 41,674 tons, during the latter half of 1911. The output of concentrate is not so high as during the half-year January to June 1909, when 568 tons was obtained from 36,825 tons of ore. The yield per ton was 23.79 lb. black tin during the last half-year, figures not much different from those of the previous two half-years. On the other hand, the income from the sale of concentrate was easily a record at £56,096, owing to the present high price of the metal. The average price received per ton of concentrate was £116, as compared with £69 for January to June 1909, when the record output of concentrate was made. The sale of tungsten and arsenic, together with other small items of revenue, brought the total income to £58,725. The working cost was £53,434, again a record figure, comparing with the previous highest, £47,504, during the preceding half-year, the rise being chiefly due to the greater amount of ore treated, but partly also to the greater cost of pumping and of new plant. The above figures include lord's royalties of £2129. The total cost per ton was 23s. 6d. as compared with 22s. 9½d. during the previous half-year. The net profit was £7321, and, deducting the adverse balance, £6017, brought forward from the previous half-year, the credit balance on June 30 was £1102. E. S. King, the manager, gives an outline of the developments during the period under review. Of these, the most important is the cutting of Dunkin's lode on the 335-fm. level, as it promises to provide a large amount of good-quality ore. Also a new lode containing ore of more than average grade has been found in a cross-cut on the 160-fm. level in the Highburrow East section.

It will be remembered that the Grenville United company was formed in the summer of 1906 under the limited liability laws, to acquire the Grenville tin mine, situated to the south of Camborne, that had previously been worked for many years on the cost-book system. A year ago I mentioned that the new manager, Henry Battens, had introduced many reforms and improvements, both in the method of buying supplies and in the development and treatment of the ore. The report for the half-year January to June shows that 20,166 tons of ore was hoisted, and 369 tons of tin concentrate recovered, being a yield of 41 lb. black tin per ton. The figures for the previous half-year were 19,306 tons of ore, 331 tons of concentrate, and 38 lb. per ton. The concentrate was sold for £47,012, being at the average rate of £127; this high price is obtained on account of the exceptional purity of the product. The profit was £17,295, out of which £3501 was paid as lord's royalty, and £13,912 as dividend, being at the rate of 40% per year. In May last a call was made of 2s. 6d. on the 49,730 shares of 10s. each, on which only 2s. 6d. had hitherto been paid. The capital now consists of 130,270 shares of 10s. fully paid, and 49,730 shares 5s. paid. During the half-year, development was retarded by the coal strike, but such work as was done gave gratifying results at many points, especially in the 355-fm. level east of Fortescue's shaft. Mr. Battens is pursuing a decidedly vigorous policy of development and is erecting additional re-grinding and dressing plant.

TORONTO, CANADA

Hollinger and Dome Returns.—La Rose Affairs.—Nipissing Production.

The output of the Hollinger mine, Porcupine, for August is given as approximately $200,000, of which $110,000 was recovered in the last 13 days of the month. The production of the Dome for the first week of September is reported at $43,000. The Vipond is still struggling against difficulties, due to a shortage of the water supply and the plate area being too small. The latter trouble is being remedied by addition of three additional plates, which will make eleven in all. Meanwhile, only low-grade ore is being treated. Development at depth, at the McIntyre, has revealed a considerable change in the character of the ore, which at the 300-ft. level has become rich in sulphides carrying very fine gold. This has rendered necessary a change in treatment. The plans now being prepared for the extensions of the mill, provide for a cyanide plant, and will probably include abandoning the amalgamating process used for the free-milling ore, extracted from the upper levels. Owing to the discoveries at the McIntyre, the character of the milling plant to be put in at the McEneany will not be definitely settled until the 400-ft. level is reached, and the vein opened at that depth. The shaft is now down 370 ft. Foundations will be built for a 10-stamp mill, but only 5 stamps will be erected at present. The dump contains 3000 tons of ore worth $20 per ton. The ore-shoot on the 200-ft. level has been opened, and proved to have a good gold content for over 400 ft. The Hughes has picked up its vein at the 150-ft. level, about 50 ft. from the shaft, where it is 8 ft. wide, and richer than on the upper levels. The shaft will be put down to 200 ft. before developing the vein. Plans are being made for a 10-stamp mill, to be erected this fall. The Jupiter has cut a new vein, carrying native gold in cross-cutting at the 300-ft. level. The shaft on the Krist property, adjoining the McEneany, has been put down 50 ft., and a contract for sinking it another 50 ft. has been let. A promising vein found on the surface has been uncovered for some distance, and a plant has been ordered.

The principal feature of Cobalt mining matters lately has been the continued slump in La Rose, which is now selling around $2.75. All sorts of rumors as to the cause of this decline are afloat. It is alleged that the mine has been bottomed, one fact giving color to this supposition being that an open-cut is being made, and the famous 'silver sidewalk' of the Lawson property removed. This vein, showing about 2 ft. of very rich ore, has been well stoped out underground. The Nipissing is making heavy shipments of bullion. The output of bullion from the Cobalt district for the year up to September 7 was in all $1,970,651, of which $1,499,799 came from the Nipissing. The Beaver, which recently took over the Donaldson property in the Elk Lake district, is planning for development operations on an extensive scale, and has ordered a large plant. The Waldman is being unwatered for an examination by W. L. Malcolmson of London on behalf of prospective British purchasers. At the Peoples mine, formerly the Black Consolidated, good indications have been found on the 200-ft. level, where one vein runs over 18 inches in width and carries good milling ore. The King Edward mill is being used by the City of Cobalt mine. The reopening of the former mine is being arranged. Development is being actively carried on at the Jajola property in northern Cobalt, where the shaft is 200 ft. deep. The royalities payable by the Cobalt townsite have been reduced from 25% of the gross earnings to 15%

of the net earnings. Good discoveries have been made at the Miller Lake-O'Brien in the Montreal river district, where a winze sunk 45 ft. below the 250-ft. level shows good ore all the way. This year the mine has shipped two carloads of ore, no grade lower than 4000-oz. ore being sent out, owing to the cost of transportation. A Toronto syndicate, represented by A. P. Seymour, former manager of the Cobalt Lake, has bought claims at Hubert lake in the Elk Lake district from C. W. Haentschel of Haileybury and Samuel Tongue of Mattawa, for $1,000,000.

It is denied that the Bewick-Moreing syndicate has withdrawn from Canada. They have abandoned Porcupine, but are stated to be organizing a system of investigation for new Canadian mining districts. The offices are to be removed from Montreal to Toronto, the latter being nearer to the mining districts in which they are likely to operate.

JOPLIN, MISSOURI

RECORD SHIPMENT OF ZINC AND LEAD ORES.—METAL MARKETS AGAIN AT HIGH FIGURE.—EXTENSIVE PROSPECTING WITH CHURN-DRILLS.—NOTES OF THE MINES.

The month of September is featured by unusually heavy shipments of zinc and lead ores, the record for the week ended Saturday, September 7, having been the greatest in the history of the Missouri-Kansas-Oklahoma district. For the week in question, the aggregate valuation of ores was $469,972. The nearest weekly valuation was reported two years ago, when the aggregate reached $440,000. The average weekly valuation is about $300,000 in years of exceptional prosperity, and considerably below this figure at other times. High prices have so stimulated production that weekly shipments of zinc ore are now running close to 6000 tons, including calamine. The record week mentioned saw a shipment of 7650 tons, the accumulation from the previous week having been almost completely absorbed in the big shipment. Producers have been troubled to some extent by a shortage of cars, but this condition is being remedied to some extent. Prices for zincblende are now ranging from $55 to $60 per ton, basis of 60% metallic zinc, while choice lots bring $63. Spelter at East St. Louis is at its highest point in a quarter of a century, being quoted at $7.30, while New York metal is quoted at $7.50. Pig lead, likewise, is strong, St. Louis quotations having risen to $5.025, an increase of more than 60 points in the past few weeks, while New York pig lead is quoted at $5.15. The system of buying lead ore in this district has undergone a decided change, the ore now being purchased on an assay basis instead of on flat bids as heretofore. An 80% metallic content is fixed as a basis. The price of this ranges from $60 to $62. For ores carrying higher than this, $1 premium for each unit of lead is added. A like deduction is made from low-grade ore.

Prospecting with churn-drills is being carried on everywhere in the district, and in many places where no mining has heretofore been done. In the latter class are the operations of the Granby Mining & Smelting Co., on a large tract between the towns of Duenweg and Granby, Missouri. Lead ore is indicated in the 'clippings.' Old ground that has been reopened includes the once famous Bankers tract in the southeast part of Joplin. Leases long idle have again been prospected, and operations are being carried on beneath the old workings. A deep run of blende has been found by A. McDonald and J. White in drilling a hole on the Big Six lease at Duenweg. The ore began at 205 ft. and continued to 214 ft. On the Glenn land, in the southern part of Carthage, W. B. Shackleford, manager for the S. Y. Ramage interests, has sunk several holes into thin sheet-ore. In the Neck City field, Hill, Jones, and Van Hoose have found shallow pockety bodies of ore at 87 to 122 ft. in one hole, and at 112 to 200 ft. in a deeper hole.

Boston people have purchased for $10,000 the old Hoo Hoo mine, west of Joplin, operated by Pearl brothers. Two ore-levels are found, one at 80 to 130 ft., and another, sheet ore, at 180 ft. The upper ground only is to be worked at this time. A new concentrating plant is to be constructed soon.

One of the most complete mills in the West Joplin district, a plant run by electricity and equipped with sand-jigs, tables, and settling-tanks, is that built by the Underwriters Land Co., operators of the Yellow Dog properties north of Webb City. West of this mine the W. O. Cragg Mining Co., already operating a 150-ton concentrating plant, will begin the erection of a second plant of 250 tons capacity. At a depth of 200 ft. ore has been blocked out in drill-holes and prospect drifts. Individual motor drives for all parts of the machinery are employed at the new plant of the What Cheer Mining Co. No line shafts are in evidence in this plant, and in this respect the mill is decidedly different from any other of the Joplin district. Each set of jigs, pump, hoist, and other pieces of machinery is operated by a separate motor. The experiment is being watched with interest.

The Pratt-Durkee Coal Co., of Skidmore, Kansas, has purchased for $15,000 the Glendenning mine, west of Joplin. The lease is well opened, disseminated orebodies having been blocked out, and a small concentrating plant is on the property. The new operators have re-named the mine the Jediah.

RHODESIA

OUTPUT FOR JUNE.—ENCOURAGING DEVELOPMENTS AT SHAMVA.—THE TANGANYIKA TANGLE.

The mineral output of Southern Rhodesia for the month of June was of a value of £248,909, as compared with £246,543 in May. The different items of production were as follows:

	May.	June.
Gold	£234,407	£226,867
Silver	1,696	1,826
Lead	729	5,928
Chrome iron	4,375	13,750
Coal	5,336	5,538
Totals	£246,543	£248,909

While the gold yield was low for the month, the increased output of lead and chrome iron were compensated

MILL AT GIANT MINE, RHODESIA.

for it and the total output of minerals for June was higher by £2366 than that for the preceding month. The gold industry has been much troubled by the prevailing drought, and it was anticipated that the output would show an even larger decline. The general outlook is hopeful and the prospects of an increased gold output are good. The Shamva should be crushing within a year, and before then the Cam & Motor mines should be producing. These are two of the most important properties in Southern Rhodesia, and their advent as producers should substantially augment returns. The Hartley and Bulawayo districts continue to do well as a whole, but it is disappointing to hear unsatisfactory news from the Giant Mines at Gadzema and the Eldorado in the Loma-

gundi district, two mines which long have been the mainstays of the Rhodesian gold industry. At the former property the vein has been 'lost', and although the prospect of its rediscovery by boring is stated to be good, the position is not nearly so satisfactory today as it was a little while ago. At the Eldorado the ore-shoot has greatly decreased in size, and despite reassuring reports from the consulting engineers, it is patent that the mine is in a none too encouraging position.

The Shamva appears to be developing in a manner which must be satisfactory to shareholders. There are now about 2,200,000 tons of 5 dwt. ore blocked out. The new Nissen stamp crushing equipment, which is due to start in about a year, will have a capacity of 40,000 to 50,000 tons per month, the largest reduction plant in Rhodesia. Even at the maximum tonnage, the ore reserve in the Shamva at the present time is nearly four years ahead of the mill, and since development is to be pushed during the construction period, it is probable that the Shamva will commence milling with a five-years supply or more. This state of affairs is quite exceptional in Southern Rhodesia. The speed with which the equipment is erected will, very naturally, be dependent in no small degree on the progress of construction work on the Salisbury-Abercorn railway and the facilities presented for transporting material. It looks, however, as if the Shamva company will, without much difficulty, have everything ready for milling about the middle of next year. Whether a sufficient supply of unskilled laborers will be forthcoming by that time to operate this large equipment remains to be seen.

It is understood that Alan Gibb, chief resident engineer in the Katanga to the Tanganyika Concessions, is not returning to Africa, nor, so it is reported, is the chief metallurgist. It is an open secret that smelting operations at Lubumbashi, near the Star of the Congo mine, have been unsatisfactory, and it is generally known that there has been a great deal of ill feeling, argument, and controversy between directors and high officials of the copper company. What the upshot of it all will be is difficult to say, but it is understood that fresh technical blood is to be imported and the scheme of treatment will be materially altered.

Meanwhile the Wankie Colliery Co., in northern Matabeleland, is making great preparations for supplying these remote copper mines with large quantities of coke. The operating cost at Katanga when European coke was employed was well-nigh ruinous. Accordingly, some agreement has been made between the copper company and the colliery, and the Wankie people are erecting a large coke-plant. What system of treatment is to be adopted in the future is not disclosed. Perhaps this is because no one knows how the Tanganyika tangle is going to be straightened out.

JOHANNESBURG, TRANSVAAL

Good Ore in Modderfontein Deep.—Reef Characteristics.—Good Luck for the Goerz Group.

The principal mining topic during the past week has been the discovery of unusually rich ore in the Main Reef in the No. 1 shaft of the Modderfontein Deep at a depth of 2990 ft. from the surface and dipping 11° south. This vicinity is regarded as the most interesting area in the Far East Rand, because it is the only portion of the Rand where shaft-sinking and development operations are being extensively carried on, and above all, because it is an area where there have occurred almost as many striking failures as successes. Above the Modderfontein Deep (the scene of the recent discovery) occurs the extensive New Modderfontein mine, a fairly successful undertaking as Rand gold-mining goes. But the fact that above the rich discovery on the Modderfontein Deep the same vein in the New Modderfontein property is of lower average grade than farther to the east in the same property is only another instance of the long-recognized local variations in grade which the Main Reef on the Rand is likely to show. Below the Modderfontein Deep lies the extensive property known as the Government Areas, where the Main Reef was recently cut in the Northwest shaft, the nearest shaft to that of the Modderfontein Deep, at a depth of 2395 ft. from the surface. But in this instance its width only averaged 31 in., assaying over the four sides of the shaft at 7.15 dwt. per ton. But this failed to arouse anything like the same enthusiasm in mining circles as the Modderfontein Deep. The following is the official account of the discovery on the Modderfontein Deep: "The Reef series consists of a hanging-wall leader assaying 24.88 dwt. over 27.9 in., including partings, followed by 31 in. of waste. The middle reef assays 23.78 dwt. over 6 in. and is separated by 22.6 in. of waste from the foot-wall leader, the latter being 39 in. wide, including partings, and assaying 7.26 dwt. per ton. The average of the whole body, including waste, is 126.5 in. wide, assaying 8.84 dwt. per ton."

It may be interesting to reproduce the results of the different bore-holes on this property, put down some time before shaft-sinking operations commenced. No. 1 bore-hole struck the Main Reef series at a depth of 2967 ft., the section and assay values being as follows: Vein 1¼ in., assay value 6 dwt., quartzite 16½ in., vein 1½ in., assay value 64 dwt., quartzite 66½ in. overlying another vein 2½ in. thick assaying 5 dwt., quartzite 9 in., vein 38¼ in. assaying 8 dwt., quartzite 3 in., vein 14¼ in. assaying 4 dwt., quartzite 6 in., vein 3½ in. assaying 2 dwt., and vein 1½ in. assaying 6 dwt. resting on foot-wall slate at a depth of 3099 ft. No. 2 bore-hole missed the vein altogether, but struck the foot-wall at a depth of 2520 ft. No. 3 bore-hole struck the Main Reef series at a depth of 2803 ft., assaying 15½ dwt. over a width of 12 in. These different sections show how variable are the different conglomerate beds comprising the Main Reef series both in value and thickness, even on the same property.

The Goerz group of mines, controlling the Modderfontein Deep levels, are to be highly congratulated upon first striking the Main Reef series at what may possibly be the best developed section and carrying the richest ore of any other spot probably on the property. It is also to be hoped that these published results, obtained from over 70 samples, may not prove so illusory as was the case with those first issued under similar conditions at Geduld. It will be remembered test sampling and assay results there failed to bear any resemblance to those first published as contained within the narrow limits of the shaft when it first cut the vein—a mystery to the investing public which up to even today has not been cleared up. This satisfactory Modderfontein Deep result will be all the more welcome because it has been obtained by a group that in the immediate past has shown considerable if not well considered enterprise in launching out and spending considerable sums in acquiring and prospecting properties on the Western Rand. These have developed in anything but a satisfactory manner, and today they hold large areas of somewhat doubtful value.

Owing to a variety of causes, artificial and otherwise, ill luck and decreased mining profits have for some time past dogged the footsteps of this group—more so than of any group on the Rand. It is therefore pleasing to see that there is a prospect of better times to some extent for the shareholders in this particular group. The satisfactory results obtained in the Modderfontein Deep levels will confirm the good opinion always held of the value of the New Modderfontein property, and likewise the better indications to the east noted in development work of the adjoining Van Ryn Deep. They ought also to encourage the shareholders of the Government Areas, where encouragement is much more needed than in the case of Brakpan, where some benefit may also be expected to be reaped. The directors of the Central Mining & Investment Corporation have announced an interim dividend of 6s. per share. It is the intention to pay dividends at the rate of 5% per year, and distribute the excess as a bonus.

General Mining News

ALASKA

Cordova

Owing to a heavy gale blowing on Controller bay, the Alaska Railway Commission will not land at Katalla on the north-bound trip, but will go direct to Seward. From there they go to Knik and the Matanuska coalfield, returning by way of Chitina and the Copper River railroad; after which they will visit Katalla and the Bering coalfield. Advices state that the steamer *Victoria* has arrived at Seattle, bringing $500,000 gold and 60 tons of furs from Seward Peninsula and Iditarod.

Fairbanks

A 60-hour run on Windy bench, with eight men shoveling into the sluice-boxes, resulted in a clean-up worth $4000. A 2-stamp Nissen mill is being erected by Hudson brothers on their quartz claim, between Ready Bullion and Moore creeks, above Ester City. The stamp-mill of McIlroy, and party, on Chatham creek, should soon be at work. It was found necessary to make the mortar blocks 36 ft. deep to get proper foundation. A good discovery has been made by Crites and Feldman, on Moose creek, a tributary of Fairbanks creek, in uncovering an extension of veins found some time ago. Pan tests show it to be high-grade. Gravel averaging $2 to $2.50 per square foot of bedrock has been found on No. 2 below left limit bench, on Fairbanks creek. This is the third discovery since the beginning of this year on this creek. Reports from Iditarod state that men are going to the new finds at the George river. One dump returns as high as $1.38 from seven pans, and $1.20 per pan from the bottom of a hole. The ground is shallow and offers good working conditions. Its extent is not yet known. Material for the Flat creek dredge is at Iditarod, but the Guggenheim people may not get it finished this season. Many are leaving, and under 200 will be in camp at the beginning of October.

ARIZONA

Gila County

At the Inspiration Consolidated mines, about 500 men are employed, and McArthur Bros. are employing 175 men on railroad construction. The extension of the main line of the Arizona Eastern, from Miami up Keystone and Live Oak gulches, to the Inspiration adit, and the Live Oak mine, was started this week. In August, 4900 ft. of development was done, and the rate is increasing. Churn-drill hole No. 3, at the South Live Oak is 630 ft. deep, and is reported to have cut chalcocite-bearing schist at 610 ft., though not of profitable grade. Results are considered encouraging. At the Southwestern Miami, churn-drill holes 6, 7, and 8 are respectively 935,989, and 880 ft. deep, in schist. The enlargement of hole No. 8 to 6¼-in. size by under-reaming has been finished, and drilling will be resumed. Good ore was reported as found in this hole at a depth of 820 ft. J. A. Fleming has taken a lease on the old Irene silver mine in Irene gulch, about two miles north of Globe. The group consists of nine claims, and has silver-bearing veins in quartzite, diabase, and limestone. The mine was a producer of high-grade silver ore in the early eighties. The Iron Cap Copper Co. has just shipped a car of oxidized copper ore to the Old Dominion smelter. It runs high in iron, and is estimated to assay about 8% copper. Another car is now being loaded. The ore is coming from the 4-ft. shoot recently opened on the 650-ft. level. Driving continues east on the ore at this level, and a drift has just been started east on the 800-ft. level, to cut the same shoot. There are 12 men employed. F. A. Woodward is manager, and H. W. Woodward, superintendent.

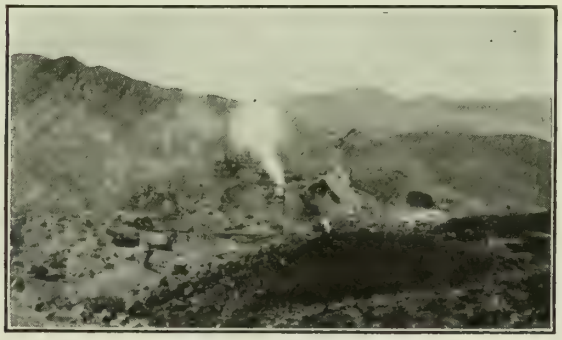
Globe, September 12.

Pinal County

In a report to the shareholders of the Calumet & Copper Creek Mining Co., M. A. Tew, vice-president, states that the power-plant, transmission lines, and machinery on the property are working well; and shareholders have reason to be satisfied with the present showing. The mill was started on July 2, and after several adjustments, is working splendidly. Concentrate from the Old Reliable mine averages 20% copper, worth about $60 per ton. Concentrate from the American Eagle is worth $35 to $40 per ton. Grading for a narrow-gauge railroad is finished between the Old Reliable and the mill, which should soon produce 25 to 30 tons of concentrate per day. At present, concentrate is hauled by teams to Winkelman, thence by rail to the El Paso smelter. An Isbell vanner is to be tried in the mill, this make having done good work at other large copper concentrators.

Santa Cruz County

(Special Correspondence.)—One 50-ton car of copper ore per day is being shipped to El Paso smelter, according to W. S. Sultan, superintendent of N. L. Amster's R. R. R. mine near Patagonia, but the grade of the ore is not stated. A considerable tonnage of low-grade ore is accumulating on the dump. The vein has been opened by drifts at the adit-level for a distance of about 500 ft. and driving north continues. A width of 40 ft. is reported at two points at which it has been cross-cut. A winze is being sunk on the vein, has reached 90 ft. below the adit-level, and a



MORENCI, ARIZONA.

drift has been started at 60 ft. in depth. The sinking of the 375-ft. two-compartment shaft will be continued to the adit, a distance of about 600 feet. Six machine-drills and 70 men are employed. The Copper Queen company, after an examination, has taken over the Bradford mine belonging to the Ferry estate. The property is 3 miles west of the R. R. R. mine, and a mile west of the Amster spur at Bloxton. About one car of copper carbonate ore per week is being shipped. The Chief Group of claims, owned by B. Curtis, W. Powers, and others, has been bonded by El Tigre people, and a 500-ft. cross-cut has been started. The claims lie 1½ miles northeast of the R. R. R. mine, and adjoin the famous World's Fair mine, owned by F. Powers. The ore carries copper, lead, and zinc. The Hosey mine, nine miles due west of Patagonia, and owned by J. McDonald and others, has been bonded to Mr. Posey, former owner of the Gold Road mine, and Mr. Frazier. Three cars of copper-silver ore per month are being shipped. The Morning Glory mine, owned by C. B. Wilson, is shipping two cars of copper ore per week to the Pioneer smelter.

CALIFORNIA

Amador County

(Special Correspondence.)—The shaft of the Keystone, near Amador City, has reached a depth of 1800 ft., or about 400 ft. below the old workings. Sinking will probably continue to the 2400-ft. level. It is estimated over six months will be required to complete the shaft. In the upper levels considerable milling ore is blocked out, and indications are considered favorable for intersection of the veins at further depth. C. R. Downs is manager. The South Eureka and Central Eureka companies have recently purchased land suitable for dumping places for mill tailing. A large dam will be erected, and the tailing pre-

vented from flowing upon and damaging agricultural lands. The material from the South Eureka will flow to the ground through a ditch, while a trestle and pipe will be part of the outlet for the Central. Both mills will discharge tailing behind the same impounding dam. Developments on the 2700 and 2800-ft. levels of the Central Eureka are reported to be satisfactory. The new vein recently cut on the 2800-ft. level shows well. It is understood that the full complement of 40 stamps may be in operation soon, if enough ore is available. Unwatering the lowest workings of the Plymouth Consolidated is going ahead and unless the old workings are badly caved, the management intends to start development within a few months. So far the shaft is said to be in a fairly good state of preservation.

Jackson, September 16.

MERCED COUNTY

The Original company, in the Merced river canyon, cleaned up bullion worth $5100 from 16 days' work, 335 tons of ore being crushed. Only half of the mill worked for nine days, but it is hoped to keep the 10 stamps running in future. The 200-ft. level is in 90 ft., and will go 200 ft. further. Twenty-five men are employed.

NEVADA COUNTY

The new hoist at the Gold Point mine has been erected and the head-frame is now being constructed. This mine is between the Brunswick and Maryland properties. The shaft is down 248 ft., and driving from this point is in progress, cutting good ore. It is intended to sink to 1000-ft. depth. The new electric line to the Montana mine, in Willow valley, is completed, and electric power is now used for driving the compressor. It will also be used for hoisting and pumping. Prospects at the mine are satisfactory. H. Kitts and others have bonded a portion of the bed of Deer creek, near Kendrick, and will erect a dredge, which will be driven by electric power.

SHASTA COUNTY

(Special Correspondence.)—The Noble Electric Steel Co. has resumed iron production at its Heroult smelter. The single furnace is yielding 15 tons per day. Framework for a second unit is being erected. The company intends to add new furnaces from time to time. It is stated that success has crowned the efforts to produce gray iron. The by-products plant is producing charcoal, tar, and various chemical products of value. Repair work at the Afterthought copper mines is being completed, and active development is expected to commence within a few weeks. Experiments with the new process continue, and its success is understood to be assured. Preliminary work on the route of the railroad from Bella Vista to Ingot is nearly finished and the company intends to start soon with construction work. With the prospect of early working, the Ingot smelter, gold mining in the district is stimulated. The Moonlight owners have ordered a 5-stamp mill, and machinery is arriving. The ore carries gold with pyrite. Promising discoveries have been recently reported by prospectors in different portions of the field. It is again rumored that the Bully Hill Copper Co. is contemplating resuming work at Delamar. The management has been experimenting for several months with a process designed to obviate the smelter-fume question.

Redding, September 16.

SIERRA COUNTY

The adit driven on the lode at the Fruitvale mine, on the Middle Yuba river slope of Lafayette ridge, is in 700 ft., and a cross-cut shows it to be nearly 40 ft. wide, carrying gold. The lode was 20 ft. wide at the mouth of the adit, and only got narrower in a few places. Machine-drills are used on two shifts. The quartz in the lode carries a fair percentage of pyrite. A bond has been obtained on the Eagle and Arizona claims, and the 800-ft. adit, driven some years ago, has been cleaned out and retimbered. E. Miller and C. Edwards are driving an adit to cut the vein on their claims near the Seventy-Six, on Kanaka creek. While doing assessment work on the Alhambra mine, near Poker Flat, a new ore-shoot was discovered which pans well in gold. This mine has a series of quartz veins enclosed in a large dike of mariposite. Pay-gravel has been found in claims on the Clarks canyon side of Rattlesnake last week, in a 35-ft. raise from the face of the 350-ft. adit. It is a blue quartz gravel, and $7 in coarse gold was recovered from a few loads washed.

COLORADO

GILPIN COUNTY

An orebody 36 to 48 in. wide has been opened on the 100-ft. level of the Federal mine, in the Russell district. A small vein assays up to $180 per ton. The ore carries zinc and copper, and about 20 tons has been broken out. The main shaft at the Ralls mine is 675 ft. deep, and the vein is 30 to 36 in. wide, showing good smelting ore. A new ore-shoot has been discovered in the Alps mine, at a depth of 80 ft., and assays return from $41 to $237 per ton in gold, silver, and copper.

LAKE COUNTY (LEADVILLE)

At the Boston group of claims, at the head of Mayflower gulch, a lode 10 ft. wide has been cut, but its full width has not yet been proved. It assays from 70 to 75% of lead, with good gold and silver content. The lode has been traced on the surface for about 3000 ft. During August the Eureka company sent out 26 cars of ore from the new find at Columbine shaft. The returns were from 26 to 60 oz. of silver per ton, and a fair percentage of lead.

SAN JUAN COUNTY

The State Commissioner of Mines, T. R. Henenan, had the following to say about the southwestern district to the Denver *Post*: "The region about Silverton is in a very prosperous condition and the people are sanguine about the future. The Gold King mine and mill are running full time, the Silver Lake and the Iowa Tiger mines and reduction works are very active. The Sunnyside is steadily producing, and earning large returns through the successful operation of its electrostatic zinc plant. The Congress mine at Red Mountain is employing about forty men in the production of gold, silver, and copper. The manager of the Bagley adit, at Animas Forks, has his big mill nearly completed. The Champion mine, on Sultan mountain, is working a full force of men. Several other properties are in operation and are turning out a good deal of ore."

TELLER COUNTY (CRIPPLE CREEK)

A pump is to be installed in the Eclipse shaft of the El Oro in Eclipse gulch, and 300 ft. of water removed as soon as possible. A cross-cut will be started in the Comanche Plume adit to open the main orebody outcropping in the upper Eclipse adit. Good ore has been cut in the Mollie Katheleen; shipping is to be resumed at the Kalamazoo claim; and the Chickenhawk has three machines at work on the 1000-ft. level.

During the year ended August 31 the Jerry Johnston shipped 1315 tons of ore having a gross value of $182,059 and net value of $104,442. Dividends amounting to $24,978 were paid. The main shaft is 975 ft. deep, but little work has been done below 650 ft. It is proposed to erect a mill. Water in the Gold Coin shaft is 89 ft. below No. 10 level, and is receding at the rate of one inch per day. Installing the new pumps at the 1600-ft. level of the Golden Cycle is well advanced. The Trilby mill is to be dismantled shortly.

IDAHO

IDAHO COUNTY

There has been general activity in mining in the Elk City district of late, and the outlook is bright. Mills at the Mineral Zone, Last Chance, and South Fork are working, while the crusher, Huntington mill, and Pelton wheel at the Mascot are all in place and should be soon running. At the Penn-Dixie, No. 1 adit is now in 800 ft. At present a shaft is being sunk on the Keystone claim,

and a small vein is yielding some rich ore for the mill. The latter has been overhauled and a cyanide plant built for treatment of part of the tailing.

SHOSHONE COUNTY

The property of the Clearwater Copper Mining Co., situated at the headwaters of the north fork of the Clearwater river, promises to be a big mine. In the lower adit of this property, an ore-shoot 1400 ft. long has been opened, it is reported, and cross-cutting has proved it to reach 30 ft. in width, carrying copper, gold, silver, and lead. The mine is well equipped, and there is ample water-power. This district is rather remote, being 14 miles from the regular wagon-road. The United Lead company, near Osburn, is reported to have cut good ore in a drift driven on a lode in the lower adit. The drift is about 4000 ft. long. The Snowstorm mill, at Larson, has been shut down for some time for repairs. A heavy flow of water has been met with in the Silver Cable, east of Mullan, in the new adit, which is expected to cut the lode 100 ft. below the discovery. The consolidation of the Surprise and Highland Chief companies was practically completed last week.

MICHIGAN

HOUGHTON COUNTY

The J. A. Roebling Sons company has purchased the plant and 304 acres of land belonging to the Dollar Boy Land & Improvement Co., and the Tamarack & Osceola

MINING AND METALLURGICAL BUILDING, MICHIGAN COLLEGE OF MINES.

Manufacturing Co. The present wire mill will be enlarged, a steel-wire mill added, and other finished copper products will be produced for the Western trade demands of the Roebling company.

MISSOURI

NEWTON COUNTY

The smelting plant of the Granby company, at Granby, was destroyed by fire on September 10, the damage being assessed at $100,000. Fire is supposed to have started from a spark from the furnaces. The milling plant and laboratory were saved. About two years ago the mill was burned down. The lead smelter had not been at work long, and its loss will take from the Joplin district an active buyer of lead ores, until it can be rebuilt.

NEVADA

CHURCHILL COUNTY

The debt of the Nevada Hills company is now $275,000. The mine makes 30,000 gal. of water per day, of which 17,000 gal. is needed for the mill, which is now treating 125 tons of ore per day.

ESMERALDA COUNTY

Active prospecting is to be started at the Zara company's claims, in the Hornsilver district, 35 miles southwest of Goldfield. The Southwestern company has purchased the Great Western mine and will begin work on a large scale. The Hornsilver company has opened some good ore by cross-cutting from its 300-ft. level. The shaft is down to 460-ft. depth, and at 500 ft. cross-cutting will begin. This district is isolated and lacks good transportation and milling facilities.

A number of Goldfield people have filed placer locations to the east side of Silver Peak, about 20 miles west of Goldfield, on a salt marsh or dry lake, which is said to contain potash deposits. The district is to be thoroughly tested. The deposits were originally discovered about eight years ago by J. Shirley, of Goldfield. Several samples have yielded 10 to 15% potash salts from a depth of 6 ft. The Goldfield Midway company will sink its shaft to 500-ft. depth on its ground on the north side of Vindicator mountain. Work already done shows a lode about five feet wide. The Black Butte Leasing Co., working from the main shaft of the Diamondfield Black Butte, has cut 3 ft. of ore worth $22 to $30 per ton. On the second level of the Nevada Eagle high-grade ore has been opened, and the 365-ft. level is being driven to develop it further. The main shaft of the Florence Goldfield is now below 1250-ft. depth.

HUMBOLDT COUNTY

(Special Correspondence.)—The National Placer Co. has built a large machine on its extensive holdings in Gold gulch. The apparatus has a capacity of 1000 tons per day. Scrapers, operated by horses, are employed to excavate the material. W. T. Henley has installed a machine in the main gulch, where he has several claims. It is said the gravel is of good value. The Charleston Hill Development & Mining Co. is driving a cross-cut adit to intersect the orebody developed in the upper workings. A survey of the holdings is being made preliminary to application for patent. Regular shipments of concentrate from the National mill are being made to Winnemucca. The company is pushing work on its rich Charleston hill property. Operations have been resumed at the Gold Note mine near Kennedy. The mill is being overhauled, and it is planned to commence production shortly. Paul Klopstick is manager. Oklahoma Mining Co. is developing milling ore in its property at Dyke. Veins of high-grade quartz are also reported. Thomas Ewing is manager. In the Yellow Dog claim a 15-in. shoot of rich ore has been uncovered at a depth of 120 ft. Some of this is said to assay about $500 per ton. A second shoot, 2 in. wide, has also been cut. On adjoining claims, John Yates and associates are opening veins of rich quartz on the Yellow Dog vein. These properties are situated at Dyke, in the Pine Forest district. Prospectors report the discovery of a 2-ft. shoot of rich ore, eight miles from Rye Patch. Black Canyon and other sections of the Humboldt range report that considerable prospecting is under way. The Sheba, Wheeler, and other mines are being actively worked.

Winnemucca, September 6.

The offices and superintendent's house at the National Mines property were destroyed by fire last week. Books and records were saved. The old concentrate building was burned, but the mill was saved. Work will proceed as usual.

NYE COUNTY

At Manhattan, the Big Four company is raising from the 500 to 400-ft. level on a large orebody. The Kendall-Douglass has treated 130 tons of ore averaging $46 per ton. From the White Caps mine 55 tons per day is sent to the Associated mill. The War Eagle mill treated 114 tons valued at $28 per ton, for lessees at the Litigation Hill Merger, formerly Bath lease. Twelve feet of ore has been opened by lessees at the Indian Camp. The Manhattan Milling & Ore Co. is to erect a new cyanide plant.

The new pumping plant at the Manhattan Big Four, with a capacity of 300,000 gal. per day, is now at work. Plans for the new mill have been approved and construction will be started soon. An effort is being made to finance the old Manhattan Mining Co., one of the first companies at Manhattan. During August the Tonopah Mining Co. treated 14,429 tons of ore yielding bullion valued at $227,100, including the value of 62 tons of con-

centrate, and the net profit was $129,368. Ore production from the district for the past week totaled 10,205 tons, worth $255,125. The Tonopah-Belmont sent out bullion weighing 20,466 oz. on September 11. The mill is treating an average of 500 tons of ore per day. At the Midway a new shaft is being sunk. On the 600-ft. level of the West End the cross-cut has gone through 25 ft. of ore, with no hanging wall in sight, averaging $25 to $30 per ton. The mill will be treating 135 tons per day in a few days. The North Star has cut a vein of good-grade ore on its 1250-ft. level. On last payday at Tonopah the sum of $250,000 was distributed among the men.

STOREY COUNTY

At a special meeting of the Comstock Pumping Association, held in San Francisco, the use of Ward shaft was offered to the mines of the Gold Hill section, the offer remaining open till September 20. If not accepted, machinery will be lifted from the 2150-ft. station, and water will rise to the Sutro tunnel level. During the week ended September 14, reports on the Comstock mines contained the following: The water at Ward shaft has been kept at 50 ft. below the 2150-ft. station, the vertical centrifugal pump at the C. & C. shaft worked well, and various repairs were made in the shaft. The Mexican mill crushed 477 tons of ore averaging $24.95 per ton, with an extraction of 95%. On the 2500-ft. level in the north drift, out 250 ft., a winze was sunk 14 ft. on the vein, showing on the north about 42 in. of quartz, worth $3.15 to $9.33 per ton; and on the south 18 in. of low-grade ore. Twenty-one tons of $17.33 ore was taken out of this opening. At the Ophir cyanide plant the tube-mill, Dorr thickener, solution tanks, and foundation for Butters filter are about complete. The usual work was carried on at the Consolidated Virginia, Union Consolidated, Sierra Nevada, and other mines.

WHITE PINE COUNTY

At the Boston Ely the shaft is 1260 ft. deep, and from 15,000 to 20,000 gal. of water has to be pumped daily. A new boiler and compressor are being erected as fast as possible.

The Nevada Consolidated company is contemplating resumption of work at the Ruth and Star Pointer properties. Mining here will have to be done by the caving system. Over 8,000,000 tons of ore averaging 2½% of copper is opened. The Ruth shaft, used mainly for ventilation, is down 610 ft., and the Star Pointer shaft 495 ft. deep. The two mines are connected by a drift 2700 ft. long.

NEW MEXICO

GRANT COUNTY

At the Pacific No. 2 mine of the Savanna Copper Co. lessees are sinking a shaft to 100-ft. depth. The old adit has been cleaned out and stoping is in progress, and one car of ore per week is sent to El Paso smelter. Foundations for the electric plant at the Emma mine, at Fierro, are nearly finished. It is thought that the Phelps-Dodge company will work its mine at Leopold when a railway is constructed to that place. The Twin Peaks company is erecting a 100-ton mill and cyanide plant.

SOCORRO COUNTY

(Special Correspondence.) — The Ernestine company treated 1354 tons of ore during the two weeks ended September 12, and produced 10,360 oz. of bullion in 10 days, besides 5 tons of concentrate. Thirty stamps should be regularly at work from now on. At the Socorro the lower levels are in good ore. The Deadwood mill crushed 1700 tons in August, and the Oaks Company sent to the mills 461 tons averaging $17 per ton.

Mogollon, September 13.

UTAH

JUAB COUNTY

As far as can be learned, there is no wage trouble brewing in the Tintic district, the rumors to that effect being caused by the miners' action at Bingham. Tintic producers of zinc ore have been notified that shipments of ore under the reduced freight rate began on September 16.

A meeting of the mine employees of the Tintic district has been held, and they felt that a raise in wages is within reason, considering the cost of living, that wages have remained at one scale for some years, and the present profitable returns from mining generally. Miners at present receive $3; machine and timbermen, $3.25; and shovelers, $2.75 per day. The new electrically-driven compressor at the Swansea Consolidated, at Silver City, is working, and should reduce costs somewhat. The Chief Consolidated sent out 50 carloads of ore during the past two weeks. The Yankee Consolidated received $4357 for ore shipped in August. The Gold Chain company has paid a second quarterly dividend, of 2c. per share, amounting to $20,000.

SALT LAKE COUNTY

At a meeting of the Bingham branch of the Western Federation of Miners, a ballot on the wage question was taken, and showed 9 to 1 in favor of a strike if the mining companies do not grant an increase of 50c. per

BINGHAM CANYON OPEN-CUT MINING.

day for practically all classes of labor. Should a strike be declared, about 3000 men would be involved. The companies have already agreed to a 25c. increase.

As a result of the above-mentioned meeting, a general strike was started at 7 o'clock on Wednesday morning, and by 10 o'clock all the mines were idle. C. H. Moyer, president of the Federation of Miners, advised against an immediate strike, but was overruled by a unanimous vote.

SUMMIT COUNTY

At the annual meeting of the New York Bonanza it was stated that 3767 ft. of development had been done at a cost of $18,779, or about $5 per foot. Shipments were made from the 400 and 500-ft. levels, but the ore was too poor to pay. Between these levels there are several thousand tons of ore averaging 12 oz. of silver and 2% lead. A raise above the 200-ft. level shows fair ore. Receipts totaled $36,736, and there was a loss of $3334 on the year's work. The mill at the Ontario is now complete and should soon be at work. Notice has been served on all 'jiggers' along 'Poison creek' that they must cease making concentrate from the tailing from the mills of the Daly West, Daly-Judge, and King. It is expected that a lawsuit will result. Shipments for the week totaled 1310 tons from four mines.

AUSTRALIA

For the first seven months of the current year the mints at Melbourne, Perth, and Sydney received for coinage gold valued at $7,725,000, $14,485,000, and $7,380,000, respectively.

QUEENSLAND

Three new mining bills are now before the Parliament

of this state, namely, 'Drainage of Mines,' 'Mines Regulation Act Amendment,' and 'Mining for Coal and Mineral Oil.' For the first six months of 1912 the production of minerals, except coal and gems, in Queensland, was valued at $7,920,000. The annual report of the Chillagoe Copper Co. is rather discouraging. This company owns mines, a railway, sampling plant, Huntington-Heberlein and Dwight-Lloyd machines, blast-furnaces, and converters. The metallurgical problems require a high degree of technical skill, and the price of coke is high. The year's revenue was $1,715,000, and there was a deficit of $16,000.

Tasmania

During its past financial term of six months, the well known Mt. Bischoff tin mine produced 404 tons of tin from 113,178 tons of ore stamped, at a cost of $1.10 per ton, not including smelting. Its revenue was $400,000; gross profit, $214,000; dividends paid, $180,000; making total to date $940 per $24 share; and $505,000 carried forward to current account.

CANADA

Cobalt

There has been a rush to Gauthier township, in the Larder Lake district, where it is reported large veins show free gold. One claim has been sold for $10,000. For stealing silver ore from the Millerette and O'Brien mines, one man received two years, and another three months in jail, while the charge against a third man was dismissed. La Rose company has started to mine the famous Lawson vein 'silver sidewalk,' which was always shown to visitors to the camp.

Porcupine

The Schumacher mine, at Pearl lake, has been flooded. The accident happened on the 100-ft. level in cross-cutting north for the McIntyre veins, and all workings filled with sand and water at this shaft. Another one will have to be sunk; and deeper than 100 ft. before cross-cutting toward or around Pearl lake can be safely done. The lode in the Hughes claim has been cut on the 150-ft. level and is richer than on the upper levels. In addition to the value of the quartz, the schist was rich in gold. Work at the Three Nations Lake and Dome Lake properties is promising. Foundations have been started for the power-house of the Porcupine Lake company.

Yukon

During August the Yukon Gold Co. dredged 982,900 cu. yd. of gravel, yielding gold worth $641,700, equal to 65c. per yard. For the season to date 3,464,000 cu. yd. have been dealt with, yielding $2,402,400.

August 24 was the sixteenth anniversary of the discovery of gold on Bonanza by Robert Henderson; and the Dawson *Weekly News* devotes some space to the subject. It says in part: "It was the find on the creek near Dawson which sent tens of thousands hurrying through the Northland, the find which made Klondike, Nome, Fairbanks, Koyukuk, Iditarod, and numerous other districts. These placer districts led to the opening of copper mines on the Copper river, Whitehorse, and at the head of the White river. The Bonanza find brought on the discovery and development of Alaska's rich inland coal-lands. The prospector remains a live factor in this territory. Yukon has every reason to celebrate the discovery which brought about the awakening of the northern empire." The total production of gold from the Yukon Territory, and small neighboring districts, amounts to $169,000,000, from officially recorded returns. At Oglivie bridge, two miles from Dawson, two dredges, which are duplicates of No. 2 dredge on the Klondike, having a daily capacity of 12,000 cu. yd., are being built.

From the Pueblo mine, seven miles from Whitehorse, the Atlas Mining Co. is shipping 400 tons of ore per day, and as soon as the railroad can handle it the tonnage will be increased to 1000 tons per day. The company employs 150 men, and its ore reserves are estimated at 17,000,000 tons. The railroad company expects to operate the mines all winter and to be continuous shippers. A special heating plant will be put up to keep ore from freezing in the bins.

CHINA

At the Tayeh silver mines, at Lungkoshan, rich ore has been opened, and plans are under way for smelters to be erected nearby, while a railway is to be constructed either to the river or Wuchang. The Duisky coal mines, on Saghalien island, are said to be the best in the East, both in quality and quantity, analyses showing 71% of coke in the coal.

MEXICO

San Luis Potosi

Recently 400 flasks of quicksilver were shipped from this state to New York, this being unusual, as the output has been consumed in Mexico or shipped to Europe. The bulk of the quicksilver production comes from Moctezuma and Guadalcazar, 40 miles north and 52 miles northeast of San Luis Potosi, respectively. The former development is comparatively recent, and the mines include about 400 acres. They are situated about 5700 ft. above sea-level and have rich deposits of cinnabar, the annual production being some 1200 flasks.

Sonora

Mining is suffering in this state from the revolution, and many small properties have closed down for fear of being interfered with. Every effort is being made by the Southern Pacific Company to keep the railroad open between Cananea and Naco. The Cananea company has decided to erect four more Great Falls converters. The Democrata smelter resumed work after a week's shut-down for repairs.

Twenty-one bars of bullion have been stolen from the El Tigre mine; and a reward of $5000 has been offered by the management for its recovery.

NEW ZEALAND

The August gold output from all mines was valued at $340,000, against $680,000 for the same month of 1911, the large decrease being due to strikes at the Waihi and Reefton mines, already noted in the *Mining and Scientific Press.*

PHILIPPINE ISLANDS

On July 1 the new dredge on the Guaymas river was launched, and should be at work by now. A new electrically driven dredge has been purchased from Hongkong by H. E. Nelson for work on Mariquina river. It has a capacity of 100 cu. yd. in 10 hours from 24-ft. depth. The Luzon Gold Co., which holds several properties in Tayabas, Neuva Ecija, Rizal, and on the tributaries of the Umirai and Agelo rivers, have fitted up a hydraulic plant. The Junction Mining Co. has been formed in Manila, with a capital of ₱200,000, to mine in the Surigas district, Mindanao.

RUSSIA

(Special Correspondence.)—The platinum market at Ekaterinburg is quiet, and large business can only be done at a reduced price, which sellers refuse to accept, although they have large stocks. The present price is $37.23 per oz. for 83% metal. Offers by the *staratelli* (free laborers) are plentiful, more so than last year, and speculators who hold platinum buy more from them, paying over the above price. There has been an increase in the use of dredges for winning platinum, most of the dredges working belonging to the Platina company, operating in the Verchotur district. For osmiridium there is a constant demand, but no supply.

St. Petersburg, August 25.

SUMATRA

The May yield of Redjang Lebong mine, near Bencoelen, was valued at $117,500, and net profit $60,080.

Personal

Professional men are invited to send news of their engagements and travels. Such news is interesting to friends.

HOYT S. GALE is here.

E. A. AUSTIN is in Alaska.

L. C. TRENT is at the Palace.

GEORGE R. DAVIS is in the city.

W. P. HAMMON is in London.

J. E. HALL is at the St. Francis.

E. GYBBON SPILSBURY is in Texas.

FRANK SMITH is in San Francisco.

JOHN B. FARISH is in San Francisco.

A. E. BARLOW is in British Columbia.

E. O. MCGRATH is in town from Tuolumne.

GEORGE L. SHELDON has returned from Katalla.

JOHN A. DAVIS was in the city during the week.

J. G. BERRYHILL was at Ludwig, Nevada, recently.

S. S. ARENTZ has moved his office to Salt Lake City.

F. W. OLDFIELD left San Francisco for Mexico last week.

FRANKLIN LEONARD and J. B. MENARDI are here from Nevada.

W. A. CARLYLE has been in Mexico on professional business.

V. H. HUGHES has been appointed state geologist of Missouri.

W. C. BOLLEY is now superintendent of the Baltic mine, Michigan.

T. INOUYE is in Salt Lake City and will come to San Francisco.

J. F. CALLBREATH was here during the week and has gone to Los Angeles.

A. P. ROGERS is in Panama and expects to return to New York, October 1.

CHARLES A. BANKS left New York, September 10, for British Columbia.

R. C. SPECHT is at Weaverville, California, on placer examination work.

CHARLES JANIN has returned from Graniteville, Nevada county, California.

W. H. ALDRIDGE has moved his offices from Los Angeles to 14 Wall street, New York.

FREDERICK HELLMANN left San Francisco, September 16, for Los Angeles and the East.

CECIL POCOCK is now with the Compania Minera Santa Clara de Morochoca, Lima, Peru.

N. M. MUIR has left Mexico and is temporarily at 1311 Spruce street, Berkeley, California.

OSCAR LACHMUND has been examining placer ground in Yuba and Siskiyou counties, California.

W. J. ALMOND is on his way to Indiana from Rhodesia, expecting to return to San Francisco later.

H. FOSTER BAIN is at New Orleans, on his way to New York, where he will stay from September 30 to October 7.

SHIGEMA YAMANOUCHI, who has been visiting Europe and Nova Scotia, sailed for Yokohama on the *Mongolia*, September 13.

W. H. TANGYE has been appointed superintendent of the Calumet & Sonora, Cananea, Sonora, in place of C. W. STRAHAN, resigned.

GEORGE E. FARISH is on his way to Arizona to examine a copper property, expecting to return to New York at the end of this month.

MILLARD K. SHALER sailed from Brussels for New York on September 7 and will proceed to Lawrence, Kansas, returning to Brussels in a month or two.

G. MCN. ROSS and GUSTAVE SCHRADER are here to attend the meeting of the local members of the American Institute of Mining Engineers, held today at 12:30 at the Sutter hotel.

Market Reports

LOCAL METAL PRICES

San Francisco September 19.

Antimony	11—11¾c	Quicksilver (flask)	42
Electrolytic Copper	18—18¼c	Tin	50—51¼c
Pig Lead	5.35—6.30c	Spelter	8—8¼c

Zinc dust, 1400 lb. casks, per 100 lb., small lots $9.50—9.75; large $7.50—8.50

METAL PRICES

(By wire from New York.)

NEW YORK, September 19.—Copper remains quiet. Lead and spelter are firm. There is good business doing. Average daily prices for the past week, in cents per pound, based on wholesale transactions, standard brands, are given below.

Date.	Electrolytic Copper.	Lead.	Spelter.	Silver, per oz.
Sept 12	17.53	5.10	7.45	62⅞
" 13	17.48	5.10	7.48	62½
" 14	17.48	5.10	7.48	63
" 15	Sunday.	No market.		
" 16	17.48	5.10	7.50	63
" 17	17.48	5.10	7.50	63¼
" 18	17.48	5.10	7.50	63⅛

LONDON QUOTATIONS

(By cable, through the courtesy of C. S. Burton & Co., New York.)

	September 19.
Camp Bird Ltd	$ 6½
El Oro	3½
Esperanza	10
Oroville Dredging	1⅛
Santa Gertrudis	7⅛
Tomboy	6⅛

COPPER SHARES—BOSTON

(By courtesy of J. C. Wilson, Mills Building.)

	Closing prices, September 19.		Closing Prices September 19.
Adventure	$ 7¼	Mohawk	$ 66
Allouez	45	North Butte	34⅜
Calumet & Arizona	80½	Old Dominion	60
Calumet & Hecla	548	Osceola	111
Centennial	19⅝	Quincy	86½
Copper Range	57	Shannon	15¼
Daly West	4	Superior & Boston	1¼
Franklin	9	Tamarack	40
Granby	57¾	Trinity	5¼
Greene Cananea, ctf.	9¼	Utah Con	11
Isle-Royale	34⅛	Victoria	2¾
La Salle	5¼	Winona	4¼
Mass Copper	7	Wolverine	79¾

NEVADA STOCKS

(By courtesy of San Francisco Stock Exchange.)

San Francisco, September 19.

Atlanta	$ .22	Mexican	$2.85
Belcher	.32	Midway	.55
Belmont	9.75	Montana-Tonopah	2.22
B. & B.	.05	Nevada Hills	1.90
Big Four	.40	Ophir	.67
Booth	.06	Pittsburg Silver Peak	.97
Chollar	.06	Round Mountain	.40
Combination Fraction	.14	Savage	.03
Con. Virginia	.42	Tonopah Extension	2.70
Florence	.90	Tonopah Merger	1.02
Goldfield Con.	3.00	Tonopah of Nevada	7.12
Jim Butler	.69	Union	.61
Jumbo Extension	.35	Vernal	.11
MacNamara	.22	West End	1.62

MINING STOCK QUOTATIONS—NEW YORK

(By wire from C. S. Burton & Co., New York.)

	Closing Prices. September 19.		Closing Prices. September 19.
Amalgamated Copper	$ 88½	Miami Copper	$ 28⅞
A. S. & R. Co.	86½	Mines Co. of America	2⅞
Braden Copper	7	Nevada Con	22⅜
B. C. Copper Co.	5½	Nipissing	8⅜
Chino	44	Ohio Copper	1⅜
First National	2⅛	Ray Con	23⅛
Giroux	5⅛	Tenn. Copper	31⅜
Goldfield Con.	2⅛	Tonopah Belmont	9⅛
Greene-Cananea	9⅜	Tonopah Ex.	2⅛
Hollinger	12½	Tonopah Mining	7
Inspiration	19½	Trinity	6⅛
Kerr Lake	2⅜	Tuolumne Copper	2⅞
La Rose	2⅛	Utah Copper	64⅛
Mason Valley	12⅜	West End	1⅜
McKinley-Darragh	1⅛	Yukon Gold	3⅛

Book Reviews

Any of the books noticed in this column are for sale by, or can be procured from, the MINING AND SCIENTIFIC PRESS.

METHODS IN CHEMICAL ANALYSIS. By F. A. Gooch. 536 pp. Ill., index. John Wiley & Sons, New York, 1912. For sale by the *Mining and Scientific Press*. Price 4.

This volume deals with methods originated or developed in the Kent chemical laboratory, of the Yale University, and is suited for advanced students. The first 73 pages cover appliances and general procedure in a condensed form. The methods are arranged in a series of chapters covering groups from the alkali metals to iron. The work is well presented, well arranged, and well printed.

PRACTICAL FIELD GEOLOGY. By J. H. Farrell; with a GUIDE TO SIGHT RECOGNITION OF 120 COMMON MINERALS, by A. J. Moses. Pocket size. 273 pp. Ill., index, flexible cover. McGraw-Hill Book Co., New York, 1912. For sale by the *Mining and Scientific Press*. Price $2.50.

This is not a geology, that is, it does not treat of geological facts and history, but is a manual of methods; and a particularly good one. It is admirably adapted to help the man who has received good general training in geology but who is not familiar with practical field methods in economic work. One of the valuable features is the detail with which methods of mapping, both topographic and geologic, are given. The numerous illustrations from actual examples in the field are well chosen and well presented. Altogether the authors have succeeded in producing a book that will prove of large service.

FIRE PREVENTION AND FIRE PROTECTION. By J. K. Freitag. 1017 pp. Ill., index. John Wiley & Sons, New York, 1912. For sale by the *Mining and Scientific Press*. Price $4.

After a study of this volume, it should be said that it ought to be in the hands of everybody contemplating erecting buildings, also of architects, contractors, and insurance companies, especially in San Francisco. Although of considerable length, the work has been published in convenient form, so that it will easily fit into the pocket, and be handy for reference. Chapter I deals with the annual fire losses in the United States, which have been around $200,000,000 for some time, some detail being given to the conflagrations at Chicago, Baltimore, and San Francisco. Chapters II and III argue on the theory and practice of fire prevention and protection, and on fire insurance. In the latter case, instructions or suggestions are given how to insure certain buildings. In chapter IV the slow-burning or mill construction is discussed, with many diagrams and details of buildings. Part II contains 80 pages on fires in fire-resisting buildings and conflagrations, and shows the result of fires in certain buildings, even as recent as the Equitable affair in New York, besides much detail to the fire in San Francisco, and lessons learned therefrom. On the manufacture and use of fire-resisting materials much valuable information is given. Part III of the book covers fire-resisting design of buildings, inside and out, details of floor and window construction, and results of many fires. In this section, the architect should find everything required for making a modern building fireproof. Part IV deals with fire-resisting construction in like manner. Special structures, such as theatres, schools, and factories, where fires often result in great loss of life; safes and vaults, which are for the purpose of protecting valuables, coin, and documents from fire, water, and impact of falling bodies; and garages demand special construction, which are shown in part V. Part VI considers much important auxiliary equipment and safeguards, as sprinkler systems, automatic fire-alarms, watchmen, standpipes, and hose; inspection of fire-protective devices; and fire-drills. Altogether, this is a valuable work on an all-important subject.

Concentrates

Most of these are in reply to questions received by mail. Our readers are invited to ask questions and give information dealing with the practice or mining, milling, and smelting.

SNOW fell at Sucre, Bolivia, in July, creating a sensation and upsetting all traditions.

MACHINE drills at the Alaska Treadwell mine averaged 29.6 ft. per day, and 34.4 tons broken per day, during 1911.

LAUNDRY machines are used at the United States Treasury to wash dirt out of money; a reversal of the miner's process of washing gold out of dirt.

DRILLING contests at the annual picnic of the Butte miner's union, resulted in a team from Arizona drilling 43⅜ inches in 15 minutes into granite, followed by a Butte team with 41 $^{11}/_{16}$ inches in the same time.

AIR-RECEIVERS accumulate oil from compressors, and explosions have resulted from this, showing that the receivers ought to be cleaned out periodically. The mining regulations in Western Australia enforce this work.

SPITZBERGEN is an interesting island, north of Norway, in that it is under no special flag, and contains coal and marble. The American-owned coal mines will produce about 60,000 tons for the year; and an English company is to quarry marble for export.

GRADING TESTS on certain ores by wet and dry methods have shown differences of 2% in accuracy in favor of the former. In the latter method, particles of ore become coated with extremely fine dust, which will not shake off; whereas in the former this is washed off by the water used during screening.

GNATS are especially troublesome at Copper River district of Alaska this season, as they generally are in the North. Many parts of Australia are troubled with flies, while mosquitoes are a nuisance in tropical countries. Mining regions are usually in outlandish enough parts, let alone being troubled with such pests.

ITALY imported in 1911 metals valued at $113,000,000 Pig iron amounting to 232,811 tons was imported, and scrap iron, 392,703 tons. Of the latter, only 12,658 tons came from the United States, there being strong competition with European producers. Sulphur exports totaled $7,917,880, of which $174,279 went to the United States.

FLUORSPAR is found in crystals, generally cubical in color, ranging from a clear slightly bluish or green glasslike tint through various other brilliant colors to dark purple, although much of it is white and opaque. Associated with others minerals, fluorspar has a broad distribution, but deposits of workable size are not abundant, the deposits thus far exploited in the United States being found only in the states of Arizona, New Mexico, Colorado, Illinois, Kentucky, Tennessee, and New Hampshire.

IRIDIUM is a rare metal, not more than 5000 oz. being produced annually, of which about 500 oz. are recovered in the United States, mostly from imported platinum sand, and copper ores and bullion. Prices ranged in 1911 from $60 to $64 per ounce for pure metal. Iridium finds a fairly extensive use in the points of fountain pens, in standard weights, pivots, and contact points. An oxide of the metal, iridium black, is valuable as a pigment for decorating chinaware. According to the Bureau of Statistics, 3905 oz. of iridium, and iridium in native combination with platinum metals, valued at $210,616, were imported into the United States in 1911.

Motor Truck Tests in Army Maneuvres

Two important army tests in which Mack and Saurer trucks have been conspicuous in the summer of 1912 were the National Government maneuvres in Iowa and Wisconsin held early in June, and the Connecticut maneuvres recently brought to a close.

The western maneuvres were made over a route that was especially constructed for the difficulties of operating motor vehicles, and in these tests trucks of from 1 to 3 tons live-load capacity were employed. The object of the tests was to determine how far from the base of supplies the army could be maintained with trucks as a means of transportation, likewise to ascertain the practicability of motor trucks operating over irregular highways; that is, crossing fields and maneuvring through timber and brush. The regulations were exactly the same as would prevail in actual warfare. Regular highways were never used in transporting supplies, and naturally these regulations caused many difficulties

The International Motor Co., New York, had two entries in the western maneuvres—a Mack standard 1½-ton truck and a Saurer 5-ton model. The Saurer was the same type of machine which has competed annually for the French war department subsidies since 1904 and which has never failed to win the first honor in its class in the European trials.

The Mack 1½-ton truck was used as a substitute for the regulation camp wagon and followed the mule-drawn wagon in the line of march, and as the infantry set the pace which could not be exceeded by the truck, it is obvious that this was a very exacting test for a light type truck to run three or four miles an hour as a steady pace.

The Saurer truck was used for carrying the supplies between the army's base and the command, and its mileage was increased by twelve each day for the distance covered by the command.

In the New England army maneuvres recently completed there were two Saurer trucks entered, one the famous 'Ocean-to-Ocean Pioneer Freighter,' the first commercial car to cross the continent. This truck has been running constantly in demonstrating work in New York since its famous journey made in the summer of 1911. The fact that its manufacturers were confident enough of its stauchness after the strenuous work in which it has already been put to enter it in the army maneuvres that were designed to particularly test the hardihood of a motor truck, indicates the faith which Saurer advocates have in their 'slogan,' —'In more than 17 years no Saurer has ever worn out.' The Saurer pioneer freighter was employed for handling baggage, camp equipment, tents, etc., and it was constantly overloaded during the New England maneuvres to at least 25%. In the report, the driver of this truck says that on the first day's run to Bridgeport, Connecticut, there were no road difficulties, and everything went along nicely until they reached Tyler City camp, after which there was a succession of bad bridges, sandy roads, and heavy rains. Under the stress of the heavy going, the pioneer freighter was one of the few trucks entered that was not delayed by mud and breaking through bridges. The New England maneuvres were designed particularly to test the hill-climbing ability of trucks carrying full loads, and the two Saurers are claimed to be the only two trucks in these maneuvres that surmounted the hills over which the army marched. The reason for the ease with which the Saurer climbed the grades is the fact that it had its origin in the Swiss Alps, where the grades are much steeper than they are anywhere in the United States except in the Far West, and also because the light weight of the chassis of the Saurer truck enables its engine to exert its power in propelling the load and not in pulling the dead weight which with most trucks is the greatest drawback.

The Sixth Annual Employees' Outing of the DODGE MANUFACTURING CO. of Mishawaka, Indiana, was held August 22 at Springbrook Park, Indiana.

New Type Spiral Riveted Pipe

The Standard Spiral Pipe Works, 25 North Dearborn street, Chicago, is placing on the market a reinforced galvanized spiral pipe which is made from two strips of steel of different widths and with a continuous interlocking seam. Both strips of steel are rolled to shape on the edges and are interlocked and rolled down under very high pressure in a special machine which this company has patented. The strips of steel are first cut the required width from long sheets of steel and the ends are welded together. The steel is then placed on large spools. The strip used for the outside or reinforcing band comes from the steel mills in long lengths on reels. Both these strips are fed into the machine at one end, rolled down and interlocked in the machine, coming out at the other end in the shape of pipe.

This pipe is smooth on the inside and has the reinforcing band running on the outside the full length of the piece, and can be made endless. This strip is not welded or soldered on the pipe, but is interlocked in the form of a continuous seam. Ample folds are made on both strips, so that a large bearing surface-contact is obtained at the seam. The advantage of this reinforcing band and smooth inside can readily be understood by engineers and others who have hitherto had to contend with frictional resistance met with in riveted pipes.

A soft open-hearth steel is used which will stand the required bending, and the steel is not weakened by being punched full of holes near the edge, nor is there one per cent as great a possibility of this pipe leaking as that of any riveted construction. In winding the steel into the spiral form, advantage is taken of all the tensile strength and stiffness which the material has, and lighter gauges of the pipe can be used for pressures that would require considerably heavier gauges by any other method of construction.

It will also be noticed that in the construction of reinforced galvanized spiral-pipe there are no rivet-heads protruding on the inside, but the pipe is smooth inside, and therefore has the least possible frictional resistance to the flow of water and other substances, and will not allow particles to adhere to the inner walls of the pipe, and thus gradually reduce the diameter and increase the friction. Its lightness enables it to be moved from place to place and to be installed in difficult places of access.

It will be noticed that at the point where the reinforcing band pases around the pipe, there are four thicknesses of metal. A number of bursting tests have been made on this pipe. One at the Armour Institute with a piece of 18-in., No. 20 gauge, reinforced galvanized spiral-pipe. It required 235 lb. hydraulic pressure to burst the seam. From this it will be noticed that the efficiency of the joint is very great. Another was made on a piece of 16-in., No. 20 gauge, where the hydraulic pressure was raised up to 320 lb., at which the wide band of steel between the two seams commenced to bulge out, and actually expanded three-quarters of an inch in diameter. The pressure was then turned off and a section cut out of the pipe, and it was found that the seam had not been affected in the least. There was no sign of fracture or opening of the seam either on the inside or on the outside.

Standard reinforced spiral-pipe can be supplied in any required length up to 20 ft., galvanized, and asphalted in any required length up to 25 ft. Price-lists and further information can be obtained and estimates on any quantity will be gladly submitted.

R. B. HUTCHINSON, formerly manager of the smelter in Chihuahua for the Rio Tinto Copper Co., and recently manager for Corrigan, McKinney & Co. in Mexico, will open an office for consulting practice at El Paso, Texas. Norval J. Welsh will be associated with him.

The CANADIAN COPPER CO., Copperclíffe, Ontaria, has ordered a Ruggles-Coles class F-8 dryer.

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EDITORIAL

CONDITIONS in Nicaragua are much quieter and it is hoped that peace plans can soon be promulgated.

DIVIDENDS of the Anaconda Copper Mining Company have been increased 25 cents per share, as a reflex of the rising price of copper.

MEMBERS of the American Institute of Mining Engineers should not neglect to send proxies to be voted at the meeting in New York on October 7.

INDIA has begun to ship pig iron to Japan, the cheap price of the rather low-grade pig and the less freight as compared with European ports proving attractive to the Japanese consumers.

TIMES change but human nature never. The coopers' union is protesting against the substitution of steel for wood in the casks used by the Standard Oil Company, as did the weavers against the introduction of steam-driven looms in England.

MAIL for Yukon points by way of White Horse closed for the season on Monday with the departure of the *City of Seattle* from Seattle. Later mail will have to be handled from coast points by dog team. The last steamer for Nome and St. Michael departs early in October.

DEFINITE facts are the most elusive of abstract bodies and an otherwise readable article is often weakened by their absence. Our readers will be correspondingly grateful to Mr. Charles Janin for their free use in his admirable discussion of dredging on the Seward peninsula, and his example is one that may well be emulated by authors.

CELEBRATION of the twenty-seventh anniversary of the achievement of the classic burro was quietly made by the Bunker Hill & Sullivan Mining & Concentrating Company on September 10 by declaring dividend No. 180. Its record of $13,715,550 paid in dividends is an enviable one, and speaks eloquently of an excellent mine under excellent management.

FINAL cancellation of the Cunningham claims comes as no surprise, as it is merely the formal action following the previous decision of the Secretary of Interior. There seems now little hope that the claimants will ever receive either the land or the return of their money, and however much we may favor a change from the old policy of distributing the public lands, this is a substantial injustice that should be remedied.

MEXICAN commerce has suffered remarkably little from the political disquiet of the past year, reaching a total of $240,000,000, as compared with $250,000,000 the preceding years. The export of mineral substances increased $3,000,000 despite a decrease of $2,500,000 in the yield of gold bullion, since silver exports increased nearly $4,000,000 and copper nearly an equal amount. Our neighbor is prosperous even if disturbed.

EXCURSIONISTS from the Eighth International Congress of Applied Chemistry will reach San Francisco next week and are to be entertained by the local members of the American Chemical Society on Tuesday evening, October 1. An excellent opportunity for promoting acquaintance with the foreign members will thus be afforded.

OBSERVERS profess to detect the hand of Standard Oil in the new loan which Mr. A. W. Jackson has floated for the republic of China. The rate is high and the situation is almost too complicated for comment. Another side of the picture is seen in a protest, made to the President, that the operations of a mine some distance from the tombs of the Ming Emperors are disturbing the shades of the illustrious dead.

GOLD imports of $750,000 have been received at New York during the week, and other consignments are expected. These are the first gold imports in some time past. Early in the month New York municipal 4½ per cent bonds fell below par, and the same downward tendency is observable in other municipal bonds. The demand for capital has become so great that a high interest yield must be afforded to attract investors.

KATANGA copper matters are now under the direct control of the Belgians. It is said they have sent out as manager an engineer experienced in coal mining; a rather peculiar choice, since the problem is essentially metallurgical. The cheap smelting of silicious copper ore, in the absence of sulphides, is yet to be accomplished. The new manager is reported to have got at the heart of things promptly and announced that coke consumption must be reduced. Exactly, but how?

ELECTION of Mr. G. A. Denny to the presidency of the Mexican Institute of Mining and Metallurgy is a well-deserved honor which reflects credit upon the Institute as well. Mr. Denny has had varied experience in the far parts of the earth, and his work, in collaboration with his brother, while consulting engineer for the General Mining & Finance Corporation, is well known. The Mexican Institute, like its American analogue, has difficulties of a financial nature, and it is to be hoped that they may be as speedily adjusted.

COMMERCE of the United States in August exceeded that of the corresponding period in preceding years, both in imports and exports. Imports reached $155,020,792, an increase of $30,000,000 over the preceding year, and $17,000,000 more than in 1910. Exports were valued at $167,885,095, an increase of $26,000,000 over 1911, and $36,000,000 more than in 1910. Dividends and industrial disbursements by railroad, traction, and industrial corporations during October are estimated at $174,579,000, an increase of $11,000,000 over last year. And yet people believe that a presidential year is a bad one for business.

CESSATION of work by the miners of the Utah Copper Company was announced in our news columns of last week. The miners, few of whom were union men, were persuaded by officials of the Western Federation of Miners to strike to enforce a demand for an increase of 50 cents per day in the rate of pay. Complaint was also made by the Greek miners against an employment agent of the company, and his resignation has been accepted. Recognition of the union has been made an issue, and 1000 miners are said to have joined since the strike began. The miners at first took possession of the property, but by the prompt and wise action of the Governor of Utah, were peaceably persuaded to evacuate their stronghold. Both sides are still firm. Some of the possible aspects of the case are indicated by our New York correspondent, who speculates on the effect on the copper market. It is no less interesting as an evidence of the growth of concepts regarding the profit sharing of corporations with employees. The price of copper has increased over 40 per cent during the past year, and the workmen are not satisfied with the 10 per cent increase of wages granted them on September 1. But the difficulty of sharing prosperity with employees is that they are not prepared to accept a corresponding decrease in wages when prosperity departs. The Utah Copper Company has done admirable work and will doubtless meet this difficulty as well as it has preceding problems.

NOTABLE contemporaries have recently elaborated anniversaries. *The Times*, of London, on September 10 commemorated its forty-one thousandth issue by a special number dealing with the development of printing and newspaper publishing, on which so great a journal can be expected to speak with authority. The *South African Mining Journal* celebrates its twenty-first birthday with an issue reviewing two decades of progress on the Rand, while the tenth anniversary of *Chemical and Metallurgical Engineering* happily coincided with the meeting of the Eighth International Congress of Applied Chemistry in New York. Our excellent contemporary, *The Canadian Mining Journal*, devotes its issue of September 15 to the mines and minerals of Nova Scotia. Though but a stripling to *The Times*, we have already rounded the half century, and with the privilege of maturity we commend our juniors for the excellent work they have done, and wish them a continuation of the prosperity they have deservedly enjoyed.

The Institute and Its Members

In the consideration of many details fundamentals are frequently obscured. During the past year many communications have been addressed to members by officers and committees of the American Institute of Mining Engineers, and on another page several of the more recent are reproduced. In the discussion of Institute affairs which has been in progress for many months two topics have been to the fore; the proposal to increase the dues, and the land debt of the Institute. Whether from their stimulus to the pocket nerve, or because they are easily grasped, these topics have occupied an undue share of attention. As Mr. Charles Kirchhoff points out, the Institute has always been able to meet its ordinary expenses from its ordinary income, and no increase is now necessary except to meet the interest charge and repay the principal of the land debt, which has already been reduced by subscription to $68,000. The recent appeal sent out by Mr. James Douglas has brought responses from 233 members, and $12,800 additional has been pledged, thus reducing the debt to $55,200. Further subscriptions will doubtless be received, and the plan proposed by the San Francisco members of temporarily increasing the dues of those members who prefer not to subscribe, will adequately meet the situation. Out of the total membership of the Institute, 500 members have already subscribed $125,000 toward the land debt of $180,000, and the others should not be slow to do their part. Subscriptions are more effective than yearly payments, since they lighten the present interest charge of $2720 on the debt, and $20 per member from the majority who have not yet contributed will amply meet the situation. In spite of the experience cited by Mr. H. V. Wheeler, in our 'Discussion' columns, we deprecate an increase of dues. The Institute has been able to do admirable work on its former income, and the proposed increase would tend to cause young engineers to postpone joining the Institute, and bear heavily upon some of the present membership.

Questions of finance are, however, but minor considerations, the essential problems are many, and, in our opinion, they centre about the difficulty of awakening the members to a sense of their duties, privileges, and responsibilities. The Institute is an association of mining engineers and metallurgists, formed for their mutual benefit. The Directors and the Council are trustees and servants for the membership. Unless the members take enough interest in Institute affairs to know what they want and why they want it, and communicate their wishes to the Council, they alone are to blame if the Institute does not fully meet their needs and desires. In calling the meeting at San Francisco to discuss these matters, postcard notices were sent to 175 members, but only 15 attended the meeting. Presumably, those who were interested enough to come were those best informed, yet it was evident that many of those present had forgotten the purport of the communications sent them on Institute affairs, if indeed they had ever read them. This is the root of the whole matter. The Institute should be a society, not a publishing house. No amount of effort by a few men can make a society useful and effective unless the membership interestedly participates. At the meeting in New York on October 7, and at the general meeting at Cleveland next February, questions of general policy will be acted upon; reclassification of membership, formation of local sections, consolidation of the Mining and Metallurgical Society with the Institute. If the action taken does not suit you, Mr. John Smith, it is because you have done nothing for the Institute beyond paying dues and reading the *Bulletin*. More needed than a subscription by each member toward the principal of the land debt is a contribution of interest toward the funded *esprit* that constitutes the greatest asset the Institute has or can possess.

The Lure of Mystery

In the old-fashioned novel, which Kipling has called the three-decker, young men who wished to make themselves irresistible to the other sex would assume an air of settled melancholy and make vague references to an incurable and secret sorrow which darkened their lives. In the story this procedure was always effective. In these less sentimental days, buccaneer captains of industry often utilize the same psychological phenomenon—the lure of the mysterious—in selling shares in enterprises organized to recover buried treasure or bullion lost in sunken ships. More originality in playing upon human weakness was exhibited by Walter Scott, better known perhaps as 'Death Valley Scotty,' who in devising romantic fiction concerning nonexistent mines showed himself an able even though unworthy bearer of the name. For years his doings furnished 'copy' for the journals that pander to the craving for excitement. Early last June there appeared in one of the Los Angeles papers an advertisement, illuminated by a photograph of Scott, stating that he had disposed of his claims in Death Valley to a local syndicate for "a million dollars," and that a corporation, to be known as the Death Valley Scotty Gold Mining & Development Company was in process of formation for their exploitation.

Through the efforts of the Los Angeles Chamber of Mines and Oil, stimulated by its secretary, Mr. G. M. Swindell, the following romantic but sordid story was disclosed.

Several years ago Messrs. Burton Gaylord, of Los Angeles, and A. M. Johnson, president of the National Life Assurance Company of Chicago, provided Scott with $5000 in cash, and paid for the special train in which he made his record-breaking transcontinental trip. This arrangement was made with Scott contingent upon his divulging the situation of his claims in Death Valley upon his arrival in Chicago, when he would be paid an additional $5000, and given a substantial interest in the company to be formed for the exploitation of his property. As Scott had nothing to divulge, nothing happened; and he arrived in Barstow on his return with about $12. Mr. Johnson, however, proved sufficiently credulous to continue for several years to provide him with sufficient funds to enable Scott to 'splurge' occasionally; and, later, the Girard family of Philadelphia became interested, and were also mulcted of several yearly payments. A story, probably fabricated by Scott and elaborated by his friends, is to the effect that his backers planned to send Scott, at the proper time, with an armed guard, in charge of about a ton of high-grade ore, by special train from San Francisco to New Orleans; thence by boat to New York City, where the ore, with an assay certificate, was to be placed on display in Tiffany's window. A $15,000,000 corporation was to be formed, with shares of the par value of $100, no certificates being issued for less than ten shares. It is pleasant to contemplate the eagerness with which investors would have parted with their hundred-dollar bank-notes to purchase blocks of this stock.

Early in 1912 Scott opened negotiations with Messrs. F. C. Goodin and Frank Sharp for the purchase of his alleged properties, and claimed to have received $25,000 from them on June 1 as first payment on his claims. When this statement was published, Dr. C. W. Lawton, who has a judgment against Scott for $1000 for professional services, haled him into court as a judgment debtor. In his usual spectacular manner Scott declined to tell what had become of the money he was supposed to have received, saying he "didn't keep books in his business." After maintaining this attitude for several days, he was finally committed for contempt.

Meanwhile the Los Angeles Chamber of Mines and Oil had become active in the matter, and learned that the company had no claims, that its representative was to go with Scott to Death Valley and locate everything within a radius of ten miles, Goodin remarking that they "wanted the fakir kept as far away as possible." The results of the Chamber's investigation were presented to the District Attorney, with a memorandum as to Scott's past. Mr. Samuel E. Browne, chief of detectives, played upon Scott's feelings so that he finally admitted that he had been paid but $200 for signing a receipt for $25,000, which was to be used in the exploitation of the company. Meanwhile, Goodin and Sharp had been served with subpoenas to appear before the grand jury, and a similar writ issued for Scott. He admitted before the grand jury that he had been paid but $200 for signing a $25,000 receipt, stating voluntarily that he had never owned any mining property, and that he had never had more than $200 in high-grade ore in his possession at any one time. He denied, however, that he had ever acted as a go-between for 'high-graders,' though he confessed that he has often bought high-grade ore for use in what he termed his 'grand-stand plays.' Truly a pitiful ending to a career made national as a result of the free advertising accorded by sensational newspapers.

Goodin and Sharp were indicted for perjury and are in course of trial. The greatest credit attaches to the members of the Chamber of Mines and Oil, and especially Mr. Swindell, for their successful efforts in unmasking make-believe. Chicanery, exaggeration, and misrepresentation have too long been associated with certain kinds of mining finance. When mining men generally are more ready to discountenance and oppose such methods of promotion, mining will be less commonly confused with gambling by the general public.

Gold Dredging on the Seward Peninsula

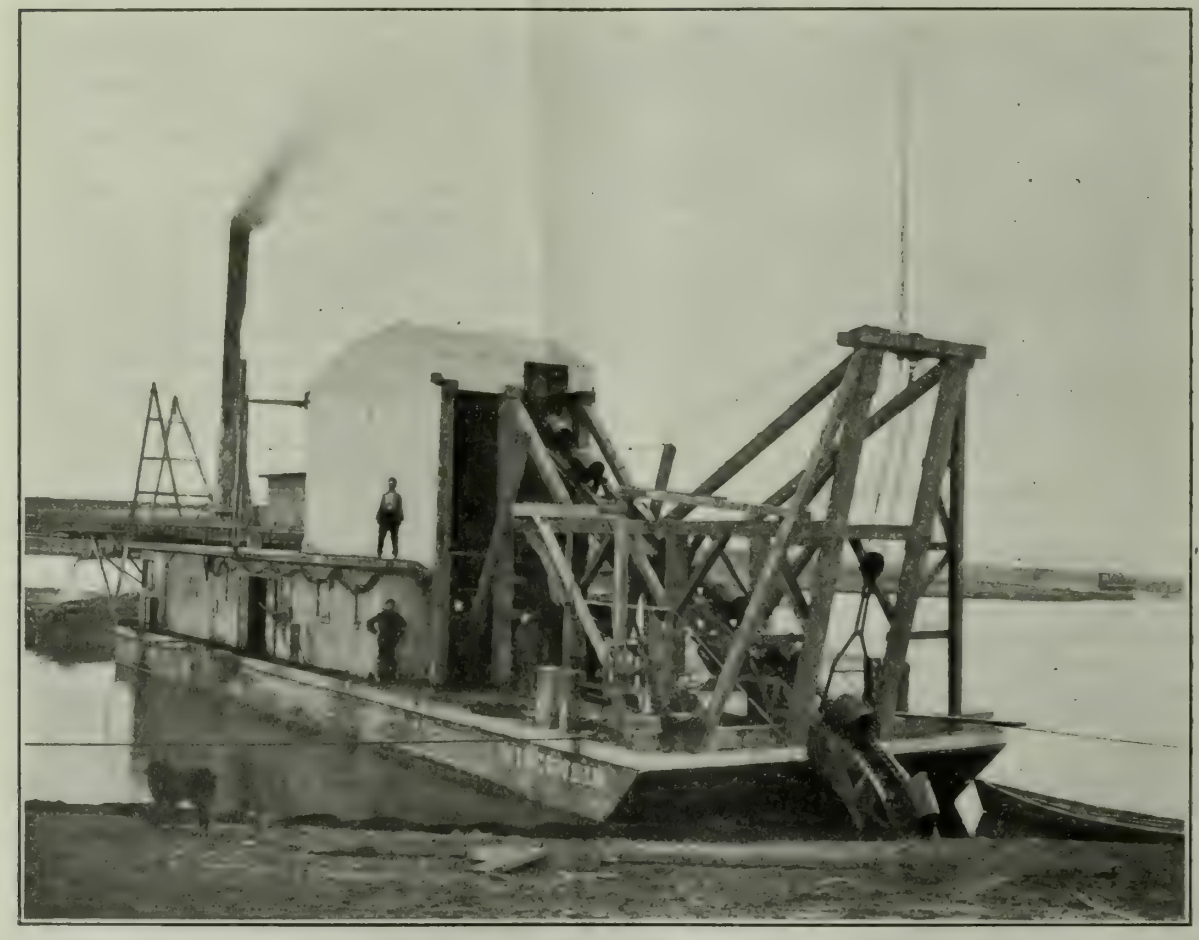
By Charles Janin

Gold dredging has become the most important branch of the mining industry on the Seward peninsula. This is due in part to the almost total cessation of winter drift mining and the decrease in the number of mining operations except dredging. The dredges operating in 1910 had, with some exceptions, a successful season and greatly encouraged further construction. In 1910, 16 dredges were operating on the Seward peninsula, in 1911 there were 22 at work, and during 1912 there were working, or in various stages of construction, 39 dredges in all, though some of these will not be finished until 1913.

The first dredge to operate on the Seward peninsula was the Wisconsin, which was put on the Snake river, near Nome, in 1899. This was not a financial success and did not operate long, but the dredge is still in existence. I photographed the boat when in Nome, but it is more interesting to show evidence that the dredge really operated, so I secured the picture reproduced here showing the old boat in action. A dredge operator told me that previously to putting a dredge on his property he had serious thoughts of buying and repairing the Wisconsin. The owners, however, fortunately for him, asked more for the old boat than he was willing to pay. With the practical experience gained from operating his present dredge he now congratulates himself that he did not 'fall' for the Wisconsin. Around Nome there are the remains of many peculiar machines which were designed to win gold from the beach or creek gravels, that serve to show the ignorance and optimism of the first arrivals as well as the credulity of the investors in these enterprises.

One of the most interesting of these various contrivances is that shown in the accompanying illustration. One can picture the machine charging down the beach into the surf, dropping the goose-neck suction arrangement, and then commencing to "draw the yellow metal," the man in charge keeping one eye seaward ready to up anchor and away at indications of heavy breakers. Needless to say, the yellow metal secured by such machines was obtained by using them as a magnet to draw it from the pocketbook of the credulous investor, yet I understand that a machine of similar type is now being built at Nome.

While, as in other localities, numerous failures marked many of the early dredge installations, and while a number of the dredges now operating are not a financial success, dredging at the present time is the most important factor in the gold production of the Seward peninsula, the total gold production for 1911 being $3,100,000, of which nearly one-half was won from dredging operations; during 1913 a number of additional boats will probably be arranged for, and it may be expected that a still larger proportion of the total gold production will be obtained from the dredges.



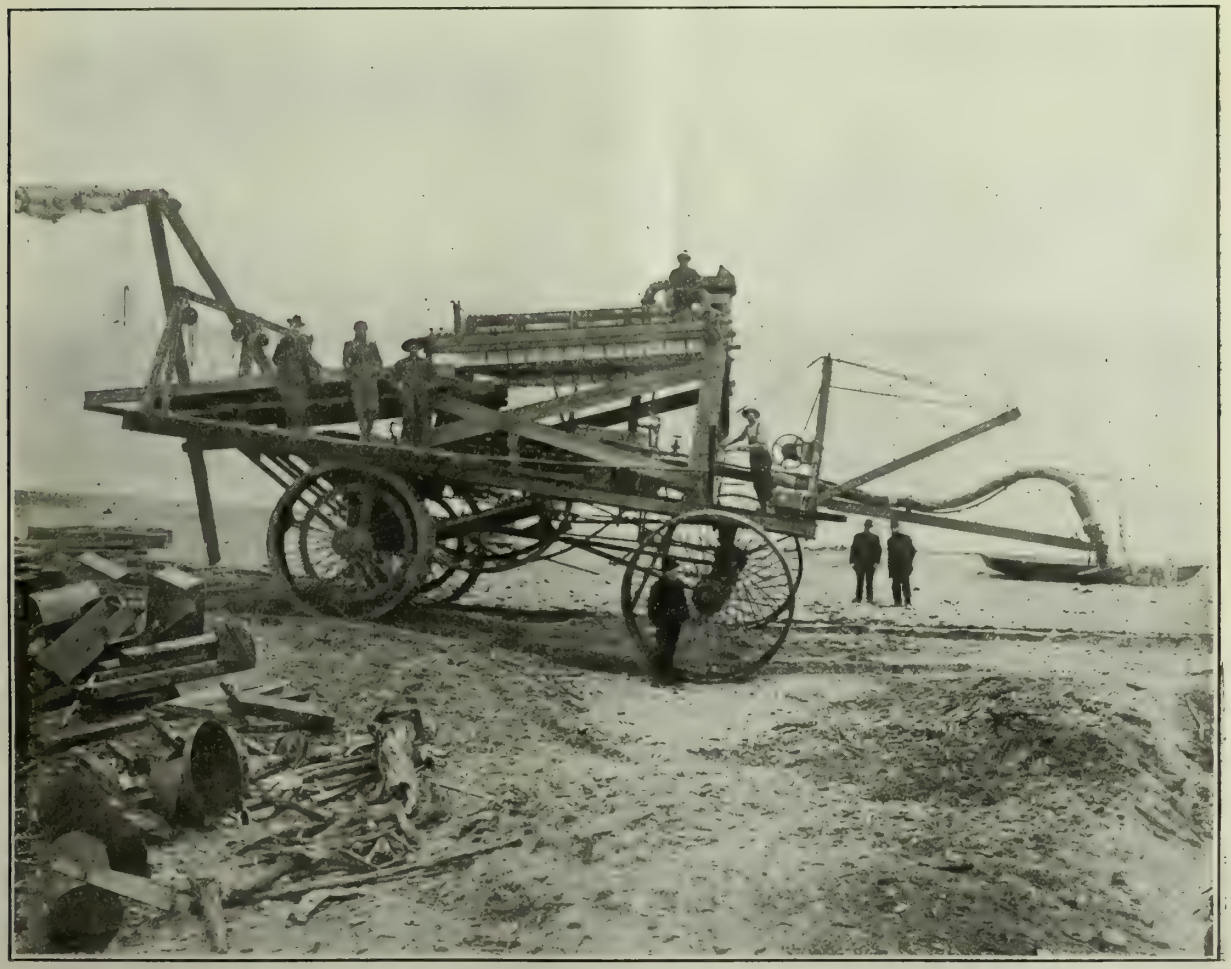
WISCONSIN DREDGE IN ACTION.

Although practically all the mineral production of the Seward peninsula is derived from gold placers, some profit has been made from the tin placers on Buck creek, and the dredge of the York Dredging Co. is a profitable enterprise. This enterprise has been described by H. G. Peake (*Mining and Scientific Press*, p. 652, 1911).

Dredges start about June 15, or shortly after the arrival of the first steamers in Nome, and stop at the close of the season, in time for the crew to leave on the last boat out.

Those dredges employing local men start a little earlier in the season and work a few weeks later, but one of the operators, who started his dredge in May, stated that he thought there was little profit to be made by starting before the spring frost was out of the ground. Some of the reasons for the failure of certain dredges may be mentioned: (1) the ground too low in gold content, (2) too small an area to warrant an expensive plant, (3) frozen ground too deep for economical thawing, (4) building a dredge on property that has not been prospected, (5) high power cost, and (6) poor management; which also probably covers several if not all of the items above.

DREDGING FIELDS NEAR NOME.



A FEARSOME GOLD EXTRACTOR.

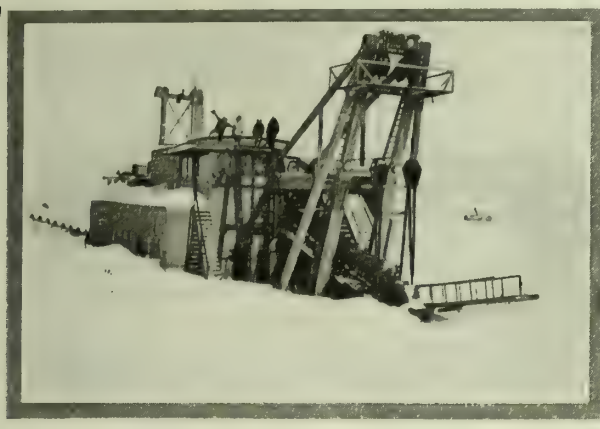
TABLE OF DREDGES OPERATING ON THE SEWARD PENINSULA.

Map No.	Name.	Size of Buckets.	Location.	Fuel Used. Kind.	Fuel Used. Consumption Daily.	Hp.	Av. Daily Capacity. (cu. yd.)	Builder.	Manager.
1.	York Drg. Co. (a)	2¾	Buck creek (c)	distillate	165 gal.	87	900	Union Construction Co.	McDonald & Johnson
*2.	Kelliher (a)	2¾	Kougarok	distillate		100	....	Union Iron Works	Dan. Kelliher
*3.	Budd Creek G. D. Co. (a)	3	Budd creek	distillate		...	....	Union Construction Co.	Hugo Johnstone
*4.	Anglo Alaska G. D. Co. (a)	2	Joe creek	distillate		...	....	I. B. Hammond	Geo. Pidduck
5.	Nome Montana (a)	5	Shovel creek	coal	5 tons	120	1200	Risdon	Dr. Ramsey
6.	Kimball No. 2 (a)	2½	Shovel creek (d)	distillate	120	60	900	Kimball & Saupe	C. Kimball
7.	Seward G. D. Co. or Three Friends (b)	5	Solomon river	coal (o)	12 to 17 tons	230	2000	Western Engineering Co., Bucyrus Mchy.	Webb & Halla
8.	Siverson No. 1 (a)	1½	Solomon river	coal	2½ tons	230	600	I. B. Hammond	Siverson & Johnson
9.	Flodin No. 1 (a)	2½	Solomon river	coal	3 tons	100	900	Risdon	C. Flodin
10.	Siverson No. 2 (a)	2½	Solomon river	coal (o)	3 tons	100	900	Risdon	Siverson & Johnson
11.	Solomon G. D. Co. (b)	3	Solomon river	coal (o)	7 tons	160	1800	Bucyrus	Mr. Mallock
*12.	Flodin No. 2 (a)	2½	Solomon river (d)	distillate	120	60	....	Kimball & Saupe	C. Flodin
*13.	Shovel Creek (a)	2¾	Shovel creek	distillate		100(?)	....	Yuba	Corey C. Brayton
14.	Mulligan (a)	1	West creek (E)			...	....	I. B. Hammond	
15.	Casadepaga G. D. Co. (a)	2½	Willow creek	distillate	160 gal.	100	800	Union Construction Co.	Mr. Beardsley
*16.	Ruby Gold D. Co. (a)	2½	Casadepaga (d)	distillate		(?)	....	Union Construction Co.	Gaylord & Grigsby
17.	Blue Goose (a)	5	Ophir	wood	12 cords	160	1000	Reconstructed, originally, I. B. Hammond.	Dr. Kittleson
18.	Kimball No. 1 (a)	2¼	Ophir (d)	distillate	120 gal.	60	800	Kimball & Saupe	Julius Saupe
19.	Wild Goose (b)	3½	Ophir	distillate	300	140	1800	Yuba	Gilbert Russell
20.	Lubbe (a)	2½	Mystery (d)	distillate	150	85	800	Union Iron Works	Chas. Lubbe
21.	Warm Creek G. D. Co. (a)	2½	Warm creek	distillate	120	90	800	Byron Jackson	A. E. Wellington
22.	Council Gold D. Co. (a)	2½	Gold Bottom	distillate	120	90	800	Jackson, reconstructed	W. M. Withers
23.	Bourbon dredge (a)	9	Bourbon creek	electric (j)		300(?)	1000	Ed. L. Smith (?)	E. E. Powell
24.	Wonder dredge (a)	7	Wonder creek	electric (j)		275(?)	1200	Reconstructed	E. E. Powell
25.	Plein G. D. Co. (a)	3½	Otter creek	crude oil	11 bbl.	130	800	Risdon	Mr. Plein
26.	Sioux Alaska (a)	2¾	Morse gulch	distillate	160 gal.	85	750	Northern Construction Co.	Colin Murray
27.	Arctic G. D. Co. (a)	2½	Grass creek (E)	distillate	160 gal.	90	800	Northern Construction Co.	Frank Middaugh
28.	Julian G. D. Co. (a)	3	Osborn creek	distillate	190 gal.	100	1100	Union Construction Co.	V. A. Julien
29.	Dry Creek or Gold Beach (a)	5	Osborn creek	crude oil	12 to 24 drums.	160	1200	Reconstructed, originally, I. B. Hammond.	J. Montgomery
30.	Saunders Creek D. Co. (a)	3½	Hasting's creek	distillate	200 gal.	140	1000	I. B. Hammond, Bucyrus buckets	Andy Anderson
*31.	Flat Creek (a)	10	Flat creek	electricity		...	....	Ed. L. Smith	E. E. Powell
*32.	Nome Gold Gravel Co.	10	Cripple river			...	....	Ed. L. Smith	E. R. Jordan
*33.	Candle Creek (a)	2	Candle creek (d)	distillate		...	....	Union Construction Co.	Sundquist & Pearce
*34.	Inmachuck G. D. Co. (a)	3	Inmachuck (d)	distillate		...	....	Union Construction Co.	Hogandorn & Johnson
*35.	Hank Freeze (a)	2	American (d)	distillate		...	....	Banard	Hank Freeze
**36.	4 Holyoke	9	Holyoke	distillate		...	....	Ed. L. Smith	Greenberg & E. R. Jordan
*37.	Ernst Arctic G. D. Co. (a)	1¾	Beach at Nome (d)	distillate		...	....	Banard, erected by Union Con. Co.	Ernst Bros.
**38.	Pasadena G. D. Co. (a)	3	Budd creek	distillate		100	....	Union Construction Co.	J. D. Campbell
**39.	Iver Johnson	3	Inmachuck	distillate				Union Construction Co.	Iver Johnson

*New dredge finished 1912 or still under construction.
**Proposed dredge.
(a) Open-connected.
(b) Close-connected.
(c) Tin dredge.
(d) Flume dredge.
(E) Not operating.
(o) Have changed fuel to oil this summer, but not sufficient data obtainable as to results of new fuel.
(j) Power generated from oil.

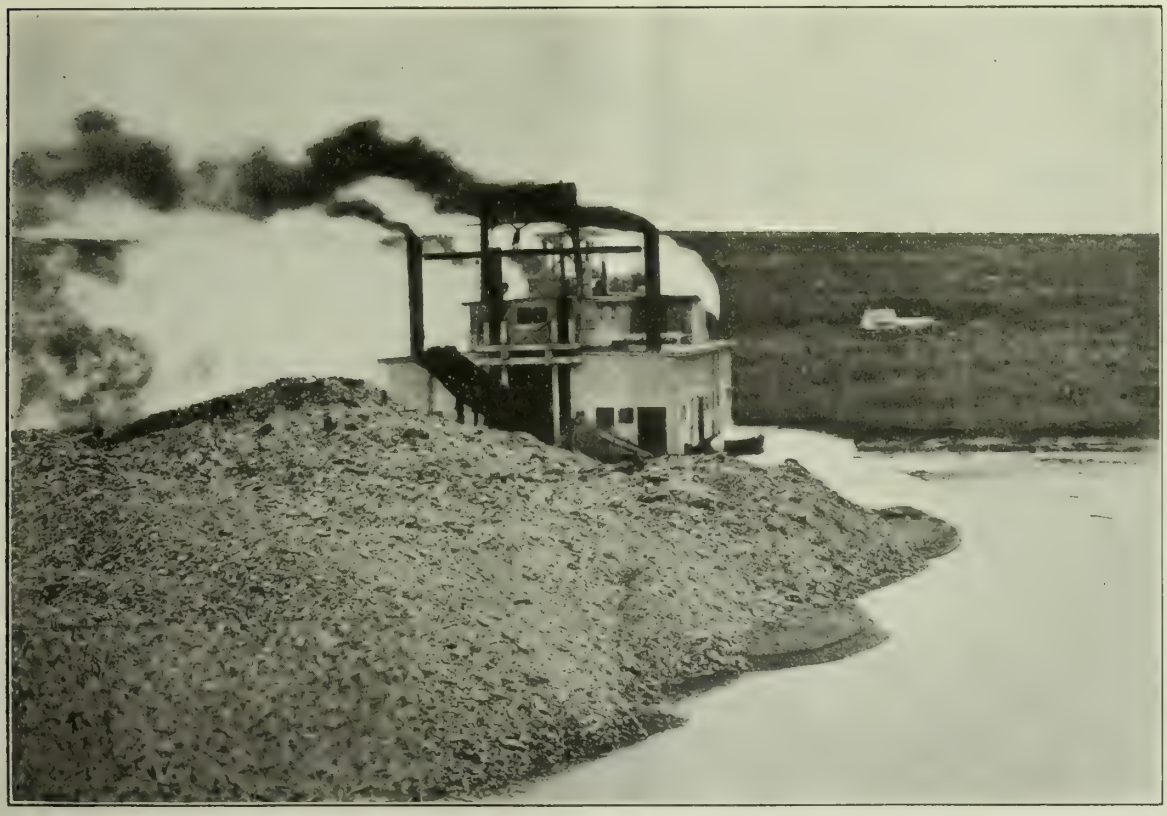
To the man shoveling gravel into a sluice-box, a few acres undoubtedly looks like a large piece of ground, and probably seems sufficient to warrant building a dredge, but some of the dredges built in Alaska seem as large as the property for which they were constructed. This is a disadvantage that has been overcome, in one instance at least, when there was another property in the vicinity to which the dredge could be moved after working out the first area. Moving a dredge is not generally considered a simple matter by those accustomed to the heavy California type dredge, built to dig ground 30 to 60 ft. deep. With the flume dredge, that has been proved successful on shallow ground under favorable conditions in Alaska, it is a different matter. The Kimball & Saupe dredge operating on Melsing creek worked out the property for which it was built, and the owners moved the boat to 24 Ophir, about ten miles distant. The total cost of moving and reconstruction, according to the owners, was approximately $3000, which seems a low figure for the work involved. This is an important feature in dredge construction in the Far North, and one that is readily appreciated by those familiar with conditions there. The flume dredge is simple in construction and works well where the gravel is easily washed. Mr. Saupe expects to build a dredge better adapted to frequent moves, and which can be used to advantage on areas otherwise too small for the individual dredge, but containing sufficient gold to make such a procedure profitable.

A problem that has attracted much attention in recent years is the possibility of commercially thawing the deep ground; occasionally items appear in the technical and daily papers to the effect that a dredge is to be built to work ground in Alaska from 60 to 100 ft. deep; one such item of 'news' being of recent occurrence. Most of the ground this dredge is intended to work is permanently frozen, and as the gold content claimed is only 39c. per cubic yard, it is not difficult to prophesy the ultimate result of the enterprise. Thawing shallow frozen ground, from 14 to 25 ft. deep, for dredging is successfully done in the Yukon, and in a small way in the Seward peninsula. Some time ago the Blue Goose company on Ophir were obliged to thaw occasional small spots of frozen ground ahead of the dredge. The cost of doing this, according to Gilbert Russell, who was then manager, was 40c. per cubic yard. Blasting was tried, but was successful only where small patches of frozen ground overlay thawed ground. State-



BOURBON DREDGE SNOWED IN.

KIMBALL No. 2 FLUME DREDGE.



THREE FRIENDS DREDGE, BUILT BY WESTERN ENGINEERING & CONSTRUCTION CO., AND EQUIPPED BY THE BUCYRUS CO.

ments have been made by interested parties to the effect that permanently frozen ground 50 ft. deep near Nome had been successfully thawed and dredged, but this I found out was not the case. The only place where thawing is carried on ahead of dredging near Nome was that done by Mr. Plein on Otter creek. Mr. Plein uses a 35-hp. boiler, which supplies 18 points and consumes 330 gal. of crude oil per day; oil costs $3 per barrel delivered. The ground being thawed at the time I visited the dredge was from 6 to 8 ft. deep, and the cost of thawing, according to Mr. Plein, was 20c. per cubic yard. With greater depth it becomes increasingly difficult to penetrate the ground with the steam-points, and in districts with higher fuel costs the expense of thawing would be proportionately increased.

One would think that by this time investors would have become sufficiently enlightened to demand that a property be prospected before purchasing a dredge, but this is not always the case. In fact, in Alaska it seems to be the exception and not the rule to prospect a property thoroughly; the parties interested evidently preferring to do their prospecting with the dredge, as in several areas in Seward peninsula practically the only prospecting was done after the dredge was built. By some miracle, one of the dredges so installed, I have been told, happened to be on ground containing sufficient gold to pay operating expenses, but it is doubtful if the return of the investment will be secured. To say the least, the policy of prospecting the ground with a dredge cannot be considered good practice, and cannot be too strongly condemned. The number of failures in Alaska dredging should impress the investor of the future that ground should be first thoroughly prospected by a competent engineer before a dredge is constructed. The larger dredge construction companies are recognizing this, and do not encourage the drawing of hasty conclusions about a property. The two largest dredge concerns in the United States have had an engineer investigating this field, and making a study of the obstacles that must be overcome to make dredging a success. The fuel problem is a matter of great importance, and the high cost of fuel at the dredge accounts, in great measure, for the high operating cost as compared to dredges in more favored districts. In Alaska, as elsewhere, the operating cost is not always freely given by the operator, who at times is himself ignorant of the real cost of operating his boat. In the matter of yardage handled by the boat, the man in charge is sometimes gifted with a generous imagination; one operator claiming a capacity for his dredge in excess of the theoretical capacity of the buckets. It is not to be wondered that operators getting such yardage as this sometimes obtain a low operating cost per cubic yard.

All dredge operators in Alaska are not, however, of the class mentioned. Some discuss questions of cost freely and are constantly trying to improve methods. Some facts that militate against low costs are the short operating season, the high wages paid, the scarcity of good men, and the inexperience of those in charge, a number of instances where considerable saving could be effected being noticed on some of the dredges visited. Few dredges keep yardage records by bank measurement, and itemized expense accounts; none that I saw attempt to figure depreciation, and as for amortization, there are some operators who do not understand what the word means, much less how to make use of the principle.

To show the difference in power costs in the Far North as compared to California fields, the following will be of interest: In a table* I prepared, showing operating costs of dredges in California, the cost of power for dredges using electricity ranges from 0.41 to 2.02c. per cubic yard, the latter being that of a 5-ft. boat working on partly cemented gravel. On the Seward peninsula electricity is available for only two operating dredges, the Bourbon and the Wonder, being generated at an oil-burning plant on the Bourbon property. Figures of power cost were not obtained from these boats, if indeed they are kept; the enterprise not being a financial success, and one that has been subject to considerable criticism in the past. Various schemes have been proposed to generate power at a central station for dredges in the vicinity of Nome, but nothing beyond the Bourbon plant has been attempted. Some of these schemes involved using a steam plant, while others were more ambitious and were based on the utilization of water-power at a considerable distance, with long transmission lines to the Nome district. When a company is operating only one dredge the installation of a plant to generate electricity is rarely feasible, and it is doubtful if at the present time a central plant to generate electricity would be a profitable enterprise.

The use of gas-engines has demonstrated that a great saving can be made in the cost of fuel compared to dredges using coal, wood, or crude oil when transportation for any distance from the seaport is necessary. Several boats have been changed from coal to oil-burners this summer, and a considerable reduction in the fuel costs is expected. The new arrangement has not been in operation, however, long enough to obtain figures of any value.

I have shown in the table accompanying this article the approximate amount of fuel used by the different dredges, but the following more fully elaborates the matter. In making comparisons with outside dredges it must be borne in mind that these are not power costs, but fuel costs only, as they do not include labor, etc. The Plein dredge burns 14 bbl. of oil per day, at a cost of $3 per bbl. at the dredge. With an average daily capacity of 800 yd., the cost for fuel thus indicated is 5.25c. per cubic yard handled. The operating costs of this dredge, according to Mr. Plein, were 16c. per yard, with thawing costs of 20c. per yard additional. The Three Friends dredge has the unenviable record of having the highest fuel costs on the peninsula, with the exception of the Osborne Creek boat, but not excepting the wood-burning Blue Goose. The reason for this was that the Three Friends boat, through a mistaken idea of economy at the time it was built, was equipped with slide-valve engines and locomotive boilers. The coal consumption varied from 12 to 17 tons daily, costing about $22 per ton at the dredge. Accepting 14 tons at $22 as an average daily consumption, the fuel cost is $308. The average daily yardage for 1911 was 2000 cu. yd., so the fuel cost thus indicated was 15.4c. per cubic yard. The total operating costs are not made public, but were said by some one familiar with company details to have been in excess of 35c. per cubic yard. This year the management changed to oil fuel, and had just installed oil burners the day I visited the dredge. A considerable saving in fuel costs is expected, but in my opinion a more economical arrangement would be for the company to dump the fuel-eating locomotive boilers overboard and put in suitable up-to-date machinery.

The Solomon dredge, which has a capacity somewhere approaching that of the Three Friends dredge, but is a better equipped boat, handled an average of 1800 yd. per day for 1911. This dredge consumed 7 tons of coal per day at $27 per ton, or $189, representing a fuel cost of 10.5c. per cubic yard. This dredge has also been changed to use oil for fuel, and a considerable saving is computed by the manager, who states that oil could be delivered to the dredge for $4 or less per barrel, on account of an arrangement entered into with the Three Friends company, whereby the two companies erected a storage-tank at Solomon and arranged to buy a considerable quantity of oil at a time, thus securing more favorable prices. The Nome Montana fuel cost, as computed, is approximately the same as that of the Solomon. The Blue Goose dredge burns from 7 to 10 cords of wood, costing $12.75 per cord. The dredge averages 800 to 1000 yd. per day; assuming a fuel consumption of 10 cords and the yardage handled at 1000, the cost per cubic yard for fuel would be 12.7c. The Blue Goose is one of the most interesting dredges on the peninsula. Originally built by I. B. Hammond, it has been completely overhauled until the equipment bears but little resemblance to that of the original boat. It has so-called 5-ft. open-connected buckets which, however, are only about 4 cu. ft. actual capacity; the buckets dump into a hopper feeding a sluice

*_Mining and Scientific Press_, July 30, 1910.

22 ft. long, fitted with cast iron riffles, which catch about 65% of the gold recovered. From the sluice the gravel passes to two shaking screens placed tandem, each 15 ft. long, and from these screens to a belt-conveyor tailing-stacker. One of the most agreeable features of the dredge to the visitor as well as the crew is the cuisine, a veritable Hamburg-American service directly on the boat. Here I enjoyed the best meal I had during my stay on the peninsula. Tom, the Japanese cook, is allowed $1.50 per day for food, and seems to exercise rare judgment in catering. No complaints of the food served are heard on the Blue Goose, which differs in this respect from some of the mining camps I visited.

The Wild Goose dredge burns about 300 gal. of distillate, costing 25c. per gallon. With an average of 1800 cu. yd. per day a fuel cost of 4.2c. per yard is indicated. The Wild Goose is the most successful dredge on the peninsula. It has a 3½-ft. close-connected bucket-line and was built by the Yuba Construction Co. Some difficulty has been experienced with the engines, but they have been thoroughly overhauled this year and some other changes made, among which may be mentioned an 8-ft. extension to the dredge ladder.

The Osborn Creek dredge was first built on Lower Dry creek at Nome. This ground had not been prospected before the dredge was built; a too frequent practice mentioned elsewhere. When the boat was ready to run it was found that a great part of the ground was permanently frozen and too low grade for profitable dredging. The dredge was afterward moved to Osborn creek, about 12 miles distant. The machinery was first removed and the hull sawed in half and hauled in sections. A section weighed 55 tons and was drawn by 66 horses. This dredge has not been a profitable enterprise, and is in the hands of a receiver appointed for the benefit of its creditors. The fuel cost, as mentioned previously, has been the highest on the peninsula, due in most part to inefficient handling. Two locomotive boilers supply power, and crude oil is burned. The consumption, or rather the consumption plus loss, was 1 drum of oil, costing $15, per hour when running; two teams would not have been sufficient to keep the dredge supplied with oil had it not been for the frequent stoppages of the boat. The company engaged William Colley, one of the Union Construction company's superintendents, to overhaul the oil-burning apparatus this summer, with the result that a saving of about 40% in the fuel used was effected. Other fuel costs could be quoted, but these examples serve to illustrate the different fuel costs and the advantage of distillate over coal, wood, or crude oil. The small dredges burn about 120 to 190 gal. of distillate per day, their fuel cost ranging from 4c. per cubic yard up, according to the capacity of the dredge and the price paid for oil. Some operators purchase their oil in cases, and others in drums; the case oil is more expensive, and is subject to a higher percentage of loss through leaks, while shipping in drums necessitates an initial outlay for the drums.

The matter of freight, as stated elsewhere, is a serious problem. Summer freight costs, according to the principal dredge constructor, in Alaska can be figured roughly at $1 per ton per mile. Fuel oil in drums is figured by freighters as 2 drums to the ton, and in cases at 25 cases to the ton, the one being 0.45c. per mile per gallon, the other 0.4c. Distillate costs in San Francisco approximately 9c. per gallon in drums and 16c. in cases, $8 being charged for the drum and rebated on its return. Steamer freight charges on oil are the same whether shipped in drums or cases.

In addition to the placer examinations on which I was engaged, there were a number of other examining and prospecting parties in different localities, and there are several proposed dredge installations on the Seward peninsula other than those I have noted in the table. Aside from those dredges that have been built for property unsuited for dredging, the results for 1912 will probably encourage further dredge equipment, and if the intending investors awake to the fact that a property should be thoroughly prospected before contracting for a dredge, there is every reason to believe that a number of successful enterprises for small dredges will be developed in the future.

Geological Field Work in Alaska

The delay in passing the appropriation bill has made it impossible for the United States Geological Survey to carry out all the field plans for Alaska that had been formulated for 1912, but the funds that became available by emergency appropriations made it possible to dispatch several of the smaller parties for a full season's work, and others started for Alaska as promptly as the appropriation permitted.

In southeastern Alaska the Survey proposes this year to study the gypsum and marble deposits. E. F. Burchard, who sailed from Seattle about the first of September, has been put in charge of this work and will visit the marble deposits near Wrangell and at the north end of Prince of Wales island.

Detailed surveys are being made of the west end of the Chitina copper belt, where important discoveries of ore have been made. A topographic survey of this field was begun on July 15 by D. C. Witherspoon and will be continued up to the close of the field season. The study of the geology and mineral resources of this district is being undertaken by F. H. Moffit, assisted by Theodore Chapin and J. B. Mertie, Jr. Mr. Chapin has been working with Mr. Witherspoon. Messrs. Moffit and Mertie sailed for Cordova on the first of September.

A detailed survey of the copper-bearing region adjacent to Galena and Landlocked bays is also being made this summer by R. H. Sargent and C. E. Giffen, who are engaged in making the topographic base map of this district, beginning work about the first of September. The geology of the same region is being studied by S. R. Capps and B. L. Johnson. G. C. Martin, who was detailed to make a study in the northern part of Kodiak island, reached Kodiak on the first of July. He spent six weeks in investigating the volcanic phenomena. On the completion of the investigation Mr. Martin undertook a preliminary examination of the mineral deposits of the western part of Kodiak island.

The discovery of gold in the Ruby Creek district and the large gold production from the Iditarod district made it imperative that the Geological Survey continue its investigation of this field, and H. M. Eakin was detailed for this purpose. He arrived at Ruby Creek about the middle of July and later extended his work southward to the Iditarod district.

For a number of years the Geological Survey has been investigating the water supply available for placer mining in the Yukon-Tanana region. This year R. W. Davenport was detailed to investigate the water resources of the Forty-mile district, and C. E. Ellsworth those of the Birch Creek and Fairbanks districts. This work was begun about the first of May and will be continued to the end of the open season. The important developments in lode mining in the Fairbanks district making it desirable to supplement the detailed survey already made of this field, Philip S. Smith was intrusted with this investigation. He arrived at Fairbanks about the first week in September, and it is hoped that he will be able to study most of the important discoveries of auriferous quartz in the district.

Through the courtesy of the United States Commissioner of the International Boundary Survey, a geologist was permitted to accompany the parties which are surveying the boundary north of the Porcupine river. A. G. Maddren was detailed for this purpose and accompanied the boundary party, which reached its field of operations about the first of June. It has just been announced that the survey through to the Arctic coast has been completed. Alfred H. Brooks, geologist in charge of the Alaska division of the United States Geological Survey, has been appointed a member of the Alaskan Railroad Commission, and is now en route to Alaska.

Prospecting for Chromium Ore

By W. C. Phalen

*Chromite or chromic iron ore is the only important source of the element chromium. The metal chromium is known, however, as a minor constituent in many other minerals, among which may be mentioned certain varieties of spinel (picotite, $(MgFe)O.(AlCr)_2O_3$), garnet (uvarovite, $3CaO.(AlCr)_2O_3.3SiO_2$), muscovite (fuchsite, chrome glimmer), beryl (emerald, $3BeO.Al_2O_3.6SiO_2.nCr_2O_3$), chrome diopside, and clinochlore. In these minerals chromic oxide (Cr_2O_3) is isomorphous with alumina (Al_2O_3) or ferric oxide (Fe_2O_3). Among the chromates, chrocoite ($PbO.CrO_3$) is the commonest, but other chromates are known, for example phoenichrocoite ($3PbO.2CrO_3$), vauquelinite ($2(PbCu)O.CrO_3(PbCu)O.P_2O_5$), and chromates of certain of the metals of the caustic alkali and alkaline earth groups.

Chromite, the commercial source of chromium, is theoretically a mixture of chromic oxide and ferrous oxide with the symbol $FeO.Cr_2O_3$. Theoretically it contains 68% of the former and 32% of the latter oxide. The two oxides may be present, however, in widely varying proportions. The percentage of chromic oxide may range from 40 to 60, or it may run as low as 10; the percentage of ferrous oxide may range from 10 to 50. Alumina and magnesia are usually present in the ore, sometimes in considerable amounts, the former replacing the chromic oxide and the magnesia replacing the ferrous oxide.

Properties and Tests.—The mineral chromite is iron-black to brownish black in color and has a brown streak. It has a metallic or sub-metallic lustre, but in some determinative mineralogies it is classified with minerals having both a non-metallic and a metallic lustre. It is infusible, or at most only the finest particles or sharp edges of the mineral are rounded before the blowpipe. It is not readily attracted by the magnet, if at all, but a little of the mineral when finely powdered and mixed with an equal amount of carbonate of soda and intensely heated on charcoal forms a mass which is attracted by the magnet. The mineral imparts a green color to the borax or salt of phosphorus beads. The cleavage or fracture of the mineral is uneven. Its hardness is 5.5; its specific gravity 4.2. It crystallizes in the isometric system. A knowledge of the above properties should make the determination of the mineral a matter of little difficulty either in the field or in the laboratory, to the prospector supplied with a simple blowpipe outfit.

Occurrence

The mineral chromite occurs disseminated in basic eruptive rocks of the peridotite, amphibolite, and pyroxenite groups, and particularly in the serpentine and talcose products resulting from their alteration. Since this is the rule, and practically without exception, it is in these classes of rocks that effort should be expended in searching for new occurrences of the mineral. Chromite is widely distributed through areas of serpentine and associated basic rocks in different parts of the United States. Serpentine areas in the United States have been found in a few localities in the old metamorphic rocks which stretch from New England to Georgia; at various points in the Rocky Mountain region; throughout the extent of the Sierra Nevada and Coast ranges in California, and at a few places in the Cascade mountains. The mineral occurs widely disseminated through many of these areas, but it is concentrated into workable quantities only locally. In the United States deposits of chromic iron ore are found in Massachusetts, Pennsylvania, Maryland, North Carolina, Wyoming, California, and in the black sands of the Pacific Coast. In the last few years chromite has been produced mainly in New Caledonia, Rhodesia, Asia Minor, Russia, Greece, Canada, India, Japan, and other countries.

Massachusetts.—In Massachusetts chromite occurs disseminated in the serpentine phases of amphibolite in Hampshire and Hampden counties near the Berkshire county line. No orebodies of commercial importance have as yet been found.

Pennsylvania and Maryland.—In southern Pennsylvania and northern Maryland numerous areas or bands of serpentine are found in a belt running northeast and southwest and extending from Delaware county, Pennsylvania, through Chester and Lancaster counties in the same state, and through Cecil, Harford, and Baltimore counties, Maryland. This serpentine contains considerable chromite disseminated and in the form of lenticular bodies. As the serpentine disintegrates, the chromic iron ore collects as sand and gravel along the streams. These stream deposits and the solid ore lenses have yielded considerable ore where mined in southeastern Lancaster county, Pennsylvania, near the state line in Harford county, Maryland, and in Baltimore county, Maryland.

North Carolina.—In western North Carolina chromite occurs associated with dunite (simple olivine rock) in Watauga, Yancey, Madison, Buncombe, and Jackson counties. The chromite generally occurs as small grains disseminated through the dunite, but a few important deposits have been found. The mineral is found as small disseminated grains and as balls and nodules of various sizes, only the latter type being of importance as ore. One of the larger deposits north of Burnsville, Yancey county, was 3 ft. in its greatest diameter, while another, southwest of the town, contained several tons of ore.

Wyoming.—A deposit of chromite is known in Deer Creek canyon, Converse county, Wyoming, about 15 miles southwest of Glenrock. The orebody is lens-shaped and occurs in serpentine in a box canyon on the northern slope of the Laramie hills.

California.—In California chromite is now known to occur in a large number of counties, and in 1911 it was reported as having been mined in three, namely, Shasta, Siskiyou, and Tehama counties. An occurrence of chromite in Shasta county is situated in the western part of the county on Shotgun creek, but the serpentine in which it occurs extends as far south as Slate creek. At the forks of Shotgun creek, about a mile from the Southern Pacific railway, a series of lenticular chromite bodies occur in a somewhat indefinite shear zone which is vertical and courses S. 40° W. through the serpentine. Five bodies connected with more or less distinct vein-like leaders have been mined. The ore generally separates easily from the serpentine, but in places it is firmly 'frozen' to it. Other parallel zones have been found in the same region. An incomplete analysis of the material gave 43.87% chromic oxide.[1]

A belt of serpentine having an approximately north-south strike runs through the southwestern part of Tehama county and the northwestern part of Glenn county. The belt is on the lower eastern slope of the Coast range, called Yolla Bolly mountains. Chromite float is found in this serpentine in a number of places. Mining operations have been conducted on the north fork of Elder creek in Tehama county, and at the Black Diamond mine near Newville, Glenn county. The ore shipped from the Tehama county locality was on the basis of 47% chromic oxide as a minimum. The Black Diamond mine has also yielded considerable ore.

In Siskiyou county considerable chromite float in relatively small pieces has been found in serpentine near the top of the Forest mountains. Chromite float has also been reported from 10 miles southwest of Gazelle in the same county.

Many years ago chromite ore was shipped from San Luis Obispo county in considerable amount. The chromite ore occurs in irregular pockets and stringers in serpentine which is deeply disintegrated in most places. The ore was obtained from this disintegrated material. Owing to

*Published with the permission of the Director of the U. S. Geological Survey.

[1]Diller, J. S. Redding folio No. 138, Geologic Atlas, U. S. Geol. Survey, 1906.

the way in which the ore occurred, mining was mostly surface work and many pits were scattered over the area. The principal mines were eight or nine miles north of the town of San Luis Obispo in the serpentine hills of the Santa Lucia mountains. Other mines were west and southwest of San Luis Obispo in the Los Osos mountains. In the northwestern part of the county on the western slope of Pine mountain chromite occurs under similar conditions. The cost of mining the ore found in San Luis Obispo county was somewhat high owing to its occurrence in relatively small pockets disseminated through the serpentine.

In addition to the occurrences mentioned above, chromite is known in other counties in California, among which are Alameda, Amador, Butte, Calaveras, Del Norte, Eldorado, Fresno, Mendocino, Napa, Placer, Plumas, San Benito, Santa Clara, Sierra, Sonoma, Trinity, and Tuolumne.

Rhodesia.—Rhodesia and New Caledonia are the two countries producing most of the chromic iron ore at the present time, and are also the countries in which development seems most promising. The Rhodesian deposits may be cheaply mined and shipped to seaport at a low rate, so that their production has increased rapidly, notwithstanding their remoteness from market and the fact that the production of chromic iron ore has been somewhat irregular during recent years. The important deposit of chromic iron ore occurring at Selukwe, Rhodesia, is a huge segregated mass associated with serpentine. It is easily mined, the supply is large, the cost of mining is low, and the deposit is in close proximity to the railway. Hence the production has increased rapidly, notwithstanding the remoteness of the deposits from market. Chromite is known in other parts of southern Rhodesia—for example, at Victoria, Makwiro, and Lomagundi—and it is not unlikely that these deposits contain large bodies of ore. The chromic oxide content of these ores varies and is sometimes low, as at Makwiro. The deposits appear to be connected with the great intrusion of picrite which runs north and south through southern Rhodesia from the Zambesi river almost to the Limpopo, and is marginally altered to serpentine in several places.

New Caledonia.—A large part of the world's present production of chromic iron ore comes from New Caledonia, a French possession, east of Australia. The mineral was discovered there in the early seventies. In the deposits in the southern part of the island the ore occurs: (1) as rich, soft, and easily broken masses in a ferruginous clay, and (2) in the forms of veins and masses in serpentine. The more friable ore, being the more easily separated from the country rock, is mainly sought after. The only chromic iron ore mine on the island which is worked below the surface, is the Lucky Hit in the group of mines to the south of Noumea. This ore as mined contains from 30 to 40% chromic oxide, and is concentrated mechanically to raise it to marketable quality. The largest deposits are in the northern part of the island around the Tiebaghi mine, the yield from which is approximately 4000 tons of ore per month, containing up to 67% chromic oxide.

Uses

The uses of chromium may be classified as chemical and metallurgical. Under the former is included its use in the manufacture of pigments, dyes, mordants, and in special tanning processes; under the latter its application as an ingredient in bricks and furnace linings and in the manufacture of special steel alloys. The element received its name from its tendency to form colored compounds. Among the chromium pigments are chrome green, Guignet's green, chrome yellow, chrome orange, and chrome red. Three chromium colors are used as dyes, namely, chrome yellow, chrome orange, and chrome green. Chromium salts, including chromates and bichromates, are used in the dyeing and printing of cotton, linen, and wool. They act as oxidizing agents and are reduced to chromic oxide, which is fixed on the fibre. The goods are then ready to hold the desired dye. Tanning with certain metallic salts, among which those of chromium are used, has become important for certain light leathers. Leather tanned with chromium salts is tough and resistant to moisture.

The mineral chromite itself is used for furnace linings in the form of brick made of crude chromite and coal-tar, which are held in place by tar mortar. Sometimes mixtures of chromite and other materials are used, and the chromite may be used in the crude form alone. Chromite seems to have several advantages for use in furnaces used for smelting lead, copper, antimony, and other metals, the slag from which rapidly attacks acid linings. Much, if not all, of the California chromite is used in the manufacture of furnace linings. The price of chrome bricks f.o.b. Pittsburg, Pennsylvania, was $175 per thousand in 1911. Chromic iron ore is used in making ferro-chromium employed in the manufacture of special steels, either alone or in combination with other steel-hardening metals like tungsten, manganese, and nickel.

Demand

The magnitude of the demand for chromite may best be ascertained from the domestic production—that is, the output of the domestic mines actually sold—and the importations. The production in 1911 in the United States came entirely from California and amounted to only 120 long tons, valued at $1629, or $13.57½ per long ton. The importations of ore were 37,540 long tons, valued at $407,958. There was imported besides, a small quantity of chromate and bichromate of potash, and chromic acid. Imported chromic iron ore from New Caledonia, carrying 50% chromic oxide, was quoted in New York during 1911 at from $14 to $16 per ton, this price being for carload lots and exclusive of cost of transportation. The ore is usually purchased on a basis of 50% chromic oxide, but when the percentage of the oxide exceeds this figure, the value of the ore rises in proportion.

Gold in the La Sal Mountains

By J. M. Hill

*The La Sal mountains are in the Colorado plateau region, which is characterized by long mesas cut by canyons 2000 to 2500 ft. deep, with steep cliffs 500 to 600 ft. high. Above this relatively level plateau, which has a general elevation of 8000 ft., the northern group of the mountains rises abruptly at Mount Waas to a height of 12,586 feet.

Two classes of mineral deposits are worked in the vicinity of Basin and Mesa. In the mountains there are several quartz-mining prospects and at least one locality where placer gold has been recovered. The quartz mines have made practically no production, and it is probable that $5000 would cover the entire output from both quartz and placer mining in the region.

The quartz prospects in the northern La Sal mountains are few in number and the value of the ore is low, even at the surface, where many gold-bearing deposits in other districts are enriched. The veins, so far as they can be seen, are small and contain much barren quartz. The high charges for transportation to the railroad at Cisco, ranging from $12 to $15 for outbound and $25 per ton for inbound freight, are an additional handicap.

The placers of Wilson Mesa are apparently of small extent. They contain only a small quantity of gravel, and all the gold in it cannot be saved by sluicing, because some of it is carried in boulders, which require some sort of crushing. They include so much material that surely carries nothing of value that it would hardly seem advisable to install expensive crushing and amalgamating machinery unless it were found practical to sort the ore from the waste by hand. Besides these unfavorable conditions, only a very small and uncertain supply of water is available for placer operations. The placers contain, however, some free gold that might be procured at a profit if the deposits are worked in a small way.

*From Bulletin 530-M, U. S. Geol. Survey.

Production and Allied Statistics, California Oilfields

By J. H. G. Wolf

Statistics present but dry facts, but when studied for their significance they exhibit the trend of an industry in an unmistakable way. The second of the accompanying tables shows the world's production of crude petroleum in the decade from 1900 to 1910, showing the relation of the growth of the industry in California to that of the United States. The first gives the statistics of California production from the time immediately preceding the bringing in of the Lakeview well (and the attending flowing wells of large capacity in the Sunset-Midway field of the West Side of Kern county) to and including July 1912.

ply fuel on the Atlantic seaboard as California is now supplying the Pacific.

It is fortunate that these discoveries have come at a time when Russia's supply is declining heavily and all the known fields of the United States are apparently either at the maximum of their productive possibilities, or are on the decline. It comes also at a 'psychological moment'—the opening of the Panama canal, when the world's trade routes are destined to be re-routed, and the Pacific will become the theatre of the struggles for commercial supremacy: for trade rules the world.

PRODUCTION AND ALLIED STATISTICS, CALIFORNIA OILFIELDS.

(From and after February 1910.)

Date.	Stocks, bbl.	Production, bbl. Total.	Production, bbl. Daily.	Shipments, bbl. Total.	Shipments, bbl. Daily.	Daily Surplus. (Bbl.)	Returns to Producers. Agency Members. (Cents.)	Returns to Producers. Non-Ag'y Members. (Cents.)	Wells Pumping. Total No.	Wells Pumping. No. Active.	Wells Drilling. Total No.	Wells Drilling. No. Active.
1910.												
February ..	.....	4,515,560	161,983	.....	.....	.....	44	50	....	....	....	....
March	.....	5,598,745	194,278	.....	.....	.....	43.5	50	....	....	....	....
April	.....	6,618,636	220,621	.....	.....	.....	41.5	40	....	3600	....	618
May	.....	7,172,313	231,177	.....	.....	.....	42.0	30	....	....	....	....
June	.....	6,696,789	223,226	.....	.....	.....	42.9	30	....	....	....	....
July	29,337,808	6,901,965	222,644	4,781,065	154,227	68,417	38.0	30	4320	3695	751	633
August	31,557,635	6,743,159	217,521	4,822,468	155,563	61,958	35.2	30	4414	4071	875	642
September..	30,516,319	6,492,462	216,415	4,612,185	153,739	62,676	36.1	30	4658	4112	790	675
October	34,308,509	6,098,388	196,722	5,208,322	168,010	27,712	35—5	30	....	....	....	....
November..	31,047,388	5,753,625	191,787	4,873,803	162,453	29,224	35—5	30	....	....	....	....
December...	33,319,724	6,111,807	197,155	5,514,860	177,898	19,257	35—5	30	4815	4257	845	678
1911.												
January ...	34,016,514	5,992,352	193,331	5,330,017	171,936	21,395	35—5	30	....	....	....	....
February ..	34,947,540	5,439,720	192,027	4,584,907	163,746	28,281	35—5	30	4937	4322	1003	774
March	37,317,636	6,341,603	204,600	4,541,368	146,495	58,105	35—5	30	5007	4386	865	651
April	37,984,865	6,725,259	218,138	5,470,318	182,340	35,798	35—5	30	5199	4420	869	606
May	38,294,830	6,630,133	213,875	6,032,445	194,595	19,280	35.0	30	....	....	....	....
June	39,119,527	6,402,304	213,875	5,392,716	179,752	34,123	35.0	30	5134	4536	874	617
July	40,084,099	6,663,325	214,946	5,421,515	174,887	40,059	30.3	30	5168	4557	891	614
August	41,234,623	6,696,896	216,029	5,413,430	174,626	31,103	33.9	30	5273	4639	884	571
September..	41,929,003	6,885,135	228,504	6,016,848	200,562	27,942	31.2	30	5229	4567	372	560
October	39,951,406	6,906,750	222,800	6,431,941	207,481	14,319	32.6	30	5401	4720	845	521
November..	41,093,377	6,741,718	224,723	6,020,558	200,685	24,038	32.46	29	5485	4731	849	505
December...	41,265,050	7,013,858	226,351	6,669,644	215,149	11,816	30.68	30	5548	4806	825	478
1912.												
January ...	41,648,535	7,149,701	230,635	6,398,846	206,414	24,231	30.0	30	5598	4838	788	453
February ..	42,060,297	6,532,682	225,264	6,034,134	208,073	17,191	30.0	30	5659	4861	875	471
March	43,005,609	6,923,908	223,351	6,030,906	194,545	28,806	30.0	30 to 35	5732	4936	827	443
April	43,899,497	6,810,953	227,031	5,591,339	153,044	73,987	30.0	30 to 35	5786	5007	790	416
May	44,291,423	6,882,028	222,000	6,425,681	207,280	14,720	30.0	30 to 35	5826	5051	763	421
June	44,919,262	6,895,865	226,528	6,420,405	214,013	12,515	30.0	30 to 35	5885	5091	760	408
July	45,490,175	7,013,858	223,883	6,314,579	203,696	20,187	33.1	30 to 35	5913	5153	741	411

Total number of 'Pumping Wells' does not include the 412 wells of the Los Angeles City field and the 125 wells of the Summerland field, the combined production of which wells does not exceed 1200 bbl. per day; their yield, however, is included in the figures of the state's yield each month.

In the figures for 'Stocks' there was an adjustment for losses in storage, seepage, Lakeview well losses, etc., in October, 1911.

Referring to (2), while the world's production doubled in the decade from 1900 to 1910, and that of the United States tripled, that of Russia, which up to this period had led all countries, declined from 85,000,000 bbl. to 70,000,000 bbl. per year. In 1901 the United States produced 41.6% of the world's supply; in 1910, 60.8%. In 1901 California produced 5.2% of the world's yield, and 12.6% of that of the United States, while in 1910 the figures had leaped to 23 and 36%, respectively.

The significance of these figures is much enhanced by the fact that the discoveries of the past few years of new fields and of extensions of old fields, in the southern San Joaquin valley, make it practically certain that California can and will supply all the petroleum for which there is a market for many decades to come. So vast an area has been added to the previously known deposits, and so profusely have the known fields produced when once opened, that it is with difficulty any approximate estimate can be given of the state's probable future annual yield. Mexico is the only country where there is much promise of new fields of magnitude, aside from California. The Mexican fields are contiguous to the gulf coast and promise to supply fuel on the Atlantic seaboard as California is now supplying the Pacific.

Referring to (1), while stocks have increased in the past two years some 15,000,000 bbl., there has been no appreciable gain in the daily yield of California since April 1910, or the month the Lakeview well first poured forth its enormous yield. (The well was brought in March 15, 1910.) There has been an apparent increase of daily shipments to the trade (consumption) of 50,000 bbl. between July 1910 and July 1912. This gain in delivery to the trade has been a healthy one, but it has been at the expense of the producer; prices dropped from an average at the well of 50c. per bbl. the day the Lakeview was brought in, to 30c. On the other hand, the consumer who was paying 90c. per barrel delivered on San Francisco bay early in 1910 has since obtained his supply at as low a figure as 65c. It is reputed that quotations on the bay now range to 80 cents.

It should be remembered that about 70% of the California yield is consumed as fuel oil, and that 40% of the remaining 30% that is refined, possibly 40% comes back into the fuel market in the shape of residuum, so the oil consumed as fuel is somewhat greater than the 140,000 bbl. indicated daily consumption. The price of 30 to 35c. to

producers is upon probably 70% of the state's yield. Price varies according to specific gravity; the high-gravity refining oils, the equivalents of the Pennsylvania crude, bring as much or more at the wells than the same grade in the Eastern fields, but the quantity available is small. The recently discovered Lost Hills and the Belridge fields (the latter an extension of the McKittrick field) are yielding a fine supply of over 30°B., and this, with the extension of the practice of extracting the gasoline from the natural gas which has heretofore gone to waste, has eased the local demand for refinable products materially.

In July 1910 there were 3695 actively producing wells, yielding 222,644 bbl. per day, or 60 bbl. net to the market each day from each well; in July 1912 the yield was 43 bbl. per well per day, or about what it was in 1909, before the Lakeview and wells of its class had entered the lists.

WORLD'S PRODUCTION OF CRUDE PETROLEUM, 1901 TO 1910.

	1901.	1902.	1903.	1904.	1905.	1906.	1907.	1908.	1909.	1910.
United States	69,389,194	88,766,916	100,461,337	117,080,960	134,717,580	126,403,936	166,095,335	178,527,355	183,170,874	209,556,084
(California)	(8,786,330)	(13,981,268)	(24,382,472)	(29,649,434)	(33,427,473)	(33,098,598)	(39,718,375)	(48,300,758)	(58,191,000)	(74,849,700)
Russia	85,168,556	80,540,044	75,591,256	78,536,655	54,960,270	58,897,311	61,850,734	62,186,447	65,970,350	70,336,574
Dutch West Indies	4,013,710	2,130,495	5,770,056	6,508,485	7,849,896	8,180,657	9,982,597	10,283,357	11,041,852	11,030,620
Galicia	3,251,544	4,112,159	5,234,475	5,947,383	5,765,317	5,467,967	8,455,841	12,612,295	14,932,799	12,673,688
Rumania	1,678,320	2,059,935	2,763,117	3,599,026	4,420,987	6,378,184	8,118,207	8,252,157	9,327,278	9,722,958
India	1,430,716	1,617,363	2,510,359	3,385,468	4,137,098	4,015,803	4,344,162	5,047,038	6,676,517	6,137,990
Japan	1,116,688	1,204,971	1,209,160	1,419,473	1,472,804	1,705,776	1,994,207	2,061,841	1,882,393	1,926,599
Canada	756,679	530,624	486,637	552,575	634,095	569,753	788,872	527,987	420,755	315,895
Germany	313,620	353,674	445,518	637,431	560,963	578,610	756,631	1,009,278	1,018,837	1,032,522
Peru	271,800	286,725	278,092	290,123	447,880	536,294	756,226	1,011,180	1,316,118	1,330,105
Italy	16,150	18,933	17,876	25,476	44,027	53,277	59,875	50,966	42,388	42,388
Mexico	.....	.....	.....	.....	.....	.....	.....	1,000,000	3,481,410	2,488,742
All others	.....	26,000	20,000	40,000	30,000	30,000	30,000	30,000	30,000	30,000
	167,409,987	181,976,988	194,798,894	218,023,055	215,040,917	212,907,868	264,232,687	285,081,311	298,326,073	327,472,256

When these figures are compared with the yield of the Appalachian field, 1.73 bbl.; Lima-Indiana, 2.74 bbl.; Illinois, 8.37 bbl.; Mid-Continent, 5.27 bbl.; and Gulf, 14.08 bbl., the significance of the producing business in the California fields can be more easily grasped. It is probable that the high yield per well will continue for some years, due to the influence of the production from newly opened ground.

Work Along the Mother Lode

By C. W. Morse

Following are some notes made on a hurried trip along the Mother Lode.

Good management has kept the total working costs of the properties visited from $2.75 to $3.75 per ton, while better ventilation, the use of stoping drills, and a bonus system in some contracts have helped to keep down costs. It was a surprise to find mines as old and with ground as heavy as the mines of the Mother Lode with only one opening to the surface. A property where five times as many men are employed on timbering as on ore, and where timber costs 50 cents per ton, is interesting to those not familiar with heavy ground.

At the South Jackson new shaft the Ingersoll-Rand hand drill 'B.C. 26' is in use with satisfactory results in the slate, some of which is hard. The drill is rotated by hand; uses hollow steel rose bits. The holes are put down at any angle desired, to a depth as great as 8 ft., though 6 ft. is the average depth. The best record for a round in the softer slate was 5 hours for 24 holes and 6 plugs. In the harder slate 9 hours has been required

ARGONAUT 40-STAMP MILL.

for a round. The shaft is 3-compartment, each being 4 by 5 ft.; 12 by 12-in. timbers are used with 8 by 12-in. spreaders. The sinking record for last month was 112 ft. It will be interesting to learn how these drills work in hard rock. The same company makes a similar drill with a self-rotating chuck, which should be an advantage.

In the same shaft delayed-action fuses are giving excellent results, and their use should be compelled by law for all shaft work. They would be valuable in any close place in the mine. They have very few misfires. A frequent cause of misfires in fuses is poorly insulated lead wires or wires on which the insulation has been damaged by tamping or rough handling. The water in the average drill-hole contains enough mineral salts to make it a fair conductor, so enough current may pass between the two lead wires to prevent the platinum bridge being heated to the ignition point of the fulminate, thus allowing some of the fuses to fail while others explode. I found this to be the cause of misfires in a salt mine in central Kansas, where damp salt was used for tamping. The same weakness was found to be the cause of annoying misfires in the Panama canal work. At the South Jackson the fuses are connected in parallel to two pieces of telephone wire which are in turn connected to the cable from the soil on the surface. The blaster carries the key to the switch-box on the light circuit, and when all are out of the shaft he connects the cable and throws in the switch.

Around Jackson there have been several cases of hook-worm among the miners, and in Angels one case was heard

of. The mines have probably been infected by the European laborers employed. The miners are peculiarly susceptible to malaria. The physicians disagree as to the extent of fibrosis. One thought that few of the miners escaped; others thought that not many were affected. As the miners do not apply for life insurance, they do not come under as close examination as those working at other trades. Chronic bronchitis is not prevalent. The stope drills are the cause of much irritating dust. At one mine they tried using the spray attachment, but, as usual, the miners objected to the use of any new device and preferred to 'eat dust.'

Precipitation of Copper From Mine Water at Butte

The large amount of copper annually recovered from copper-bearing water at Butte is not generally realized. In 1910, a total of 4,558,850 lb. of copper was recovered by precipitation on scrap iron. In 1911 the water pumped from the Leonard shaft yielded 600,000 lb., while the water from the High Ore shaft yielded about the same quantity. Not all of this large quantity is produced from the mine water, however, as the leaching of old tailing, slag, and waste heaps by lessees adds very materially to the output. The recovery of copper from the mine water is of the greatest interest, however, since the quantity thus recovered is sufficient to pay the cost of pumping and yield a small profit. Handling the underground water, instead of being a heavy burden on the cost of working, is at Butte a small source of profit.

It is difficult to give exact data regarding the precipitation of the copper, since the character of the mine water varies a good deal, both according to the season of the year and according to the part of the workings from which it is derived. At one time much water was used in the Leonard mine in an attempt to extinguish an underground fire. The copper-content of the water obtained from this part of the workings was considerably above the average, but for some unknown reason this water formed a curious precipitate upon the iron, resembling fungus growths, which greatly interfered with its efficiency as a precipitant. Similar growths are also found within the mine, often on the mine timbers, and have given rise to much discussion as to whether they are vegetable or mineral growths. The following is an analysis of the water from the Leonard mine:

	Per cent.
Copper	0.0122
Iron, suspended	0.0127
Iron, solution	0.0067
Arsenic	0.00026
Antimony	0.000088
Free H_2SO_4	0.0139

The water is handled by pumps with bronze working-parts, and pumped through a column-pipe lined with wood or lead. On the surface the water is passed through a series of boxes and trays. At first the water flows at a rapid rate over large pieces of scrap iron and steel, and the precipitate collected at this point is high-grade, containing as much as 80% copper. Farther down smaller pieces of iron are used and a slower rate of flow. The final precipitation is accomplished on small scraps, chiefly old tin cans spread in layers on trays, the water dripping slowly from one layer to another. In this way practically complete precipitation is secured, analysis showing that with mine water which carries 0.03893% copper, the final effluent carries only 0.00036% copper, corresponding to an extraction of 99.1% of the copper in the water. The low copper content of the escaping water has been compared with that of the effluent solution at Rio Tinto, but it must be remembered that at Rio Tinto the copper-bearing solution carries 0.4% copper and the 0.002% copper content of the effluent solution corresponds to an extraction of 99.5%. Another analysis of Butte mine water shows an original content of 0.0099% copper, the water entering at 73°F. and escaping at 65°F. with a copper content of 0.0008%, corresponding to a 92% extraction. The average copper content of the precipitate is 45%. A curious fact worth noting is that the arsenic content of the mine water at Butte is extremely low (less than 0.0003%), although about one-quarter of the copper present in the ore is in the mineral enargite, which contains nearly 20% arsenic. At Rio Tinto, on the other hand, the amount of arsenic present in the ore is small, yet according to C. H. Jones* the copper-bearing solution contains 0.03% arsenic. This and the fact that pig iron instead of scrap steel is used for precipitation of the copper has a marked effect upon the process there employed, for both the arsenic and phosphorus come down in the final stages of the process, and form most undesirable constituents of the copper precipitate. It is not feasible, therefore, to reduce the copper content of the effluent solution so low as at Butte. At Rio Tinto, 140 lb. of pig iron is required to precipitate 100 lb. of copper, and at Butte about 150 lb. of scrap iron and steel is required.

Work of the Aguacate Mines

By P. G. Spilsbury

The following extract from the financial statement of the Aguacate Mines for the six months January 1 to June 30, 1912, may be of interest.

Total operating costs:

Administration	$0.47
General expense	0.46
Mining	1.62
Tramming	0.52
Milling	1.24
Marketing bullion	0.07
Total	$4.38
Credits from land rentals and store	0.17
Net cost	$4.21

From the mine 6713 wet tons of ore was extracted, and 5863 dry tons milled, of an average assay value of $12.15. The cost of constructing the experimental cyaniding plant, completing the mill, erecting a steam power-plant for the dry season, installing mine-bins and sorting-floor, and other mine improvements, and erecting necessary houses for the staff, all considered as permanent betterments, amounted to $2.49 per ton. During this period wood fuel was used for power.

General items of interest follow: All power at present is being furnished by the hydro-electric plant. For the next dry season the steam-plant will be moved to the site of the present electric plant, and the engines connected so as to run on the same shaft with the turbine. This plant will develop a minimum of 100 hp. It is expected that electric power sufficient for all needs will be available at the mines before July 1913. Results in the preliminary cyanide plant have been such that a 100-ton unit will be added at once, and it is hoped to have it in operation by January 1913. It is planned to place a trommel before the stamps and to send fine ore direct to a 5-ft. Huntington mill, only coarse ore going to the stamps, thus increasing the efficiency of the crushing plant.

Imports of gold and silver into Japan for the first eight months of the current year have been Y10,981,000, and exports Y16,013,000. The Nippon Ayenko Kabushiki Kaisha (Japan Zinc Ore Co.), which was recently formed, has started to work its mine at Kakeorizawa, Echigo province. The company has also six mining properties in the same district, all being in working order, the daily output of ore being 15 to 20 tons, the product containing 40 to 55% zinc. By November the output will be increased to 1000 tons per month. The company invites anybody purchasing ores to inspect its properties.

*Trans. Amer. Inst. Min. Eng., XXXV:6, (1905).

Placing Shaft-Sets

By Tom McCormac

When things go right a shaft-set can be swung, blocked, and lagged in a surprisingly short space of time. The problem is to systematize the work into some such definite routine as to insure 'things' going 'right.' This is sometimes a little harder to do than it would appear, as many miners, some experienced in but one piece of shaft work, and that one probably a sad example, consider it a reflection upon their ability as shaftmen to be shown anything so simple as a detail in putting in a set of timber. These men are hard to interest in any attempt at system, as they think it entirely unnecessary. Yet these same miners, putting in shaft timber, will bring up a varied assortment of hard-luck stories explaining just why it took so long to place the set; entirely oblivious to the fact that each preceding set seemed to necessitate stories of the same uninteresting sort. It is far more satisfactory to insist upon a system at the start, even though assured by experts that many details are unnecessary.

The first essential to fast work is to know that there is sufficient room in which to swing the set; and it is a never-ending source of surprise to me to see how poor the judgment of men in this matter is. In spite of the fact that an attempt to swing a set in a shaft, where there is not sufficient room, is not compatible with good sense, still it is very frequently tried. A measuring stick and a short plumb line will settle this point absolutely, and the time required is not worth considering.

Next is a suitable platform from which to work. If the rock be so soft that the timbers can be carried close to the bottom of the shaft, no platform will be required; the timbers can be put in from the rock pile. If the rock is harder, a platform is necessary, and is sometimes made by placing two stulls in the shaft at such a distance below the last set as to give convenient working room. On top of the stulls are placed the platform planks. A much better plan is to provide four stirrups of iron, 8 or 9 ft. long, that can be hooked on the last set and, in a loop at the bottom, support a 4 by 6 which corresponds to the stull. Across these timbers, one at each end of the shaft, can be placed the platform of a few planks. If a blasting set is used, it can be dropped on the cross pieces, and used as a staging instead of the planks. With the platform in place, sufficient ground removed to accommodate the set, and the hanging rods in the proper holes in the last set, the timbers can be lowered. These should be lowered with a clevis. The timber hitch, even when guarded with a half-hitch is, in my opinion, absolutely dangerous and should not be allowed. The most dangerous feature of this hitch is the fact that in the great majority of cases it will hold; which breeds a carelessness that might easily be attended with fatal results. The clevis can be made by any blacksmith in a few minutes out of any flat piece of iron. It is shaped like the letter 'U,' with holes in each end through which a bolt is passed.

In lowering the timbers the topman can easily send down the plates in a regular order; for instance, let him invariably send down the north wall plate first, followed by the south wall plate, and so on. He should also see that the right end goes down first, which will prevent any necessity for turning the timber in the shaft. When the wall plate is lowered the clevis is removed, the two hanging rods are put in, and, if the timber is not too heavy, it is hooked into place. If heavy timber is being used it can be guided to place while it is hoisted from the surface.

When the plates are put together it is sometimes the practice to drive a big nail through the 'horn' of the end plate into the wall plate, to keep the two pieces together. The 'horn' is already the weakest part of the plates, and the advantage gained by holding the members of the set together is, in my opinion, much more than offset by the disadvantage of splitting the 'horn,' which frequently takes place. If something of the kind is desired, dowel pins can be used; these have given good results, although I have never happened to use them. In my next work, however, I intend boring a very small hole through the tenons of the plates and pinning them together in the shaft with pins made of heavy wire nails, cut to the proper length.

With the plates in position and the posts in their places the hanging rods are tightened up solidly. Washers should, of course, correspond with the rods used, although I have seen a very heavy hanging rod accompanied by a little cut washer but slightly larger than the nut. In this case the appearance of solidity given to the shaft by the use of heavy iron was false.

The four lines are next dropped; there are men who need but three, and, I suppose, still others who can manage with but one, nevertheless, four lines make easier, quicker, and more accurate work and take up but an extra moment in the hanging. It is best to plumb from the same set for at least 50 ft., and as much farther as it is possible, without losing time caused by the swinging of a long line.

With the lines in place and fairly still, the set should be swung approximately to its place and held there by nailing short pieces of board on top of the wall plate and against the rock. Two on each wall plate and one on each end plate will hold the set solidly and nearly in its right place. These little pieces do not interfere with the blocking, since when the blocking is in place they can be knocked off, if in the way. The measurements for the proper length of blocks will fit exactly.

The topman can pick out the blocks according to the measurements sent up, perhaps being required to saw one or two of unusual length. Whether the pressure on a block should come against the grain of the wood or across the grain is a question that I would like to see discussed. If a block can be put into a shaft parallel to the posts, in this case the pressure coming across the grain, it would save some time in blocking a set. It is very easy to split this block and by driving wedges in the block itself the set can be made very solid. It is my own opinion, however, that this is poor work; that a block put in a dry shaft, after this fashion, will in the course of time fall out on account of the wood shrinking. Blocking should proceed slowly. Rush work loses time. In a large crew two men should do nothing but watch the lines and prevent any block from being tightened up too rapidly. If a block is tightened too much, the opposite block will not be able to force the set back to place, and a lot of time will be lost loosening the first block. Deliberate work pays at this time. Make each and every blow of the hammers accomplish some definite purpose. If the wedges in a shaft are placed with the sawn side against the rock they will not split so quickly.

All the blocking should be placed out of the way of the lagging; although there are some corners that would require too much moiling to permit this, and if this is done the lagging can be quickly put in place. If no attention be paid to this there will be sixteen corners to be cut in fitting the lagging to the posts. This is time lost.

If a definite routine be followed it will only be a matter of placing a few sets before a very high rate of speed can be attained, and this with no loss in accuracy. There is nothing mysterious about the placing of shaft timber; any intelligent miner with a desire to learn and the proper teaching, can learn all the rudiments in a single day. Speed, of course, is a function of experience and cannot be obtained in a day, but neither does it require any such time as a year.

Cassiterite has been discovered at two or three points in Rhodesia, but as yet the exploitation of these deposits has not proved profitable. It is already reported that an apparently large and important deposit has been located at the Arcturus district of Mashonaland, and that a good deal of Johannesburg capital is to be devoted to the making of a thorough investigation of the mineralized area in question.

American Institute of Mining Engineers and Its Affairs

The following analysis of the comparative statement of receipts and disbursements for the six years 1906 to 1911, inclusive, given on pages 26, 27, and 28 of the report of the Committee of Five, has been prepared by Charles Kirchhoff, to show what the position, financially, of the Institute is now, and will be for the next few years, assuming that it continues at the same rate of normal receipts and expenditures. The net loss shown by the accountant's statement for the period under review, taking credit for interest received, amounted to $12,696.72. During that period the Institute paid in rents and assessments:

RENT AND ENGINEERING BUILDING ASSESSMENTS

1906	Rent 99 John street	$ 2,500
1907	Assessment for operating building	10,250
1908	" " " "	6,700
1909	" " " "	6,000
1910	" " " "	4,500
1911	" " " "	4,500
	Total	$34,450

At the present rate of assessment of $4500 per year (under which the United Engineering Society is accumulating a fair surplus), the outlays would have been for the same period of six years $27,000, so that the next period of six years should show a saving in that respect of $7450.

The total payments for the interest on the Institute's share of the Engineering building land mortgage for the six years aggregated $30,462.99, as follows:

PAYMENTS FOR INTEREST ON MORTGAGE

1906	$ 9,133.33	1910	$ 3,520.00
1907	5,200.00	1911	3,133.66
1908	5,200.00		
1909	4,276.00	Total	$30,462.99

At the present time the Institute is paying interest on $68,000 net, or $2720 per year. Had the generous gifts of friends of the Institute to the land fund been received at the beginning of the period under review, instead of flowing in at a later date, then there would have been a saving in interest of $14,142.99, namely, $30,462.99 less $16,320 (six years interest at the present rate). In order to fairly judge of the ability of the Institute to meet its costs in the future, based on the normal expenditures of the last six years, there must be eliminated the two sums mentioned: $7450 representing extraordinary building assessments, and $14,142.99 in interest payments, which it need no longer face. The two sums amount to $21,592.99, so that deducting abnormal outlays now no longer a possible burden, the apparent net loss of $12,696.72 is transformed, so far as the normal conditions of receipts and expenditures are concerned, into a surplus of $8896.27. This surplus would have enabled the Institute to place to capital account the greater part of the sums received for life memberships, which aggregated $10,500, somewhat irregularly distributed over the six years under review. Under present conditions the Institute is not facing an annual deficit in its operating expenses. With an income based on dues of $10 annually, and normal receipts and expenditures on the scale of those of the period of 1906 to 1911, both inclusive, the Institute will be able not alone to carry on its work as well as heretofore—maintain the standard and volume of its publications, pay the regular annual assessment of $4500 for its share in the cost of operating the United Engineering building, pay the interest on the present mortgage debt—but to place to capital account hereafter the receipts from life memberships.

In 1907 the Institute had pledged itself under the founders agreement to pay $180,000 as its share of the land mortgage. That amount has now been reduced to $68,000, and no payment will be due on this balance of $68,000 until 1915. It is believed that through revenue received from the natural increase of membership as well as through further contributions to the land fund from friends of the Institute, this debt will be fully met. It should be appreciated that such a settlemen will give the Institute an unencumbered one-third interest in a property worth $1,659,320, in which our equity today is not less than $480,000.

The following two circular letters will be of interest to members of the Institute:

At the last annual meeting of the Institute, in February 1912, a Committee of Five was appointed to investigate all the affairs and operations of the Institute, to see whether an increase in the dues could be avoided, and to report to the Board of Directors, making such suggestions as they might deem best for the welfare of the Institute. This committee made an exhaustive examination, and its report has been distributed to our members. As was shown in the report, the management of the Institute has been striving for some years to reduce expenses and increase its efficiency. The suggestions of the committee, even those that seem to be inadvisable or impracticable, are being carefully considered by competent committees of Board and Council. There are certain matters which will come before the adjourned business meeting on October 7, 1912, to which careful, dispassionate consideration should be given.

1. The report of the Committee of Five should be accepted, and, with its accompanying papers, correspondence, accounts, reports, etc., be filed in the archives of the Institute, the committee be discharged with thanks, and the Institute be left to the management of its duly constituted authorities, the Council and the Board of Directors.

2. On the question of increasing the dues, even temporarily, the report of the Committee of Five does not justify a final conclusion. We believe that our fellow-members would neither wish to have the dues unnecessarily increased nor, on the other hand, see the means of the Institute restricted or its work crippled. We have before us the important matter of paying off the balance of the land debt, and the plans of judiciously aiding the local sections and the professional divisions, on which we count so much to help the growth and widen the beneficial influence of the Institute. We urge the postponement of action on this suggestion, and also on the other constitutional amendments suggested last year, until the next annual meeting in February 1913, when we shall have further light from this year's budget. By that time, present uncertainties will be cleared up as to routine finances, voluntary contributions to the land fund, and the amount of new resources coming from the somewhat rapid increase in membership.

3. We believe that it is not necessary, preliminary to progress and to a solution of the new problems, to attempt to throw discredit upon the past management of the Institute, or to belittle the debt of gratitude which the Institute owes to Dr. R. W. Raymond, who served it for many years with distinction and rare devotion and self-sacrifice, and who more than any other man brought it to its high place among the technical societies of the world.

4. We believe that the membership at large should be given an opportunity to express its endorsement of the action of the Board of Directors and of the Council when they recognized Dr. Raymond's lifelong services and devotion by unanimously electing him an honorary member, and to act affirmatively on the recommendation of the Committee of Five to make possible the conferring upon Dr. Raymond of the title of Secretary Emeritus.

5. We believe that the membership at large should be given an opportunity thus to approve and ratify the action of the Board of Directors when they took steps to secure for the future his aid in that part of the editorial work of the Institute which he is so eminently qualified to perform.

6. We believe that the Institute should extend to Dr. Raymond, now that he has retired from the active direction of its affairs, suitable facilities for carrying out such work, with a proper annual stipend along the general lines as arranged by the Board at the time of his retirement from active participation in the affairs of the Institute 18 months ago.

H. S. Chamberlain,	W. B. Kunhardt,
Ellsworth Daggett,	George F. Kunz,
Henry S. Drinker,	Benj. B. Lawrence,
Arthur S. Dwight,	Edw. P. Mathewson,
Anton Eilers,	Willet G. Miller,
Karl Eilers,	R. V. Norris,
B. F. Fackenthal, Jr.,	Eben E. Olcott,
John Fritz,	Jas. J. Ormsbee,
James Gayley,	Walter T. Page,
C. W. Goodale,	D. M. Riordan,
Wm. H. Howard,	Thomas Robins,
Alex. C. Humphreys,	F. W. C. Schniewind,
Robert W. Hunt,	E. G. Spilsbury,
John H. Janeway, Jr.,	Leonard Waldo,
William Kelly,	Warren A. Wilbur,
Chas. Kirchhoff,	Wm. H. Wiley.

The second letter is as follows:

In February last we addressed a circular to the members of the Institute asking for proxies to postpone action on the proposed amendments to the constitution and to have a committee appointed to study and report on the affairs of the Institute so that the members might be able to vote intelligently on these propositions. The responses were most satisfactory, over a thousand proxies having been received.

The committee was appointed and was purposely composed of men of very divergent views. Three were among the signers of the circular and two had been members of the Board of Directors of the Institute for many years. With a committee so constituted the report was necessarily a compromise and did not fully express the views of any one of its members. We hope, however, that it was full and explicit enough to serve the purpose for which the committee was appointed. The proxies received were also used at that meeting in furthering the election of George C. Stone, Charles F. Rand, and E. B. Kirby to the directorate of the Institute. They were not voted at all in the matter of the secretaryship of the Institute. This was intended to indicate a suspension of judgment. Mr. Kirby was elected to the Board in order to give the very large Western membership at least some representation in that body.

At the adjourned annual meeting to be held October 7 some decision should be reached in regard to the amendments proposed last year, and probably action will be required on other matters referred to in the report of the Committee of Five. We therefore ask for new proxies to enable us to act on these questions, as we do not feel that the old ones, although of sufficient general scope, should be used as they were really granted for a definite purpose that has been accomplished. We agree with the opinion expressed in the report of the Committee of Five, that the present financial deficit may be met by the reductions which are possible in the expenditures of the Institute. It will, however, take some time to secure this, and it is necessary to provide now for the possibility that the reduction may not be sufficient for the purpose. Therefore we propose to offer an amendment to the constitution in the following sense: giving the Board of Directors the right to increase the annual dues not to exceed $5 a year, for such length of time as may be necessary to pay off the land fund; the increase to be used solely for that purpose and the dues to automatically recede to the present basis of $10 per year as soon as the object is attained.

It is our opinion: That all of the amendments to the constitution proposed last year should be rejected. That the meeting should be again adjourned to the date of the Cleveland meeting of the Institute. This is to allow of full discussion of any matters appertaining to amendments of constitution and by-laws brought up October 7 before final action at the next annual meeting in February 1913. The present constitution precludes action on any amendments which have not been proposed in their final contents at a previous annual meeting.

Lewis G. Rowand,	James R. Finlay,
George C. Stone,	John H. Allen,
J. Parke Channing,	J. A. Van Mater,
Robert Peele,	Edmund B. Kirby,
Richard H. Vail,	H. M. Chance,
C. R. Corning,	F. L. Garrison.

A meeting of the San Francisco members of the American Institute of Mining Engineers was held on September 21. Members present were: E. H. Benjamin, S. B. Christy, Frank Dennis, H. W. DuBois, J. B. Farish, A. A. Hanks, E. A. Hersam, C. Janin, W. S. Morley, R. W. Postlethwaite, B. R. Putnam, G. McM. Ross, Gustave Schrader, R. Chester Turner, H. W. Turner, and J. F. Wilkinson. S. B. Christy presided. After a full discussion, the following resolutions were passed:

1. The land debt of this Institute should be met as soon as possible; those who wish to contribute may properly subscribe in accordance with their means, and the remainder of the sum should be met by a temporary annual increase of the dues during the term of the mortgage, excepting those members who have already subscribed $25 or more to meet the debt.

2. Any change of name of the Institute is unnecessary and undesirable.

3. In case a change of name should be voted by the members, the name should be changed to American Institute of Mining and Metallurgical Engineers.

4. The matter of reclassification of members should be postponed until the annual meeting in February 1913.

5. There should be no distinction in dues between classes of members, other than honorary and junior.

6. The standard of membership should not be lowered in any effort to secure a larger membership with a view to a larger income.

7. That a committee of five be appointed to transmit the sense of this meeting to the Council and Board of Directors of the Institute before the adjourned general meeting, October 7, 1912.

The Southern California local committee of the American Institute of Mining Engineers has called a meeting to be held in Los Angeles, September 30, and has sent out the following suggestions for discussion:

A. We recommend that for the present rules of the Council, governing sections of the Institute, there be substituted a constitutional amendment providing for the formation of local sections and specifying the powers thereof, and their relations to the parent body, and granting the largest degree of autonomy consistent with reasonable supervision by the Council.

B. It is the sense of the committee that some adequate provision for geographical representation in the Council of the Institute should be provided. Would suggest that the chairmen of the local sections should become ex-officio members of the Council, and that other members, to the required number, should be elected at large by members of the Institute.

C. We consider that the secretaries of the Board of Directors and of the Council should be elected by these boards respectively, instead of by the Institute at large.

D. By-law 4, paragraph 4, should be amended to read as follows: Neither the secretary of the Council nor the secretary of the Institute shall be the same person as the secretary of the Board of Directors.

E. That provision be made to secure free nomination for the general offices from the membership at large, and that the nominating committee be instructed to propose two or three names for each office in case such number be not nominated by the members. We feel that some provision

should also be made for district representation in all offices, excepting president and vice-president.

F. As to the Board of Directors, while we clearly recognize the necessity of having enough active members residing near New York City, we feel that the policy should be established of securing members of that board, so far as possible, who have had sufficient experience in other parts of the country to enable them to represent the members thereof.

G. We favor the establishing of topical divisions similar to the Iron and Steel Division, under the auspices of the Institute, with headquarters in regions appropriately embracing membership particularly occupied in work relating to the scope of such divisions. A division of precious metals and allied ores should be formed in the West and probably one or more for the copper, lead, and zinc industries in the Middle West.

H. We urge the importance of prompt and effective cooperation of the Institute in the forthcoming International Engineering Congress, to be held at the Panama-Pacific International Exposition, San Francisco, in 1915.

I. We deem it unwise and unnecessary, at this juncture, to increase dues, being convinced that this will be wholly unnecessary if the finances be arranged in accordance with plans now partly in operation.

J. We heartily endorse the action of Mr. James Douglas, past president of the Institute, in soliciting subscriptions as a means of liquidating the mortgage indebtedness, and do hereby pledge our best efforts to secure for this purpose the due share of contributions from members residing in our district.

K. We suggest that the policy should be followed of giving representation geographically upon all general committees, as publication, nomination, and in every way possible of giving members in all parts of the country full opportunity for expression of opinions on matters affecting organization, prestige, and financial and professional administration.

L. We recommend that bi-monthly reports of the proceedings of both the Board of Directors and the Council be distributed to all members with the *Bulletin*, and that the more important acts be announced more frequently in prominent mining journals.

The Braden Copper Company

The Braden Copper Co. may shortly have to do new financing, according to the *Boston News Bureau*. The company has in its treasury $1,000,000 7% five-year second lien collateral trust convertible bonds of a $2,000,000 authorized issue. There are outstanding $13,000,000 in securities, of which $6,000,000 is stock and the remainder is bonds. Many predictions regarding the Braden property made some time ago by the management have fallen short of realization. It was thought that between 15,000,000 and 18,000,000 lb. of copper would be produced last year, but not until early in 1912 was production commenced.

The Braden mill has been finally completed with a nominal capacity of 2000 tons per day. Only a 50% recovery has been secured in the new mill, which caused the management to install the Minerals Separation process in the single-unit mill. The result has been most satisfactory, as recoveries have run as high as 90%. It has been determined to equip the three sections of the new mill with this process, and when completed each unit will have a nominal capacity of 600 tons. A recovery of over 85% is looked for. The cost of these alterations will not exceed $200,000, and the capacity will eventually be increased to 3500 tons.

The smelter will be enlarged sufficiently to handle the concentrate coming from the daily treatment of 3500 tons of ore. This work does not mean that the leaching process has been abandoned; work on the leaching plant, however, has been more or less delayed. Although the latest estimates of Pope Yeatman, consulting engineer, gave the Braden 23,000,000 tons of reserves, it is understood that the actual amount of developed and partly developed ore is considered nearer 30,000,000 tons. Operations have been retarded of late by caving at the mine, and the mill has not treated its normal capacity. During August but 25,000 tons was run through the plant.

Katanga Developments

According to the report of G. Campbell, British vice consul at Katanga, as summarized in *The Financial News*, the smelting of the copper ore at Elisabethville is still in the experimental stage. On the arrival of the railway at the Star of the Congo the Union Minière proceeded to set up a smelter at Lubumbashi for the treatment of the ore by blast-furnaces. The smelter started to work regularly in August 1911, and continued until the end of November, when the lack of fuel caused a stoppage, and a delay occurred, which was prolonged by an accident which took place in December. Work was resumed in January 1912, and continued until the end of February, when the supply of fuel again failed. The arrival of 500 tons of coke toward the middle of March enabled operations to be continued for another three weeks. Up to the present time coke has been imported from Europe at the cost of £12 per ton landed at Elisabethville; but an arrangement for the supply of either coal or coke from the Wankie colliery, which is situated on the main line between Bulawayo and Livingstone, is under consideration, while some favor the use of electricity. It is presumed that the board is discussing the question in the light of a report furnished by a special commission which visited Katanga in November 1911, and it is clear to all that expenditure must be decreased if any substantial profits are to be made. None the less, it is disappointing that the work should suffer at the precise moment when satisfactory results are being obtained.

During January and February 1912 over 98 tons of bar copper was obtained; lately the ore has been washed before smelting, with the result that 25 tons per day has been produced. The copper has brought £60 per ton at Antwerp. A small plant has recently been put up for the treatment of the ore by the reduction process, using charcoal, which is procurable in the vicinity, as fuel, and experiments will no doubt be carried on with the plant when the smelter is closed.

Mr. Campbell considers it too early as yet to gain reliable information as to the value of the recent discoveries; but states that it is generally admitted that, with the exception of gold and diamonds, several years must elapse before deposits of minerals, of whatever value, which lie beyond the territory controlled by the Union Minière, can be worked at a profit. A few claims have been pegged out in the district through which the railway from Sakania to Elisabethville runs; but the majority are far distant from transport facilities, and it is obvious that copper, tin, and iron cannot be worked under such conditions. No important gold discoveries have been made of late, as far as is known, while work on the Kundelungu diamond pipes has been so handicapped by lack of labor that no opinion can be given as to their value. Prospectors have, in short, been disappointed; they are aware on their arrival that the country is far from the coast, and that working expenses are bound to be heavy; but they do not take into account the fact that the most highly-mineralized portion of the Katanga, to the extent of one-third of the district, is in the hands of the Union Minière, and as they work their way to the regions beyond the main copper belt they find their difficulties and expenses increase far more than they expect, owing to the high price paid for carriers at Elisabethville and the scarcity of food for the first 100 to 150 miles.

THE Mysore group of mines of British India produced bullion worth $900,250 during August, the Champion Reef contributing $210,700 from 18,702 tons, and the Mysore $361,900 from 25,446 tons treated.

Discussion

Readers of the MINING AND SCIENTIFIC PRESS are invited to use this department for the discussion of technical and other matters pertaining to mining and metallurgy. The Editor welcomes the expression of views contrary to his own, believing that careful criticism is more valuable than casual compliment. Insertion of any contribution is determined by its probable interest to the readers of this journal.

Increasing the Dues of the American Institute of Mining Engineers

The Editor:

Sir—The proposed increase in the annual dues of the American Institute of Mining Engineers from $10 to $15 has occasioned grave doubts among many members as to whether it would actually increase the revenue of the society. For it is feared that so many resignations will result, and that it will prove such a formidable bar in increasing the membership, especially from the much-needed younger element, that it will prove a boomerang as a net revenue producer, while it will increase the burden of the 'loyal stayers' some 50%. As I belong to that one-eighth portion of the membership known as life members who paid their dues for life in a lump payment, I feel that my personal opinion should be withheld in a matter that increases the dues of the other seven-eighths of the membership, especially as the energetic 'insurgent committee,' in their very valuable work, produce figures and make suggestions that may render a change in the dues unnecessary.

This same problem has arisen in the history of our other national societies, and the experience of the closely related American Society of Mechanical Engineers is at least helpful in suggesting that there need be no fear of expecting any material loss in the membership or interference with the growth should the dues be increased to $15 per year. Some twenty years ago, when this much younger society had reached the stage, very much earlier in its career, where the expenses had outgrown the revenue derived from $10 dues, its executive committee had to face the present condition of the Institute. While some of the committee promptly suggested increasing the dues to $15, too many members feared the resignations that would thereby result and an effort was made to struggle on with the growing work by paring the expenses and thereby continue the dues at the original rate of $10 per year. I was then one of the 'conservatives' in this society who greatly feared a heavy loss in the membership if the dues were raised, as so many of the members were young men to whom this would add an appreciable burden. However, my brother, F. Meriam Wheeler, a 'progressive', insisted that if the society was to grow and become of greater value to its members, it must have a larger revenue and hence larger dues. He finally brought the rest of the executive committee to his point of view, and the dues were increased to $15. The resignations that followed were utterly insignificant, the income of the society was increased almost 50%, and the growth in new members was rather increased, instead of being restricted, by the additional advantages that the larger income permitted.

H. V. WHEELER.

Portage, Wisconsin, September 18.

Persistence of Ore in Depth

The Editor:

Sir—My recollection hardly agrees with that of T. A. Rickard, as to there having been a marked change in opinion on this question during the twenty years that have elapsed since the discussion in the *Engineering and Mining Journal*. Then, as now, irresponsible scribblers, or unscrupulous promoters, would frequently refer to the 'known fact' that 'true fissure veins extended to unknown depths, and usually became richer as they went down'; and then, as now, the great majority of scientific observers and experienced miners were non-commital, but inclined to a contrary opinion. I remember myself contributing a letter to that discussion, controverting one or more particular cases with which Mr. Rickard had fortified his argument. If I remember rightly, I was very careful to say that I did so without any idea of attempting to base a general rule on those or any other individual experiences. I question very much whether we are justified in doing so now.

It seems clear that the more soluble ores, and particularly those of copper and silver, are subject to migration in a manner which usually results in their removal from vein outcrops and redeposition lower down. But neither the zone of leaching nor that of secondary enrichment has necessarily any relation to the present water-level, and while our recognition of the phenomena of secondary enrichment necessarily implies that a zone of primary impoverishment must eventually succeed it, experience at Butte and elsewhere should make us very cautious in forming any hasty opinions as to the limits in depth of these zones. And when we come to gold ores, apart from alteration near the present surface, the evidence of the existence of secondary enrichment is both scanty and dubious. Notwithstanding Mr. Rickard's authority, I venture to think that most gold ores were originally deposited in or very near their present position.

We have some evidence, which accords with our generally accepted notions on the subject of vein formation, that there is a critical horizon where the conditions of heat and pressure favor the deposition of ores. But this is by no means necessarily at the actual surface, and there seems to be evidence that in many cases veins have been followed down through a barren surface-zone to one of primary ore deposition, just as they have been followed down below the zone of ore deposition to one where they are virtually barren. Would it not be as reasonable, in the former class of instances, to assert that veins increase in richness with depth, as in the latter class to say that they became impoverished? Does not Mr. Rickard confuse this impoverishment in depth of orebodies with that of veins? In the former case, sooner or later impoverishment is inevitable; for universal experience shows that individual orebodies are limited in extent in depth as well as horizontally.

I admit that undoubted cases where the zone of primary ore deposition was below the present surface are comparatively rare, but surely there is a natural reason for this: prospectors do not usually sink on barren veins, in order to find out what is below. Ordinarily prudent people, as a rule, only sink on veins which show at the surface evidence of productiveness. As orebodies, however persistent, must terminate somewhere, it is to be expected that those which have been followed down from the surface will play out eventually, and the chances of finding others in depth are by no means as good as they were of finding the original ones of which nature had furnished a section. It is quite possible that, in any given district, if a number of shafts were sunk on barren veins to depths of one or two thousand feet, and a few miles of levels driven correpsonding to the openings on the productive mines, valuable orebodies might be discovered. We should be careful to distinguish mentally between the greater difficulty of finding, or the greater expense of extracting, ore at increased depth, and the question as to whether its actual quantity or value is less.

I do not think the evidence of the value of ores raised from any district in depth, as compared with that mined at the surface, can be conclusive, unless all the veins, rich and poor, are developed to an equal extent before making the comparison. The only district where this is being done, or is likely ever to be done, is the Witwatersrand, and the evidence there is variously interpreted. In the first place, it is still uncertain whether the genesis of the ores was such as to entitle us to quote experience there as bearing on the persistence of ore in veins; and, in the second, while it is obvious that the grade of ores now being worked in depth is far lower than that mined nearer the surface, it is by no means generally accepted that the difference may

not be accounted for by the fact that the deep modern mines are taking out the veins *en masse*, whereas the earlier ones confined themselves to the then profitable areas. Surely everyone remembers that many of the outcrop mines were at first regarded as too low in grade for profitable working. It will be time enough to use the Rand as an argument to bear on the general topic, when Rand engineers have reached an agreement as to the facts. Evidence which is to throw light on a general rule must be derived from individual cases; but in any district it is apt to be conflicting, unless one is familiar with it in all its phases. I will confine myself to quoting two districts to which I have given special study.

The principal mining district of Gilpin county has been cross-cut throughout, at an average vertical depth of 1500 ft., by the Newhouse tunnel; the maximum depth reached by sinking on the veins (excepting in one instance) being two or three hundred feet less. The evidence so obtained, together with other evidence from shallow adits and mine cross-cuts, may be summed up in the statement that in depth the number of veins is less, but that in the veins which persist there is no general change in character or extent of mineralization. I make this statement without reservation, so far as it applies to the area centring in Nevadaville, which has been the principal productive area of the district. As to the Russell Gulch district, I am not so sure, but incline to sum up my observations in the same statement, although several individual instances point the other way. The Aduddel-Searle-Kokomo lode, for instance, where driven on at the Newhouse tunnel level, for a length of 2000 ft. shows no commercial ore. At first sight this looks like decided evidence of impoverishment in depth; it must, however, be borne in mind that long stretches of the same vein, as, for instance, one of equal length to the east of the Kokomo shaft, contains no commercial ore at surface. Similarly the rich pipe-like orebodies of the Druid, which occur along irregular fissures, so tight that it is hard to distinguish the fissure where mineralized, have not been found at any point below the 300-ft. level. In view of the nature of their occurrence, and the extraordinary difficulty in tracing them, however, this by no means disproves their existence in depth. Similarly rich pipe-like orebodies have been found at the tunnel level in the Trentina or Wellington No. 6 vein, which has not been positively identified at the surface.

In another district, that around St. Elmo, where gold and silver occur associated with sulphides of zinc, lead, and copper, the orebodies unquestionably are of less size and value in depth. Numerous small pockets of gold ore were taken out at the surface, but while these led to nothing in the form of permanent mines, this may be accounted for on the supposition that the ore was merely pockety, and that such pockets were naturally found only at surface. The most extensive workings in the district are those on the Mary Murphy and Pat veins, the former having been opened through a vertical distance of 2000 ft., of which 1200 ft. from the surface has been thoroughly explored. The ore in depth is obviously of far less value, although not uniformly so. Some ore of very high grade was extracted between the twelfth and thirteenth levels (1000 to 1100 ft. vertical depth), and some is now exposed above the eleventh. But most of the ore in depth, from 500 to 1000 ft. vertical, is of much lower grade in gold and silver than that found in the first 500 ft. The most striking features shown by a comparison, however, are: (a) that the distribution of the precious-metal content in the lower levels is far more erratic, the high-grade ore occurring only in irregular bunches, distinguishable from the low-grade zinc and lead sulphides only by assay; and (b) that the orebodies become progressively less continuous in depth. While it has not been found possible to distinguish any particular minerals with which the gold and silver are associated, it is noteworthy that in the upper part of the vein, and in the lower levels where rich ore is found, there is a great deal of quartz and rhodonite present as gangue. On the other hand, gold and silver are by no means always present where there is much quartz and rhodonite. Below the fourteenth level (1200 ft.) development so far has disclosed no commercial ore.

The Mary Murphy affords excellent opportunities for observing the character of the ore throughout a great vertical height, both because unsystematic mining methods have left pillars of ore standing throughout the old workings, and also because of the recent discovery of a parallel system of veins, narrower and more irregular than the Mary, but of similar character and grade, which are being worked from the second to the eleventh levels. A similar tendency to impoverishment in depth is observable, as in the Mary Murphy itself. This, then, is a rather striking case of non-persistence of ores in depth; due, in my judgment, to the fact that the primary deposition of the most valuable ore was principally near the present surface. From the fourth level to surface, there is no change in grade; and the unaltered sulphide ore in places extends right up to the grass roots.

Speaking generally, I would say that while the great majority of individual cases justifies the conclusion that mines do become poor in depth rather than the reverse, I deprecate drawing from these individual cases general conclusions as to the actual distribution of ores, from the standpoint of the geologist. From a commercial point of view, the miner does well to proceed with caution from the known to the unknown; the engineer cannot be too skeptical as to the indefinite continuance of orebodies. Economically, Mr. Rickard is doubtless justified in choosing the gold contained in the first thousand or so feet on the Rand, in preference to that in the next ten thousand; but the quantity actually there is another question. In fact, the entire discussion seems to me rather academic.

GEORGE E. COLLINS.

Denver, Colorado, September 16.

Imports of Copper Into France

Imports of copper into France during the first eight months of 1912 are not only the heaviest in the history of that country, but the percentage of United States copper to the total also established a new record. Of total imports of 122,270,400 lb. from January 1 to September 1, the United States contributed 103,051,200 lb. or 84%. The appended table, compiled by the *Boston News Bureau*, shows total imports of fine copper into France during the first eight months of the years 1907 to 1912, inclusive, the imports from the United States, and the percentage of United States imports to the total (in pounds):

	Total imports Jan. 1 to Sept. 1.	From U. S.	% U. S. to total.
1912	122,270,400	103,051,200	84
1911	94,158,400	71,899,520	76
1910	81,544,960	56,981,120	68
7909	82,418,560	63,616,000	77
1908	106,971,200	84,981,120	79
1907	67,249,280	43,384,320	64

AN exploring expedition consisting of eight members of the Geological Institute of Mexico has, from recent accounts, made some valuable discoveries in the peninsula of Lower California. The expedition was divided into four different parties, each in charge of two of the experts from the Institute. The party under the direction of Dr. Wittich and Dr. Böse pushed on through the central desert region to the great salines around Sebastian bay. Great fields of salt, 60 to 70 square kilometres in area, were discovered, and from the data collected the fact is shown that the Pacific Ocean is in course of rapid retreat from this part of the peninsula. Traces of the comparatively recent presence of the sea were found at an altitude of 3450 ft. Dr. Wittich concludes that even as late as during the prehistoric human period the peninsula was either entirely under water or formed an archipelago.—*Pan-American Union.*

Special Correspondence

SALT LAKE CITY, UTAH

CAUSE OF BINGHAM STRIKE.—DEMANDS OF THE WORKMEN. —MINE-OWNERS CONFIDENT.

Forces that have fought before are lined up for battle in Bingham. On one side is Charles H. Moyer and the Western Federation of Miners, and on the other is Charles M. MacNeill, of the Utah Copper Co., who was one of the active forces in the great Cripple Creek strike of less than ten years ago, in which Moyer was the leader on the other side. Mr. MacNeill is now in Europe, so he will not be able to personally direct the fight against his old enemy, and matters will be in charge of D. C. Jackling.

The cause of the strike which called out about 4500 men in Bingham, September 18, was the demand for recognition of the union and for an advance in wages of 50c. per day, in addition to the increase of 25c. per day granted September 1. The mine-owners thus far have refused to treat with the union, although expressing a willingness to meet committees of employees. Indications are that the strike will be prolonged, the mills at Garfield will be tied up, and the Garfield smelter of the American

BINGHAM GULCH.

Smelting & Refining Co. will be obliged to shut down in part, bringing out between 4000 and 5000 more men, or a total of between 9000 and 10,000.

The fight is far from being impromptu. Bingham has never been a high-wage district, and the Western Federation of Miners has always looked upon it with jealous eyes, even before the development of the Utah Copper Co. gave it the importance it has attained in recent years. The mine-owners have been closely organized for years, and have combatted every move of the Federation. At the time the labor troubles in Colorado were at their height, and large numbers of men from Cripple Creek, Telluride, and other districts were drifting into Utah, the Federation endeavored to get a foothold in Bingham. The mine operators watched every newcomer closely, however, and there was no work for anybody who had a record as an agitator or of having taken an active part in labor troubles. Mine operators all through Utah, in Park City and elsewhere, took this stand, and the 'undesirables' were passed on to Nevada, where they soon made trouble.

In 1906 a strike was averted by a voluntary increase in wages, which were reduced after copper slumped in 1907. Since then the Utah Copper Co. has become more and more the dominant factor in Bingham, being by far the largest employer of labor. The policy of this company has been to do all the work possible with cheap labor, hiring foreigners principally. Something like 90% of the men who went on strike are Greeks, Slavs, Lithuanians, Finns, and others of foreign birth. The Federation has been steadily fighting for membership, but has made rather slow headway in the face of the opposition of the mine-owners and the difficulties attendant on organizing a conglomeration of many races with many tongues. In fact, a minority of the strikers are members of the union, but the men were stampeded by the agitators.

Trouble has been in sight for some time. The operators hoped to avert it by the voluntary increase of 25c. per day, effective September 1, but this failed to satisfy the men. Charles H. Moyer came on to take command in person, and the vote to strike came at a meeting in which he made a speech. The mine operators are confident of winning this strike. The Utah national guard is too small in numbers to cope with the strikers if they take a violent course. This will mean the prompt calling out of the regular troops at Fort Douglas, adjacent to Salt Lake City. Experience has shown that the regular troops can control violence, and the operators believe that Moyer cannot long hold together the various groups of foreigners.

NEW YORK

STRIKES AND THE COPPER MARKET.—ANACONDA SHARES. —COPPER FROM PRECIOUS METAL MINES.

Unexpected elements have added much interest to the copper situation, which now can only be described as doubly double-barreled. The newest feature is evidently a blessing in deep disguise. A short time ago refinery production was retarded by a strike at the Baltimore plant of the American Smelting & Refining Co. and prices advanced. Now the workings of the Utah Copper Co. are held by armed workmen on strike owing to a refusal to grant a demanded wage increase. The follower of the share market has now a most puzzling problem to work out. Utah Copper is a most important producer. The stoppage of its production would make a most decided difference in September figures. Ordinarily such a condition would be considered a catastrophe and shares would have a distinct drop in the market. On the other hand, refinery production has been increasing, and last month's output was ominous in its possibilities. A growing surplus would cool the buying enthusiasm of consumers. If, however, curtailment can be effected without agreement on the part of producers, metal prices should, and probably will, go still higher, and the general copper share list rise in proportion. There is some comment concerning a possible 'runaway' market, and of efforts on the part of producers to prevent such a result. It is difficult to see just where a runaway market would start in the face of a production that breaks all records and could still be easily maintained above the average of the past two years even with the output of Utah Copper cut off. If the strike should spread to the other Guggenheim properties and Nevada Consolidated, Ray, and Chino be temporarily closed, then the only avenue for the producers who are trying to prevent a runaway market would be to let a little of the copper prosperity spread to the workmen. The copper situation is fundamentally based on exactly the same controversial elements as are all polititcal and economic questions—the struggle for an equitable distribution of wealth. The company's treasury needs a surplus, the stockholders need dividends, the miners and laborers need increased compensation. There is insistent clamor, at any rate, whether the need is there or not. The entire copper situation is most interesting, and it is undoubtedly true that never before has any group of manipulators succeeded in carrying such a tremendous deal to a similar point of progress. The public does not yet know how successful a market has been made for the metal. The price has been advanced and is held with great apparent firmness. What has been done with all of the copper is not a matter of public record.

The chief issue in the Bingham difficulty seems to be recognition of labor organizers—what used to be known as the 'walking delegate'—rather than a wage question pri-

marily. The original demand of the miners was for an increase of 50c. per day. Half of this demand was granted on September 1, and the present strike is on the ground that miners do not propose to be satisfied with 'half a loaf.' Copper Producers' figures will be affected not alone by the strike in Utah, but as well by the cessation of shipments from Cananea. The conditions along the Mexican border appear to grow worse rather than better, and the copper which is derived from Mexico will undoubtedly have to be deducted for the next two or three months. The Utah Copper Co. is to turn consumer of its own product. Plans have been completed for the electrification of the Bingham & Garfield railroad and all of the power mechanism operated in the mine at Bingham, in the smelter at Garfield, and the various pumping plants. The power will be derived from the Telluride Power Co. The manufacturers of steam-shovels are said to be working on devices to use electric power instead of steam pressure.

There is a good deal of market capital being made out of the expected action of the boards of directors of the Amalgamated Copper Co. and the Anaconda company. Both issues are being manipulated to higher levels, and the possibilities of greater income returns are being exploited as much as possible for market purposes. The Anaconda company states that its High Ore shaft is to be sunk to the 3400-ft. level. Its present depth is 2800 ft., which is the deepest working in Butte.

The Ahmeek Mining Co. is continuing to conform to precedent and has declared a quarterly dividend of $6 per share. Each dividend that Ahmeek has declared since it commenced distribution has been an increase over its previous payment. The previous dividend, which was paid in July, was $5 per share. Recent developments in the way of copper production at Cobalt are worthy of notice. The Timiskaming Mines Co. recently made a shipment to the American Smelting & Refining Co. of 30 tons of ore which contained 400 oz. of silver per ton. In addition to the silver, the ore carried 3% copper, and the Timiskaming company received $150 for the metal. This is the first payment on record made to a Cobalt property for copper. If, as has been foretold from time to time, Goldfield, Nevada, should develop into an important copper producer, it would be a noteworthy coincidence that the two best known of the precious metal districts in the country should develop into copper producers.

Wall Street has been interested in the acquiring by New York banking interests of the old Manning & Mackintosh claim against the Mexican Government, amounting to more than $50,000,000. As the Mexican Government is in such an unstable condition at the present time, it is to be presumed that Wall Street was able to acquire its part in the claim at a very considerable discount. N. L. Amster has purchased the San Jose de Sonoita grant in Mexico on the Sonoita river, consisting of some 5000 acres, valuable for both mineral and timber, but the principal present value of the property is its water rights, which will provide for all of the needs of the R. R. R. mine. An interesting organization has recently been perfected, headed by Samuel E. Adair, who was formerly an associate of the late H. H. Rogers of Standard Oil fame. Mr. Adair, working with a group of capitalists in New York and Philadelphia, has taken over a mining concession in Brazil covering 60,000 square miles, said to be richly mineralized. A unique feature of the company's work is that there is to be no stock offering. The properties will be worked entirely by leasing, on a 20 to 25% royalty basis.

BOSTON

Decline in Lake Superior Shares.—Lawson Again.—Hydro-Electric Consolidation in Utah.

The decline in Lake Superior copper shares has been worrying Boston considerably of late, as the movement is believed to represent something more than a mere transient phase of the market. It is feared that the leaven of Mr. Finlay's estimate of the district is at last beginning to leaven the whole lump. The decline of mid-September was not confined to Wolverine and the Dow stocks, but included nearly every stock in the Lake list except Ahmeek. Notwithstanding the high copper market and with every incentive to recovery, Boston has recently seen Calumet & Hecla selling 20 points below the year's high mark, Wolverine 37, Lake 14, Copper Range 9½, Mayflower 6, Old Colony 5, Allouez 4⅝, Isle Royale 3⅜, Quincy 8½, Adventure 3⅝, Superior 5⅞, Hancock 13, Osceola 21, Centennial 10, and the Dow stocks—Franklin, Indiana, Algomah, and North Lake—8¼, 8, 5, and 4, respectively. The weakness of all Lake shares has cast a gloom over the entire market. In mixed metaphors it may be said that the Lake situation is the one fly in the copper ointment which wet-blankets the market. For three generations the New England investing public has followed the Lakes, but it seems that their glory is departing.

Interest in the Ely district is also being revived by the activity on the Curb of Smokey Development Copper, an issue which is being handled here by Gay & Sturgis. Advices from Ely state that Smokey Development is showing good progress, the ore being good grade for over 100 ft. in the adit. Ely interests are predicting that Smokey Development will present the same possibility as Nevada Consolidated did at $5 per share and Cumberland-Ely at 25c. per share.

People have been wondering when and where Lawson would break out next. His stocks here have all been neglected, so far as he is concerned. Nobody has been able to say what would be the character and extent of his forthcoming eruption. Now it is announced that he will take up his war against the 'System' at the point he left off five or six years ago. The story will be resumed in *Everybody's Magazine*. *Everybody's*, a year or so ago, passed within the control of the Butterick corporation and was supposed to have modified its sensational attitude toward Wall Street with that transition. Now it appears that the magazine is to take up its 'muck-raking' again after the same fashion as when Ridgway and Thayer bought the moribund monthly from John Wanamaker, who could never make it profitable. The publishers engaged Lawson, who was then itching to expose the Amalgamated transaction, to write it up in serial form for *Everybody's*. Lawson was willing and made a great hit with his story, 'Frenzied Finance.' Following the Amalgamated flotation came the life insurance scandals, and Lawson continued his crusade in that field. Two or three years afterward he published his story, 'Friday the Thirteenth,' and later on his farewell to militant financial reform literature appeared in *Everybody's*, 'Why I Gave Up the Fight.' Now Lawson is to take up the dropped threads and is said to be more spectacular than ever. He proposes to show that 'sure-thing' gambling on the Stock Exchange is the real cause of the high cost of living, and will bring out his famous 'Remedy,' proposing to carry out his long-cherished intention of putting the Stock Exchanges 'out of business.'

The recent successful flotations of Pond Creek Coal, Butte & Superior, and Alaska Gold Mines by Hayden, Stone & Co. are to be followed in the near future by another offering, that of Telluride Power Co., unless the Bingham strike postpones the matter. The Telluride company is to be reorganized, with D. C. Jackling as president, and the plans of the banking house here are to bring about a consolidation of practically all of the hydro-electric power-plants of Utah and southern Idaho. The meeting of the company will be held in Chicago on October 1, at which time the capitalization is to be increased and a bond issue authorized. Several million dollars will be spent in building new plants and improving old ones. It is proposed to make the hydro-electric service for the mines, mills, and other industries of the intermountain country comparable in importance to the hydro-electric lines of California which serve the mines, smelters, and other enterprises of California and Nevada. The reorganized company is preparing to enter into a contract to sup-

ply Utah Copper with power at a cost of about $500,000 per year, which will reduce the expenses of the mining company about $100,000 per year. The generating capacity of the proposed consolidated plants will be 125,000 hp. Reed Smoot, David Eccles, and Jesse Knight are interested. While the new financing will be directed from Boston, it is understood that the control will be held in the West.

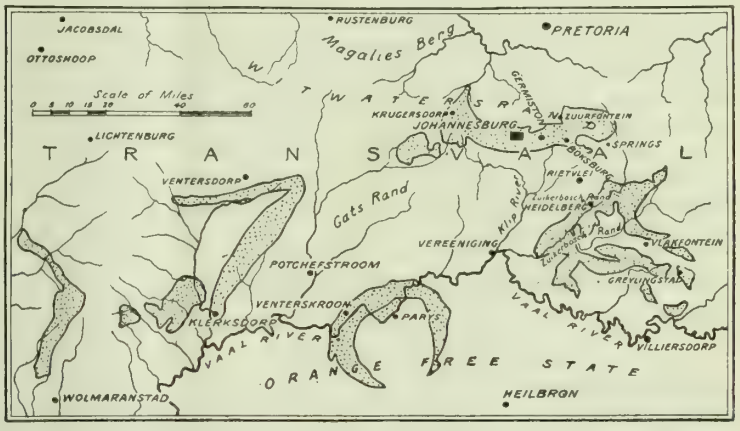
Wolverine since its 20-point slump has been the subject of all kinds of rumors. One rumor was to the effect that it would take over Mayflower and Old Colony. Wolverine is a New York copper and the others are Boston issues. Until a few months ago Mayflower and Old Colony were under the management of Harry F. Fay. But Fay was outvoted on Mayflower by the St. Mary's Mineral Land Co. faction, and Charles J. Paine, of Winona and St. Mary's Mineral Land Co. succeeded Fay as president. Physically, the expansion of Wolverine by taking over these next-door neighbors would be a logical move. Wolverine is a small property and could well afford, it seems, to follow the example of Calumet & Hecla, Copper Range, and Quincy in expanding. It is a pity that Wolverine did not acquire control of Mayflower and Old Colony last year, when they could have been had so cheap. Last year Mayflower sold down to 25c. and Old Colony to 50c. per share. The whole capitalization of the one could have been bought for $25,000 and the other for $50,000. Such a move, considering the developments which have since been made by the drills in Mayflower and Old Colony, would have made Wolverine one of the most brilliant speculations in the copper-share market here this year. Instead, it is now looked upon as approaching extinction, with the management indisposed to do anything to perpetuate its excellent name and organization. Wolverine could probably be amortized for around $100 per share, as the pillars in the drifts constitute an asset which has not been fully calculated. The company also has money in the treasury and quick assets in machinery. The debilitated condition of the Lake market is such that a consolidation of Wolverine, Mayflower, and Old Colony would be just the tonic needed. But it is a difficult matter to join two rich prospective properties with one whose days are numbered, even though it has a brilliant history in low-cost production and dividend payments.

JOHANNESBURG, TRANSVAAL

ECONOMIES FROM CO-OPERATION.—LOWER WORKING COSTS. EXTENSIONS OF THE RAND.

The Rand gold-mining industry will not suffer severely from the incubus thrown upon it by the Miners' Phthisis Act, which is estimated to mean an additional cost of a million sterling to the mines. Relief from this tax on the mining industry is to be found in the proposed co-operation among the mines in the matter of recruiting unskilled labor; the different groups having hitherto foolishly been in open competition in the labor market. The natural result has been that higher prices have been paid for negroes and higher wages offered to attract the negroes to the mines. It is expected that if the new arrangement is adhered to by all the different groups, the total saving ought to practically reach the same amount as the extra impost about to be cast on the mines through the coming into force of the Miners' Phthisis Act. The Railway Administration has also announced a reduction of 1s. 3d. per ton on the railway rate for carrying coal from Witbank to the gold mines on the Rand. Witbank is the principal centre now supplying coal to the gold mines, and as about 250,000 tons of coal per month is being used by the gold mines alone, this means a saving of about £200,000 per year in the fuel bill of the gold mines. This will be an additional compensation for the effects of the phthisis act. If, however, the mines and the Government would co-operate and induce or compel the miners to properly observe the mining regulations, there is every prospect that the better method of recruiting negro labor and the lower freight rate on coal to the Rand would result in an important reduction of costs; not perhaps to a record low level, but at all events to a shilling per ton lower than the prevailing costs of working.

The absolute necessity for lowering the working cost per ton milled appears to have been somewhat obscured by the adoption of selective mining; that is, mining the ore best adapted to increase the profits. This policy, of course, can be carried to the same extremes as sending waste to the mills, with the object of reducing the average working cost per ton milled, and both practices have been known to exist on the Rand. Selective mining tends to defeat its aim because it almost invariably results in a material addition to the working costs. After all, its benefits are of a transient character, impossible to maintain over the whole life of the mine, with the result that the duration of the mine is shortened and its latter days constitute a continuous struggle with an attenuated yield.



OUTCROPS OF THE RAND SERIES.

It was at one time thought that the adoption of coal-mining methods by aiming at a large output and low working costs per ton, would materially add to the profits of the Rand, and several coal-mining experts have been imported from England to bring about this much-needed economy. Unfortunately for the mines, the high salaries offered attracted the wrong type of men, who have been managing directors rather than practical mining engineers, with the result that the cost of mining has not decreased to the extent anticipated. What the Rand really requires is practical underground engineers, good organizers, men of sound knowledge acquired by practical mining. Those introduced have failed to meet these requirements, being more suited to lecture on mining subjects than to go underground and introduce practical economies. That Rand mining bears many striking resemblances to coal mining is true, but only to the most difficult types of coal mining. It is therefore necessary that a consulting engineer should be well versed in coal and metal mining, and above all be a good organizer and practical miner. If men of this type were introduced on the Rand, material reductions could probably be made in working cost, and the uneasiness felt at certain properties over impoverishment in depth would be removed by the adoption of better methods of mining.

The Chamber of Mines returns for the month of July record a total output of 766,338 oz. of gold, of which no less than 735,941 oz. came from the Rand. The value of the Rand monthly output alone is now over £3,000,000, and in July (a 31-day month) it was declared at £3,126,077. The outside districts only contributed 30,397 oz. to the Transvaal gold output in July, and on the whole the

gold output of the Transvaal, outside the Rand, can scarcely be considered satisfactory. There has been in progress lately an interesting discussion as to the probability of finding elsewhere in the Transvaal an extension of the Rand banket deposits. Seeing that the Rand goldfield forms the outcrop portion of an extensive irregular basin formed by surrounding bosses of granite, it might be thought probable that extensions of the Rand beds would be found beyond these granite bosses. Vestiges of extensions are claimed to have been found, but they are mostly identified with the lower, or unproductive, portion of the Witwatersrand beds, and all attempts to discover any indication of the upper or productive division of the Witwatersrand have hitherto ended in disappointment and failure. There is, of course, no reason why similar basins should not be found in other parts of the Transvaal, as beds of undoubted Witwatersrand age extend for almost the entire length of Swaziland on the Transvaal side. Unfortunately, these are all Lower Witwatersrand beds which as yet have not been proved to carry continuous profitable veins. In the Orange Free State an extension of the Lower Witwatersrand beds has been proved for many miles by the New Rand, Ltd., but as yet the upper or productive series is entirely absent. There is also the question as to whether, if found some distance from the Rand, the veins would prove profitable. In the neighborhood of Parys, in the Orange Free State, where the equivalents of the Rand productive banket outcrop, they are low grade and altogether too patchy to be workable. Taken on the whole, the prospects of finding another Rand in the Transvaal are not bright, but nevertheless there are several who still consider it possible that such a discovery may be made.

BLACK HILLS, SOUTH DAKOTA

VICTORIA MILL STARTS.—JUDGMENT AGAINST MINNESOTA MINES.—WORK AT THE WASP.

The Victoria mill has been started, and everything about the plant is working in excellent manner. About 100 tons per day is now being treated, but this will be gradually worked up to 200 tons, which is the full capacity of the leaching department. The Reliance mill has been started, under the management of F. C. Bowman, after some small changes in the mill had been completed under his direction. Judgments amounting to a little over $20,000 against the Minnesota Mines Co. have been liquidated by a group of the stockholders of the company. This is the first move in a plan to resume operations at this valuable property. Funds are now being raised to start development. The mine is equipped with a first-class hoisting and air-compressing plant, and the wet-crushing cyanide mill has a capacity of 150 to 175 tons per day. The property is at Maitland. E. Major is manager. The Bismarck mill, at Flatiron, will, according to F. B. Hitchings, the general manager, be in operation in sixty days. The plant will have a capacity of 300 tons per day and is modeled along similar lines to the Wasp No. 2, its nearest neighbor. In fact, both properties have the same character of ores.

The Wasp No. 2 company has erected some flat-bottomed ore-bins in the open-cut, into which the mine-cars will be dumped. Skips which deliver the ore to the mill will be filled from chutes in these bins. This will facilitate work as well as give a little extra storage for ore. The steam-shovel is being kept busy stripping, it being the intention to strip enough ore to keep the mill supplied while the shovel is shut down during the winter months. Where the shovel is now at work, on the north side of the open-cut, the stripping is 10 to 14 ft. thick, consisting of sand, rock, and shale. A Donaldson tilting-furnace, made by the Denver Fire Clay Co., was lately installed in the refinery, and is giving excellent service, using Wyoming oil for fuel. Coke furnaces were previously used for melting the precipitate.

E. J. Hoover, of Boise, Idaho, has secured the Golden Gate property, in Blacktail gulch, and a crew of men is employed cleaning out and repairing the old shaft preparatory to starting extensive development. The property has been a producer of a large quantity of refractory silicious ores, most of which were treated in the old Rossiter mill, at Deadwood. Nothing has been done at the property for twelve years, and the new owners hope to develop medium-grade milling ores which were untouched during former operations.

Work on the 600-ft. level has been discontinued at the North Homestake property, at Maitland, and it is announced that work will soon be started on the 300-ft. level, where a drift will be run northeasterly to tap the refractory silicious ores lying on the quartzite. This will give a large area of stoping ground. The Black Hills Standard company, a local corporation of which mention has already been made, has started its mill, and is operating steadily, handling 100 tons per day. The mill is in charge of C. G. Willard, for a number of years connected with Lundberg, Dorr & Wilson.

SUDBURY, ONTARIO

MINING IN THE WEST SHINING TREE DISTRICT.—RESULTS FROM VARIOUS PROPERTIES.—THE OUTLOOK.

There has been more activity in the West Shining Tree gold district, north of Sudbury, than last season, but there is no boom, as had been hoped and predicted by many people. The result of the winter's work and the active work of last summer did not prove a big gold mine in the district, but it gave great hope to the men on the ground and has resulted in further prospecting, and development of the already located properties. A number of engineers visited the district in the fall, but they did not advise their clients to buy any properties, because of the high prices asked, and the stiff terms required. Two options were taken on the Fred Gosselin property by different parties, and both have been relinquished after paying about $10,000 for the options and doing considerable development. The impression is that the property is of value, but the conditions did not make it possible to justify the high price asked, $300,000, within the short time allowed by the option. At any rate, Fred Galvin and Victor Rakowsky, of Duluth, have left the property, as the second payment of $15,000 is about due. The shaft was sunk 55 ft. and a good deal of surface work done. The failure of this property to interest the outside investor has had the effect of keeping other investors and operators from the district for the time. The Gosselin property is in Churchill and Asquith townships. In McMurchie township the Bennet property is reported to be opening well, as also are the adjoining Jefferson and the McIntire & McDougall properties. W. McVittie, of Sudbury, has taken an active interest in the Thomas Seville claims at McMurchie, and after an inspection decided to continue development. Other properties that are attracting attention are the Clark and Caswell claims at Asquith. The Clark claims show an extensive area of mineralized quartz, with copper and galena. Some fine-looking gold specimens have come from the McQuire claims, near the Clark group.

In general, it may be said that the area has been extended by the work of this season, and a number of new prospects have been found within the already known gold-bearing area, but there has been little progress made toward proving any of the deposits sufficiently large to be profitable. For free gold specimens this area is equal, if not superior, to the Porcupine district in its early days. What Shining Tree needs is work, and until something is done the outsider is likely to devote his attention to other fields. The district is now easily reached by a gasoline motor-boat in a day. A Government railroad from Porcupine has been surveyed to the district, and this is likely to be built soon. A wagon-road to the district is also being built which will be only 20 miles in length from the railroad.

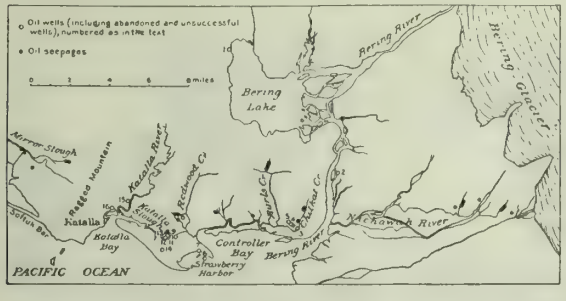
General Mining News

ALASKA

Cordova

The Bureau of the Census has issued its estimate of the population of Alaska in 1910, which gives the first judicial district, including Juneau, Ketchikan, Skagway, and others, a population of 15,216 persons; the second district, including Nome, Kuskokwim, St. Michael, and others, 12,351; the third district, including Bristol Bay, Cordova, Kodiak, Valdez, Kenai, and others, 20,078; and the fourth district, including Fairbanks, Otter, Circle, Koyukuk, Tanana, and others, 16,711; making the total population of Alaska 64,356 persons.

Seventy tons of supplies for the Government expedition to the Bering coalfield has gone adrift on a scow



KATALLA OILFIELDS, ALASKA.

and will probably be lost. Beginning October 1, the winter routing of the mail for interior Alaska will be resumed at the Cordova postoffice, and until November 24 there will be two mails weekly from Cordova and Fairbanks. From this date to March 24, there will be three mails of 1200 lb. each weekly. Father Bernard Vaughan, an English Jesuit, has spent some time in Alaska of late, and said that he found the miners to be a hearty, honest, good-natured, and open-handed class of men.

Nome

The Miocene Ditch Co., controlled by the Pioneer Mining Co., has started a suit against the Wild Goose company for $1,500,000 for having diverted the waters of the Nome river during the past six years, and alleges that these waters were acquired by the Miocene company under rights obtained through the Champion Ditch Company.

Telegraph advice states that a rich find of placer gold has been made on Boulder creek, six miles from Nome. The ground yields $2.50 per pan, and great excitement prevails. It is thought that an extension of the third beach line, which has yielded so much gold, has been discovered.

ARIZONA

Gila County

(Special Correspondence.)—Churn-drill hole No. 3, at the South Live Oak, is 780 ft. deep, and is reported to have passed through ore for 40 ft., with an average of about 2% copper, though some samples went nearly 3%. At the Copper Reef mine, 12 miles south of San Carlos, the drift from the California adit, on the California vein, has disclosed the ore-shoot for a length of over 200 ft., and the face is still in ore. It is reported to have an average width of 10 ft. and to contain 3% copper and $8 per ton in gold. A raise is being driven to the surface, a distance of 220 ft., and is now up about 160 ft. A winze has also been started on the ore, and is down about 30 ft. About 25 men are employed.

Globe, September 14.

(Special Correspondence.)—Old Dominion produced 2,597,696 lb. of fine copper in August with four furnaces in continuous operation, compared with three furnaces in July. Preparations are being made to move the old buildings near the main shaft to make room for the new crushing plant, sampling mill, ore-bins, and conveyor-houses, and excavation for the crushing plant has been started. A skip-pocket is being cut at level 14 preparatory to replacing cages with skips for hoisting ore. Similar pockets will be cut at No. 8, 12, and 16 levels. This work must be done and the change made in the method of hoisting without delaying or interfering with hoisting of ore, and therefore proceeds slowly, so that it will probably be eight months before it is finished. About 1200 men are employed. The Inspiration Copper Co. has three Velie motor trucks at work hauling supplies from the town of Miami to the mines, distances of one to three miles. They are of 1500, 3000, and 6000-lb. capacity, respectively. Records were kept of the last machine. It made trips daily at a cost of 48c. per ton-mile, of which 24c. was for labor and depreciation, 13c. for repairs, and 11c. for fuel and oil; being 9c. per ton-mile less than the cost of hauling by teams. The mine officials are quite satisfied with the work of these trucks.

Globe, September 19.

Graham County

The Arizona Copper Co. produced 1630 tons of copper in August.

Mohave County

The mill at the Mocking Bird mine has been working intermittently, and the cyanide plant has not started yet. Burke and associates, leasing at de la Fontaine mine, have shipped 50 tons of zinc ore to the smelters. They also have 50 tons of lead ore and 40 tons of screenings on hand. The tungsten mines in the Acquarius range are reported to show good ore, the average shipments being 70% ore, and the average as broken in the mine being 10%. The Golconda is shipping 1400 tons of rich ore per month to the smelter in Oklahoma. The mine is in good shape.

Santa Cruz County

Immigrant and customs inspectors have been on a tour as far west as Ajo, about 200 miles from Nogales, and report great activity in the old mining districts visited. About 300 men are working at Ajo, which has been practically dead for some years. The C. & A. Mining Co. has 50 diamond-drill men prospecting the district. Many Mexicans and Indians are employed in that part. An automobile service is in operation between Ajo and Gila, about 45 miles across the desert.

CALIFORNIA

Amador County

The ninth quarterly report of the Lincoln Consolidated Mining Co. shows that receipts amounted to $15,794, and expenses were $12,666, leaving a credit balance of $3128. To date receipts have totaled $103,454, and expenses $100,327. Everything about the mine is in first-class working order. New gear, pinion, and cable have been fitted at the hoist. A long-time power and water contract has been arranged with the Pacific Gas & Electric Co., at a favorable rate, under which that company agrees to furnish additional transformer capacity. J. Surface, Ione City, California, is now a director.

No work was done on the 800-ft. level during the past quarter, as all the transformer capacity was required for other parts of the mine. Driving will be resumed in the east cross-cut from the north end of this level later on. The westerly drift in the west cross-cut of the 1200-ft. level has been driven north for 152 ft. in low-grade ore; and work has been stopped for the present. The south drift on the 1950-ft. level has been extended 857 ft., making it a length of 1988 ft., and is now in a fine vein with good walls, which is thought to be the main Wildman vein. Probably the drift is now under the north orebody of the Wildman mine. The latter shaft is full of water and cannot be explored at present. The Wildman's south lode, 160 ft. wide, is some distance south of the shaft, and it will take the Lincoln people about three months to get under where it was found on the 1400-ft.

south level of the Wildman, this being the objective point, where good ore in large quantities is expected. The east cross-cut from the 1950-ft. level is in 802 ft. in black slate and small veins of good-looking quartz.

Calaveras County

(Special Correspondence.) -The 40-stamp mill at the Angels mine is working steadily. Fair-grade ore has been opened at a depth of 850 ft. The shaft at the Lightner has passed the 1050-ft. point and is making fair progress. It is reported that an Eastern company has taken an option on the Tulloch mine for $65,000. The property is at Albany Flat and is being worked under a bond by J. F. Curtis, who offered it to Eastern people. Fair-grade ore has recently been found. The Calaveras Copper Co. has everything in readiness for early smelting at Copperopolis, and it is planned to commence heavy production shortly. Another copper property, the Pool, at Nassau, is to be placed on the operating list, according to recent reports. Some good ore has been developed, and it is proposed to sink deeper.

Angels Camp, September 21.

Inyo County

(Special Correspondence.)—During the month of August the mill of the Skidoo Mines Co. treated 1142 tons of ore, with a yield valued at $17,613. Operating costs were $6837 and development $1232, leaving a net profit of $9545. The mill lost 10.83 days during the month.

Los Angeles, September 24.

The Foreign Mines Development Co., of London, England, successors to the California Trona Co. at Searles, is to resume work at the Borax lake mines. These deposits of trona, or carbonate of soda, cover 40,000 acres of unpatented land in San Bernardino county, and 800 acres in Inyo county. Litigation between these companies has ceased.

Los Angeles County

The Republic Smelting Corporation has been organized under the laws of Arizona, with head office at Parker, Arizona, and business offices at Los Angeles. The company is capitalized at $7,500,000, of which $1,500,000 has been paid for the property. The officers are: F. C. Fenner, president; W. J. Robinson, treasurer; R. G. Munn, secretary; and J. A. Chestnut, vice-president and general manager. W. W. Wishon will serve as consulting engineer and S. J. Gormly as metallurgist.

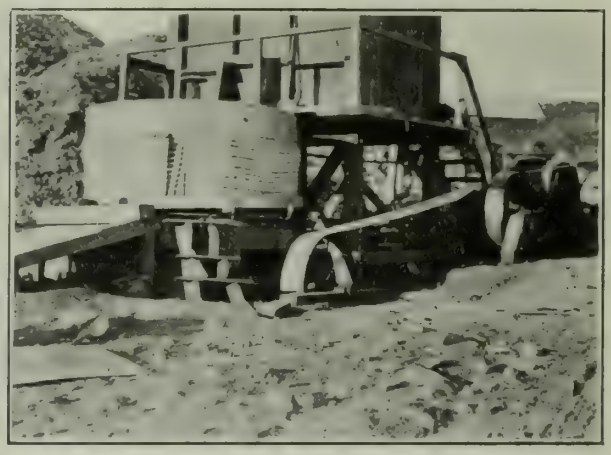
Nevada County

(Special Correspondence.)—A rehearing was recently granted in the case of the Champion Mines Co. *v.* the Champion Gold Mining Co., and both sides are preparing for the fight. The case involves title to the Champion mines in this district, now being worked under bond and option by the North Star Mines Co. The latter company appears to have no fear of future legal trouble, and continues development work. At its main properties, the North Star company is working as usual. The 80-stamp mill is operating on good grade quartz from the Central workings. During the first half of the year $100,000 was distributed in dividends, and to date the North Star has disbursed $3,586,989. Unwatering of the Oustomah is progressing. Klinker brothers, of Los Angeles, have a bond and option on the mine. The lower adit at the Native Son, near Blue Tent, is in over 400 ft., and is expected to intersect the vein about 400 ft. farther in. Hand-drills are used and the work progresses at an approximate rate of 15 in. per shift. J. H. Bishop is manager. Klinker brothers report the finding of pay-gravel at the Oak Flat, above Columbia hill. The adit is being extended to prove the channel. The gravel is of the blue variety, and by some is thought to be the continuation of the Bald Mountain channel. The erection of the new cyanide plant at the Pennsylvania mine, Grass Valley, is about to start. Preliminary grading is practically complete. Development in the mine is reported to be consistently satisfactory. Walter and Garret Biglowe, of Oakland, are arranging to reopen the old Siberia property, near Badger hill. The mine was a fair producer several years ago.

Nevada City, September 15.

Yuba County

(Special Correspondence.)—In many mining districts in California numbers of dumps of low-grade ore have been left by miners who have prospected for a higher-grade ore before erecting stamp-mills. Sometimes this better grade was found, but the low-grade dumps were covered or left as too poor for milling. At the Pennsylvania mine, at Browns Valley, J. C. Campbell has erected and is working a 9-ft. Beer roller quartz mill to treat the large dump partly shown in the illustration. This mill is a success, and two more are now at work. The dump consists of quartz and country rock of porphyritic diabase, averaging $3 per ton from test runs. The Beer mill is driven by a 20-horse-power gas-engine at 30 r.p.m., and grinds about four tons per hour through a 24-mesh screen. Both



BEER ROLLER MILL AT PENNSYLVANIA MINE.

inside and outside amalgamation is used, the latter being made efficient by the addition of a 55-ton Pierce amalgamator for saving floured mercury and fine gold.

Browns Valley, September 18.

COLORADO

Dolores County

From July 25 to August 25 the Rico-Wellington company shipped 1340 tons of ore, which returned $27 per ton net from the smelter. The company has leased the Rico Mining Co.'s mill, at Rico, for five years. It was built for the treatment of zinc, lead, and silver ores, but is not adapted in its present form to the Rico-Wellington ores. Tests have been made for some time past on these latter, and 250 tons was taken averaging 15.65 oz. of silver, 24.4% lead, and 32.13% zinc. Two products were made, zinc and lead concentrate, assaying (1) 45.58% zinc, 5.8% lead, and 5.6 oz. of silver; and (2) 55.9% lead and 31.6 oz. of silver. Out of 100 tons of ore there would be 52.5 tons of zinc and 32.4 tons of lead concentrate. About 10,000 tons of this ore is ready to be mined. It will cost $21,500 to remodel the mill. To the present two crushers, three rolls, two Huntington mills, and 10 Wilfley tables, will be added one tube-mill, five Deister tables, six Callow tanks, two Callow screens, four pumps, and several elevators. The mill will be driven by electric power, and may exceed 75 tons per day.

Jefferson County

(Special Correspondence.)—The experimental plant at the Colorado School of Mines is now equipped with the concentrating unit, and as the second quarter of the appropriation, amounting to $12,500, will be available by October 1, complete equipment for all the units is promised before the end of the year. C. T. Durell has been making tests with flotation on Colorado zinc ores, and apparatus has been arranged in the plant in advance of the

completion of the permanent equipment. Last year a course in coal-mining was added at the school, as it was felt that more time should be devoted to instruction on this subjection, considering that Colorado employs 15,000 men and produces 12,000,000 tons of coal yearly. Twenty-two men attend the coal-mining classes. Most of the coal-fields are easily accessible to students.

GILPIN COUNTY

At a depth of 245 ft. in the Gilpin Orion property, a vein of copper ore 6 in. wide and assaying $160 per ton has been cut. The shaft will be continued to 300 ft., when the mine will be opened at this depth. S. Laner and associates, working the Columbia lode on Quartz hill, have shipped 10 tons of smelting ore, averaging $35.50 per ton, from a winze sunk below the 200-ft. level. The local people working the Troublesome mine, on Winnebago hill, are mining ore worth $35.50 at the 180-ft. level. Shipments from the Bates mine, in Chase gulch, and the Pittsburg mine, Lake district, have returned good averages in gold, silver, and copper. From the latter mine 50,000 to 60,000 gal. of water is being pumped daily.

LAKE COUNTY (LEADVILLE)

Based on the present output of 150 tons of spelter per day from Carbonate ores, it is estimated that Leadville will produce 109,000,000 lb. of spelter this year, compared with a total output of 94,607,456 lb. from the whole state in 1911. During August the New Monarch company sent out 101 cars of medium-grade ore from different levels in the Cleveland and Winnie. From 500 to 600 ft. of development was done, and 80 men are employed. The Winthrop company, at English gulch, has several carloads of machinery ready to be taken to the mine as soon as the Colorado & Southern railroad has built the spur line. Lessees on the Fryer hill mines are busy. Ore averaging 30 to 40 oz. of silver per ton, with some lead and gold, is being shipped from the Adelaide through the Yak tunnel.

TELLER COUNTY (CRIPPLE CREEK)

The present flow from the Roosevelt drainage tunnel is 11,000 gal. per minute. On No. 9 level, 1000 ft. south of the Lee shaft of the Isabella, lessees have cut 8 ft. of ore assaying $41 per ton. They have also opened a rich shoot on No. 8 level. All the lessees at this property are doing fairly well. A 30-hp. electric hoist has been erected at the Mary Cashen shaft, while several machines have been started on a cross-cut to open some of the known orebodies. A 15-hp. electric hoist is also being erected on the Lottie claim of the Stratton estate. The Portland company has put in a 60-hp. electric hoist to scrape into one of the old stopes dry tailing from the mill. The Blue Flag mill is treating 125 tons per day with a high extraction. First-class concentrate from the Portland mill is being shipped to Colorado Springs for treatment.

IDAHO

IDAHO COUNTY

Machinery has been ordered for the American Eagle mine. The Rio Tinto company, which has an option on this property, is to sink a shaft 500 ft. near the mouth of No. 1 adit, where a rich shoot was found when the mine was worked some years ago. A raise will be driven from No. 2 to No. 1 adit. A. W. Boyd, the former superintendent of the mine, is in charge. The Last Chance mill has plenty of water for power and plenty of ore for crushing. A rich shoot has been opened at 300 ft. in the Center Star mine. The mill at the South Fork is again at work after a shut-down for repairs. At the Clarence Ray claim, in the Buffalo Hump country, the adit was driven 350 ft. in hard granite, and has cut ore of good grade. The lode at the Mascot has been opened by an adit 300 ft. long, besides by open-cut. It is 6 ft. wide and oxidized, suitable for a Huntington mill, and a 3½-ft. mill has been erected. It is driven by water-power. At present only copper plates are used for saving the gold.

SHOSHONE COUNTY

The Federal Mining & Smelting Co. has acquired the Wilson-Mackay property adjoining the Standard mine at Mace. The price paid is said to be about $250,000. The Federal company has held several options on the claims, but has allowed them to lapse, up to the present deal. The old bunkhouse of the Bunker Hill & Sullivan company was burned down on September 14. The Yankee Boy mine, on Big creek, has been leased to F. Barker and W. Hughes, who have started active operations. Visitors from the East have inspected the Amazon-Dixie property, which is situated near the summit of the mountains which divide Idaho and Montana. At present 16 men are employed. Ore outcrops for 960 ft. and is being developed at 200 ft. from the surface by an adit, where the lode is from 6 to 60 ft. wide. About 1656 ft. of a lower main adit has been completed. The surface has been equipped with necessary plant and buildings.

MONTANA

LINCOLN COUNTY

(Special Correspondence.)—The Kalispell-Lincoln Gold Mining Co. has completed a 3-stamp mill on its property in the West Fisher district, 35 miles south of Libby, and it will be started at once. The company has a rich vein of gold-bearing quartz, a large part of which, according to the owners, will average $100 per ton in gold.

Libby, September 16.

LEWIS AND CLARK COUNTY

At the State Fair being held at Helena during the present week, prizes will be given for the best collection of concentrator products, smelter products, and other displays. E. P. Mathewson, manager of the Washoe smelter at Anaconda, is chairman of the Mine Products Exhibit Committee.

SILVERBOW COUNTY

From the Badger State, a former Boston & Montana property, about 700 tons per day is being hoisted, but this could easily be increased if necessary. Five veins are being worked, including the Edith May and Jessie, of the North Butte. Ore sent to the smelter averages 4% copper and 5 oz. of silver per ton.

NEVADA

ESMERALDA COUNTY

Work at the mines and mill of the Goldfield Consolidated continues on the usual lines, most of the ore coming from the Clermont and Mohawk; and high-grade ore being shipped from the deep workings of the Grizzly Bear to the smelter at Tooele, Utah. This ore now contributes largely to the company's output, and it is said that a large tonnage is available. The new station in the Grizzly Bear shaft, from which the drift is to be driven south into the property of the Atlanta company and to connect with the cross-cut from the Merger shaft within Atlanta ground, has been completed, and the drift will be started at once. This work will be of value to the three companies, as it will give good ventilation for their deep levels. The shares of the Goldfield Consolidated have been withdrawn from the New York Stock Exchange and are now being traded in on the Curb market. The main shaft at the Merger is now 1400 ft. deep, and at 1330 ft. a station is being cut out, from which a cross-cut will be driven to the Atlanta to connect with the drift from the Grizzly Bear. About 800 ft. north of the shaft, and in the ground formerly included in the Baby Florence No. 2 lease, the Florence Goldfield has stoped some rich ore. A raise from the cross-cut on the 350-ft. level has entered the shoot, and stoping is now in progress. Another raise has been started from this level, and for a width of two feet the ore averages $300 per ton. Some good assays have been obtained from the 800-ft. level. The shaft is down 1245 ft., and work will soon be started on the 1200-ft. level. Ore is being sent to the Jumbo Extension mill, which has been shut down temporarily for repairs. Ore which averages $50, containing tellurides, has been ex-

posed on the Diamondfield Black Butte, in the new workings of the Black Butte Leasing Co., a a point southwest of the main shaft. A winze is being sunk on the vein, which shows 18 in. of rich ore at one end. A 40-hp. electric hoist is to be erected at the Goldfield Midway, and the shaft will be sunk to 500-ft. depth. Good assays have been obtained from an ore-shoot which has been opened on the north lode of the Vernal.

LYON COUNTY

The average shipments from the Nevada-Douglas for the past week were 350 tons of copper ore per day, the Ludwig providing 200 and the Douglas 150 tons. Gypsum is being sent out at a steady rate. The former mine is opening well, and the seventh level shows a good tonnage of 15% ore. The main incline is being sunk from 700 to 1000-ft. depth. The latter mine is being prospected by cross-cuts from adits. Diamond-drilling is to be started at the 700-ft. level of the Ludwig. The new ore-bin is well under way; and extra sidetracks and spurs are being laid down.

NYE COUNTY

During August the mines at Tonopah milled 41,586 tons of ore. For the week ended September 21 the production was 10,723 tons, with an estimated value of $268,075. The Tonopah-Belmont made a net profit of $151,074 for August, from 11,736 tons treated; and the West End made $30,900 from 3650 tons. The mid-monthly clean-up of the Extension resulted in 36,524 oz. of bullion worth $28,200. During the past week a fine orebody has been opened on the 1250-ft. level of the North Star. It was cut in the southeast cross-cut in andesite, near the Favorite claim of the Belmont company, and is 30 ft. wide, of quartz veins and country rock carrying low metal content, but 14 in. on the hanging wall showed silver and yellow pyrite of high assay value. Further driving opened 4 ft. of ore, and samples from across 14 in. and 24 in.

NEVADA HILLS MILL, FAIRVIEW, NEVADA.

gave 43 oz. of gold and 39 oz. of silver, and 53.1 oz. of gold and 58 oz. of silver, respectively. The four feet will average $250 per ton. An employee at the Tonopah Mining Co.'s mill, at Millers, accidentally drank cyanide solution last week. The usual antidotes and stomach pump were promptly used, but failed to prevent his death.

The banks at Tonopah report the receipt of $11,000 in bullion from the War Eagle and Associated mills at Manhattan, and $1080 from various leases and $700 in placer gold. On the 200-ft. level of the Big Four mine a width of 50 ft. of ore, worth $25 per ton, has been opened. The raise from the 500 to the 400-ft. level is about completed. Assays have returned $15 per ton from this work. The raise in the Kendall-Douglass lease of the Manhattan Consolidated is now up 40 ft., showing 5 ft. of rich sulphide ore, with a tendency to increase in width. All the ore hoisted is sent to the War Eagle mill and averages $46 per ton. The Amalgamated has just completed a second crushing of 100 tons of ore averaging $16 per ton, at the Associated mill. This ore comes from stopes above the 150-ft. level.

STOREY COUNTY

The new vertical centrifugal pump installed on the 2500-ft. level of the C. & C. shaft, is at work lifting water to the pumps at the 2310-ft. station. The two pumps here throw it to the Reidler pumps at 2000-ft. level, these elevating it to the Sutro tunnel drain. The water is being easily handled. The pressure water on the hydraulic elevator pumps has been turned off, they having been at work since 1899. The Ophir and Consolidated Virginia have made little headway during the past week on account of the changes in the pumps at the C. & C. shaft. The Consolidated Virginia has driven north and south on the 2300-ft. level through porphyry and quartz of low value. Good progress is being made with the Ophir cyanide plant.

At a meeting of the Comstock Pumping Association, held in San Francisco, it was decided to shut down the Ward shaft. This will mean the lifting of the pumps from the 2150-ft. station, and the rising of the water to its natural level, below the Sutro tunnel connection.

NEW MEXICO

LINCOLN COUNTY

The old White Oaks mining district, which is said to have produced gold valued at $3,000,000, and is 150 miles north of El Paso, is likely to have a revival. The gold mines are just west of the town of White Oaks, and the coal mines are on the east side; and there is ample water for general purposes. The principal developed mines of the district are the Old Abe, South Homestake, North Homestake, Little Mack, Rita, Lady Godiva, Henry Clay, and a few in the prospecting stage. The first-named has a bullion production of $1,000,000, and the second about $900,000.

LUNA COUNTY

Prospects of an increased output from the mines in the Deming district are considered good, especially as the smelter at Deming will be opened very soon. The Chance mines will use the smelter mostly for its ores. The Helen group is shipping 300 tons of ore per month. The owners of the Othello and Desdemona have contracted to deliver 20,000 tons of lead and zinc ore.

UTAH

BEAVER COUNTY

So far during September the Majestic has sent out 27 cars of ore, and the total is expected to be 45, against 40 in August. None of this ore has come from below the adit level. It has been followed for 1500 to 1600 ft. and is 30 ft. wide in places. The ore is copper-bearing, with a high percentage of iron. Thirty men are employed underground.

JUAB COUNTY

It is not thought likely that the strike at Bingham will affect the mines in the Tintic district, unless the smelters are closed. When the mine-owners get together they will hear the committee selected by the miners to discuss the wage question. Development on the 500-ft. level at the Iron Blossom has opened a fair deposit of lead-silver ore, worth $40 to $50 per ton in the raise at this point. About 150 tons of ore per day is being shipped from the mine. Electric power is to be generally used at the Victoria mine. The Knight people have selected a site for their concentrating plant. During its past year the Black Jack development totaled 1218 ft., and ore shipments netted $1954. The mine should yield a profit when the new mill is ready to deal with the low-grade ore. Good ore is being mined on the 700-ft. level of the Eagle & Blue Bell mine, and shipments may soon be increased to 12 cars per day. The May Day mine is shipping 10 cars of ore which will average about 30% zinc.

SALT LAKE COUNTY

Following are the wages paid at the Bingham mines, where the strike is still on: Machine men, $3 per 8-hr. shift; machine helpers, $2.75; hand and steel men, $2.50 and $2.75; timbermen and helpers, $2.50; trammers, $2.50;

horse and mule trammers, $2.75; and 'nippers', $2.50 per shift. Wages paid to employees on the surface are: Machinists on drills, $4.80 per 10-hr. shift; first helpers, $3.60; second helpers, $2.50; drill sharpeners, $3.50 per 9-hr. shift; blacksmiths, $4; helpers, $2.75; steam-shovel operators, $190 per month for 10-hr. shift; crane-men, $135; shovel firemen, $3 per 10-hr. shift; carpenters, $4.44; helpers, $2.50; bank-men, $3; powder-men, $3.25; pipemen, $2.50; engineers on switch engines, $4.25; firemen on locomotives, $3; brakemen, $3.50; boilermakers, $4; helpers, $2.75; and compressors, $4.50. An increase of 50c. per day for all classes of mine and mill labor is demanded.

Mr. Moyer, president of the Federation, said that "different strikes assume different attitudes, and it is not possible to forecast the future of the present strike. The Federation will do its utmost to preserve order and comply with the law. The officers of the Federation are ready to discuss the wage question. The strike is deplored, but it would have been obviated if the operators had treated with the unions." D. C. Jackling stated that "the whole trouble at the mines has been caused by a few men who have come into the district to make trouble. They are agitators pure and simple, and intended to make trouble when they came to the district. We have known what they were doing for some time; but there was no way of stepping in and stopping it without appearing arbitrary or unjust. They have raised all the trouble, mixing with the men for the single purpose of starting this strike. Now some must suffer, but these agitators will be the first to go. Notwithstanding the present high price of copper, the operators of the Utah Copper Co. have not yet fully reflected this condition, for it requires approximately four months from the time the ore is mined before the company can get its money for the product, and the present price of the metal has not been sustained for anything like such a period. No one can tell what the future action of the copper market will be, but we believe that it will be good, and therefore hope within a reasonable time to be able to readjust our scale, and offer increased wages to such classes of employees as are reasonably entitled to such increase." Regarding the concentrating plants and smelters likely to be affected, at Garfield there are about 2000 men at the former and 1200 at the latter. The International smelter employs 250, and there are 1100 employed at each plant at Murray and Midvale. The Ohio mill employs about 350, and other mills of the camp employ a total of 350 to 400 men. This makes about 6400 men employed in plants wholly or to a great extent dependent on the mines of Bingham for their employment. The Garfield smelter has a large tonnage of copper ore and concentrate on hand, but not enough to work full-handed for any length of time; the International smelter at Tooele has a good supply of lead ore on hand. The Midvale plant of the United States S. R. & M. Co. may be able to continue for a considerable time, but its Huff electrostatic zinc plant at Midvale will probably close, and the Murray smelter of A. S. & R. Co. should be able to work on indefinitely on lead-silver ores. It is stated that a great number of the foreigners employed in the mines are armed and have assumed a defiant attitude to mine officials and others, but there has been no serious trouble so far. It is quite possible, judging from the speeches of Federation leaders, that the trouble may extend to Butte in Montana and Ely in Nevada.

Tooele County

Reports state that nearly $1,000,000 worth of metal has accumulated at the International Smelting & Refining Co.'s plant at Tooele since the treatment of lead-silver ores was started last March. The new refinery at East Chicago, Indiana, is finished, and bullion is being sent from Tooele at a rate of 100 tons per day.

CANADA

British Columbia

(Special Correspondence.)—The Coronation Mines, Ltd., at Cadwallader creek, Lillooet, is doing a fair amount of development, and 12 miners are at work. The cross-cut on the 400-ft. level at the Little Joe claim cut the lode, which is from 18 to 24 in. wide, and the shoot has a length of 35 ft. A raise is being driven to No. 3 level, and gold is visible up the raise and along the drift. At the Countless claim, some 1200 ft. away from the former, a lode which outcropped on the surface 700 ft. west was cut 415 ft. from the portal of the cross-cut. This is 190 ft. from the surface, and shows free gold and pyrite over a width of four to five feet. Driving is under way for the Little Joe vein, which has been opened on the surface for over 600 ft., assaying $18 per ton throughout.

Victoria, September 18.

Yukon

The Yukon river is four feet lower at Dawson than at this time last year. About 3500 tons of freight has to leave White Horse for Dawson before the close of navigation. Of this amount, about 2000 tons is for dredges being constructed near the latter centre. Steamers have been delayed by sand and débris in the river, and the *Dawson Weekly News* of August 22 speaks plainly on the great gold output of the country, the necessity for keeping the river clear, the small Government appropriation for such work, and its effect on future work. The most prosperous mining creek is said to be the Sulphur, where there are a good number of open-cuts, self-dumpers, and windlass outfits. C. Nagin, who owns eight claims, recently cleaned up with a yield of $5000, and E. Johnston has had several good runs, one yielding over $2000. It is said that the White Pass & Yukon railway, which operates between Skagway and White Horse, 14 miles, has been sold to the Grand Trunk Pacific Railway Co., the actual transfer to be made on January 1, 1913.

MEXICO

Chihuahua

The revolution has interfered little with construction work of the Mexican Northern Power Co., and the plant should be completed by June 1913. This company has a paid-up capital of $12,000,000, and $10,000,000 bonds issued, and owns a concession to develop power on the Conchos river. The power-plant will cost $8,000,000. The main dam at the Bogrulla is 900 ft. long, 230 ft. wide on the upstream side, and 200 ft. thick at the bottom. The present installation will develop 20,000 horse-power.

Guadalajara

Machine drills are working at the Tajo mine, in the San Sebastian district of this state, and development is quite satisfactory. In the deepest workings, the Porvenir adit, the Tajo vein is from four to six feet wide; and within 100 ft. in the west drift it is expected that an ore-shoot which yielded rich ore in past years will be cut. All work is done by adits on this property. A good deal of water flows from the Porvenir adit, and this will be used to provide power. G. J. Rockwell, of Denver, is in charge.

Sonora

(Special Correspondence.)—Notwithstanding the difficulties and adverse conditions caused by the Mexican revolution and Yaquis, the management of the Mina Mexico company, of Sonora, has been able to keep its plant at work and will make all efforts to continue operations. Comparative calm is prevailing at the mines, and no serious difficulties are anticipated. The old concentrator of the company is in course of reconstruction, and the remodeled plant will have a capacity of 100 tons per day. A rich orebody has been opened between the eighth and ninth levels, and development is being pushed vigorously. The shaft is nearly 1000 ft. deep. General indications are very promising for the future of the mine. The company has a large tonnage of rich ore and concentrate on hand and expects to blow in its 100-ton smelter shortly, and resume making shipments of concentrate and matte.

Mina, September 8.

Personal

Professional men are invited to send news of their engagements and travels. Such news is interesting to friends.

R. B. LAMB is at Swastika.

C. W. MERRILL has gone East.

HARRY G. PEAKE is in Europe.

GELASIO CAETANI is in Arizona.

KARL EILERS is at the Fairmont.

A. J. EVELAND has been at Park City.

W. H. STORMS has gone to Bakersfield.

E. M. HAMILTON is at Cobalt, Ontario.

MARK B. KERR is here from Nevada City.

F. B. WEEKS was in San Francisco recently.

C. W. MORSE has gone to the Redding district.

HOWARD D. SMITH has returned from the East.

M. B. BELDEN has gone to Gilta, Siskiyou county.

LIONEL LINDSAY is visiting mills in the Southwest.

CLIFFORD G. DENNIS has returned to San Francisco.

CHARLES GUNDEROTH, of Utah, is at Miami, Arizona.

JOSEPH C. HOPPER is here on his return from Nevada.

R. HAY ANDERSON is returning to Mexico from London.

A. M. CHAMBERLIN has returned from Juneau to San Jose.

F. LYNWOOD GARRISON is expected in San Francisco during October.

K. C. STADTMUELLER is now with the Braden Copper Co. in Chile.

ALBERT BURCH has returned from Idaho and gone to Amador county.

FRED MILLER was in town during the week and has returned to Grass Valley.

HENRY R. PUTNAM has moved from Virginia City, Nevada, to San Francisco.

JOHN S. BUTLER is now with the Cia. Metalurgica Mexicana, at San Luis Potosi.

C. H. GREIME will leave Fairbanks, Alaska, at the end of September, for Seattle.

C. COLCOCK JONES was in San Francisco on his way to Los Angeles from Nevada.

J. PARKE CHANNING was here during the week and has returned to Salt Lake City.

F. H. PROBERT is at Patagonia, Arizona, and will return to Los Angeles during the week.

T. GEORGE MACKENZIE, who has been in Nova Scotia, is now at Parral, Chihuahua, Mexico.

F. L. SIZER is in Arizona, but expects to return to California about the first of the month.

E. P. CRAWFORD is at Berkeley on his return to Silver City, New Mexico, from a trip to Alaska.

W. RAY COX has been appointed mineral inspector for the General Land Office, with headquarters in San Francisco.

F. B. LAWSON, chairman of the Mountain Copper Co. passed through San Francisco on his way to Korea and the Far East.

BERNARD MACDONALD has been in Cobalt and New York, and has returned to Los Angeles, where he is staying during the trouble in Mexico.

Obituary

JOHN ALEXANDER CHALMERS died on September 9 at his home in Bournemouth, England, after a long illness. He was formerly one of the engineers for the Consolidated Gold Fields of South Africa, and in collaboration with F. H. Hatch published 'The Gold Mines of the Rand.'

Market Reports

LOCAL METAL PRICES

San Francisco September 26.

Antimony	11—11½c	Quicksilver (flask)	41.50
Electrolytic Copper	18—18¼c	Tin	.52—53½c
Pig Lead	5.35—6.30c	Spelter	8¼—8½c

Zinc dust, 1400 lb. casks, per 100 lb., small lots $9.50—9.75; large $7.50—8.50

METAL PRICES

(By wire from New York.)

NEW YORK, September 26.—Copper, lead, and spelter remain firm. Average daily prices for the past week, in cents per pound, based on wholesale transactions, standard brands, are given below.

Date.	Electrolytic Copper.	Lead.	Spelter.	Silver, per oz.
Sept. 19	17.48	5.10	7.53	63⅛
" 20	17.48	5.10	7.53	63⅛
" 21	17.48	5.10	7.53	63⅜
" 22	Sunday.	No market.		
" 23	17.48	5.10	7.53	63⅜
" 24	17.53	5.10	7.53	63⅜
" 25	17.53	5.10	7.53	63⅜

LONDON QUOTATIONS

(By cable, through the courtesy of C. S. Burton & Co., New York.)

	September 26.
Camp Bird Ltd	£ 6⅛
El Oro	3⅛
Esperanza	9/6
Oroville Dredging	1⅛
Santa Gertrudis	7⅜
Tomboy	6⅛

COPPER SHARES—BOSTON

(By courtesy of J. C. Wilson, Mills Building.)

	Closing prices, September 26.		Closing Prices September 26.
Adventure	$ 6¼	Mohawk	$ 66½
Allouez	45⅜	North Butte	34
Calumet & Arizona	81½	Old Dominion	61½
Calumet & Hecla	590	Osceola	111
Centennial	19	Quincy	88
Copper Range	58⅜	Shannon	15¼
Daly West	4½	Superior & Boston	1⅛
Franklin	7	Tamarack	43
Granby	58	Trinity	5⅝
Greene Cananea, ctf.	9⅜	Utah Con	12
Isle-Royale	35	Victoria	2⅜
La Salle	6	Winona	4
Mass Copper	7½	Wolverine	79

NEVADA STOCKS

(By courtesy of San Francisco Stock Exchange.)

San Francisco, September 26.

Atlanta	$ .22	Midway	$ .54
Belcher	.38	Montana-Tonopah	2.25
Belmont	9.87	Nevada Hills	1.80
B. & B.	.05	North Star	.38
Big Four	.40	Ophir	.58
Booth	.07	Pittsburg Silver Peak	.94
Combination Fraction	.12	Round Mountain	.38
Con. Virginia	.37	Savage	.12
Florence	.85	Tonopah Extension	2.75
Goldfield Con.	2.97	Tonopah Merger	1.05
Jim Butler	.79	Tonopah of Nevada	6.50
Jumbo Extension	.35	Union	.45
MacNamara	.22	Vernal	.12
Mexican	2.50	West End	1.57

MINING STOCK QUOTATIONS—NEW YORK

(By wire from C. S. Burton & Co., New York.)

	Closing Prices. September 26.		Closing Prices. September 26.
Amalgamated Copper	$ 90⅛	Miami Copper	$ 30
A. S. & R. Co.	90½	Mines Co. of America	8
Braden Copper	7⅛	Nevada Con	22⅛
B. C. Copper Co.	5	Nipissing	8⅛
Chino	44	Ohio Copper	1⅞
First National	2⅛	Ray Con	23⅛
Giroux	5¼	Tenn. Copper	46½
Goldfield Con.	3	Tonopah Belmont	10
Greene-Cananea	9⅜	Tonopah Ex.	2⅜
Hollinger	12¼	Tonopah Mining	7
Inspiration	19½	Trinity	6
Kerr Lake	2⅞	Tuolumne Copper	2⅞
La Rose	2½	Utah Copper	66½
Mason Valley	13½	West End	1⅛
McKinley-Darragh	1⅞	Yukon Gold	3½

Concentrates

Most of these are in reply to questions received by mail. Our readers are invited to ask questions and give information dealing with the practice or mining, milling, and smelting.

CONCRETE stringers are used underground in place of timber at the Ahmeek mine, Michigan.

AMSTERDAM has 70 factories for cutting and polishing diamonds, employing 1700 cutters and 4700 burnishers.

ANY machine, such as a concentrating-table, which rejects certain material, is not fairly treated if that product is returned to it. If a middling product is rejected let another machine deal with it.

SULPHUR production in Sicily for the year ended July 31, 1911, decreased from 397,000 to 392,000 tonnes; but exports increased from 297,000 to 446,000 tonnes, and visible stocks decreased to 535 tonnes.

ROLLS used for crushing ore are sometimes used in stages, and others are expected to reduce the ore in one operation. These machines are used at Broken Hill for crushing ore from rock-breakers before it is sent to shaking-screens and jigs.

STEEL was probably first made in the United States in 1728, by Samuel Higley and Joseph Dewey, in Connecticut; crucible steel in 1832, at the works of W. & J. H. Garrard, at Cincinnati, Ohio; bessemer steel in 1864, by W. F. Durfee, at an experimental plant at Wyandotte, Michigan; and open-hearth steel in 1864, by the New Jersey Steel & Iron Co., at Trenton.

GERMANY in the first six months of the current year produced 8,424,632 tons of pig iron, against 7,682,639 tons for this period of 1911. Domestic business is quieter than formerly, as nearly all consumers have covered their needs to the end of the year. Foreign trade continues to be lively, and is marked by increasing prices. The coal production for the first half of this year was 124,136,000 metric tons, and that of coke 13,755,000 tons. These totals are in advance of those for 1911.

FULLER'S EARTH to the amount of 2563 tons, valued at $29,137, was produced in Arkansas in 1910. The developed deposits of this state comprise an area of about three square miles, between Hot Springs and Benton, and were descovered in 1897. The earth is used for bleaching cottonseed oil, hog leaf lard, beef tallow, and stearine. The mined clay is stored for a time in sheds at the mines, hauled to a mill, and partly dried. A machine crushes it into about 1-in. pieces, when it is fed into iron cylinders and thoroughly dried by hot air or steam jacket. After this, the clay is pulverized and run through 'bolting reels,' as used in flour mills, filled into sacks holding 225 to 400 lb. each, and sent to market.

CHILE is devoting a good deal of attention to the development of coal mines. There is an increased consumption of Chilean coal every year, and the government uses it on its railroads when available. There are fairly large deposits, but more capital is required for their development. Some of the best coal is mined about three miles from Coronel bay, just south of Talcahuano. This mine has been worked for about 60 years. In 1911 the railway consumed 403,050 tons of Chilean against 116,209 tons of imported coal. Analyses of coal from 9 Chilean mines show the following: water, 0.98 to 4%; ash, 2 to 8%; sulphur, 0.21 to 4.9%; volatile matter, 32 to 43%; fixed carbon, 49 to 61%; and coke, 46 to 65 per cent.

Decisions Relating to Mining

Specially reported for the MINING AND SCIENTIFIC PRESS.

Gas Lease—Diligence Required

A gas lease providing for an annual royalty on each well contemplated that the land should be developed with due diligence, and on failure so to do the lessor was entitled to cancellation as to the undeveloped land.

Day *v.* Kansas City Pipe Line Co., (Kansas) 125 Pac., 43. July 6, 1912.

Oil Lease—Royalties Not Payable After Surrender

Under an oil lease providing for payment of royalties on oil produced and for penalty for failing to operate any well, the lessee was held liable for royalties only so long as the wells were operated, and after operation ceased, and until surrender of the lease, were liable only for the penalty for failure to operate. Mere failure to formally surrender the lease after the machinery had been removed did not entitle the lessor to further payment of rentals.

Dickey *v.* Coffeyville Vitrified Brick & Tile Co., (Kansas) 125 Pac., 74. July 6, 1912.

Mining Contract—Right to Purchase

Where the contract of purchase of mining property provided that title should not pass until the entire price was paid, and that the deed should be held in escrow, a fund being created consisting of a certain amount per month to pay the purchase price, and that failure to make three monthly payments or any yearly payment should render the contract void and forfeit to the vendor all payments made, the purchaser had a right to withdraw from the contract at any time without giving any reason therefor, and on so doing he could not be held for any further payments on the purchase price.

Richardson *v.* Dell, (Missouri) 149 Southwestern, 15. June 29, 1912.

Mining Partnership—Does Not Exist, When

Where several persons by an express or implied agreement organize a partnership to work a mine, and it appears that under the terms of such agreement the confidential relations of an ordinary partnership are to exist, and that the firm is not subject to intrusion of other partners at will, the fact that the business in which they are engaged is the working of a mine does not affect their relation or liability as general partners nor fix their relation as mining partners. Whether the relation is a general partnership or a mining partnership must be determined from the acts, intentions, and agreements of the parties as disclosed by the evidence.

Daily *v.* Fitzgerald, (New Mexico) 125 Pacific, 625. May 5, 1912.

Extralateral Right—Burden of Proof on Claimant

In an action of trespass for conversion of ore taken within the side-lines of plaintiff's claim, where the defense rests upon a claim that the ore was taken from a vein apexing within the limits of defendant's claim, the burden of proof is upon defendant to establish both the apex and continuity of the vein in question. For the exercise of an extralateral right, it must appear that the vein outside is identical with and a continuation of the one inside the claimant's boundaries. If the mineral disappears or the fissure with its walls of the same rock disappears, so that its identity can no longer be traced, the right to pursue it outside of the perpendicular line of claimant's survey is gone. To say, then, in this case, that the alleged apex on the Grand Trunk is that of the vein appearing on the Hecla, at a wholly unexplored distance of 550 ft., with a right angle distance of 300 ft. and an additional extended distance lengthwise of the claims 200 ft., is to base such conclusion upon mere speculation.

Collins *v.* Bailey, (Colorado) 125 Pac., 543. April 8, 1912. Rehearing denied, June 10, 1912.

James Lewis & Son's Copper Report

During August standard copper prices have fluctuated to the extent of £2 15s. per ton, between £77 for cash on August 9 and £79 15s. on August 28, when £79 18s. 9d. was paid for late September delivery. The backwardation ruling for three months prompt has been converted into a contango, 10s. per ton being paid for carrying 500 tons. Sales amounted to about 46,000 tons, and closing prices are £79 6s. 3d. for cash and £79 15s. for three months. There has lately been an improved demand for refined copper, and considerable sales of electrolytic have been made by American refiners at 17¾c. per pound.

American shipments from northern ports for the month are advised as 24,377 tons. European stocks have increased 458 tons, but the visible supply has decreased 242 tons. Imports have been 2825, and deliveries 7511 tons less than during the same period of last year. The total arrivals in England and France for August have been 23,025 and deliveries 21,685 tons of fine copper. Arrivals in England from Chile were 2311, and deliveries 2424 tons; and from other countries 13,655 and 12,612 tons respectively. Arrivals at Liverpool and Swansea from the United States have been 2293 tons of bars, and 995 tons of plate, equal to about 3279 tons fine; in London, 1055 tons; and France, 5331 tons. Chile charters for the month are advised as 3000 tons, including 2125 tons for the United States. Exports from the former country to August 31 were 25,215 tons, against 20,606 tons for the same period of 1911.

STOCKS OF COPPER (TONS FINE)

	1912			
	Jan. 1.	July 1.	Aug. 1.	Sept. 2.
Chilean in—				
Liverpool and Swansea..	4,225	5,414	5,671	5,558
France	714	926	1,005	981
American in—				
Liverpool and Swansea..	12,939	4,289	3,531	2,450
France	4,033	3,958	5,848	6,356
Sundries in—				
Liverpool and Swansea..	786	574	722	1,202
London and Newcastle..	6,462	4,292	3,918	3,840
Birmingham	346	329	515	470
France	507	601	623	549
English in—				
Liverpool and S. Wales..	17,346	13,735	14,263	16,030
Total in England and France	47,558	34,118	36,096	37,436
Sundries in—				
Germany and Holland...	13,400	6,545	5,578	4,696
Total European stocks.	60,758	40,663	41,674	42,132
Afloat (advised by mail and cable) —				
From Chile	1,575	1,475	2,900	2,600
From Australia	8,350	6,000	6,000	5,600
Total visible supply...	70,683	48,138	50,574	50,332

GOLD AND COPPER IN TURKESTAN.—In the eastern part of the Zaisan district many claims have been entered on areas containing gold. There are no enterprises with any considerable capital. According to information received from Turkestan some rich copper ore has been found in eastern Bokhara by a Russian officer, who for six years has been investigating this district. Analysis showed that the ore contained 24% copper. This interested Russian capitalists, and one of the Warsaw private banks is organizing a joint stock company to work these mines. Professor Norosivich, of Warsaw University, has been engaged by this bank to continue the investigation. Several English engineers from the Siberian Mining Syndicate have been searching for copper this year in Turkestan.

Commercial Paragraphs

In constructing the new Union Stock Yards at Memphis, Tennessee, all the buildings, covering about 400,000 sq. ft. of land, were roofed with J-M Asbestos Roofing furnished by the H. W. JOHNS-MANVILLE Co. of New York.

The GENERAL ENGINEERING Co., Salt Lake City, Utah, announces the addition of Karl Bernson to its engineering staff. Mr. Bernson will act in the capacity of constructing engineer, taking active charge of all construction work. He has had a large and valuable experience in this class of work for the last fifteen years, having had charge of the construction of many of the largest sampling and concentrating mills, and other classes of mine and mill construction work in the western states.

Mr. Schwanhauser, chief engineer for the INTERNATIONAL STEAM PUMP Co., has returned from a three-months trip to Europe, visiting England, Germany, and Russia. While in London he closed a contract with S. Pierson & Son for the entire pumping equipment required for a new oil pipe-line now under construction in Mexico. The pumping engines will be furnished by the FRED M. PRESCOTT STEAM PUMP Co. of Milwaukee, Wisconsin, and the condensers and auxiliaries by Henry R. Worthington.

The prospector and small operator is coming into his own again. There is a strong demand for new properties, the Government officials are showing a disposition to cooperate, and everything points to a big resumption of prospecting and development this fall and early winter. A reflection of these conditions is shown in an alliance recently completed by the WAY'S POCKET SMELTER Co. The sales of this company have reached such a point that it has become advisable to separate the manufacturing and selling organizations. In the future, Way's Pocket Smelter Co. will devote its entire time to making smelters and in experimental work along new lines. The selling organization will be J. W. Swaren & Co., 112 Market street, San Francisco, California. In the future all orders for Way's smelters and supplies should be sent direct to J. W. Swaren & Co. In addition to the Way process, this new company will handle a complete line of machinery and supplies ordinarily used by prospectors and new properties. Mr. Swaren has been a prospector himself, and he fully appreciates the difficulties met in getting equipment and supplies while out in the hills or in the desert. His personal attention will be given to securing for the customers of this new firm the best materials on the market.

That the DODGE MANUFACTURING Co., Mishawaka, Indiana, does not confine all its efforts to the manufacture of stock goods in transmission machinery, was demonstrated September 13 when a split iron sheave, 288 in. (24) pitch diameter, with a 40-in. face width, was cast in the south foundry. It required about ten days for the foundrymen to shape up the big mould, about two hours to prepare for the pour, and a little over two minutes to pour the metal—approximately 53,000 pounds. The metal was distributed by means of immense ladles, through a runway over the mould. The sight was not only interesting but spectacular, and attracted a large number of outsiders. The wheel when finished will weigh about 45,000 lb. It was made for the Anaconda Copper Mining Co., Anaconda, Montana, for use on the shaft of a 46 by 60 duplex blowing engine. It is grooved for twenty 1⅜-in. Dodge 'Firmus' manila ropes, has a 16-in. bore, and will be driven by another sheave 48 in. diameter on a 750-hp. motor at 59 r.p.m. The large wheel was cast in two sections and will be shipped in that condition. After it leaves the machine-shops at the mines the halves will be fastened together permanently not only by bolts through rim lugs. Several years ago the company made a large wheel for the Kokomo (Indiana) Steel & Wire Co. This was also 24-ft. diameter, 7½-in. face width, and weighed 80 tons. It was of four-piece construction, consisting of two split pulleys bolted together by internal rim flanges.

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EDITORIAL

PRESIDENCY of the Ananias Club will doubtless be unanimously awarded to W. R. Hearst, in the light of recent disclosures.

INTEREST was marked in the National Irrigation Congress, held at Salt Lake City during the past week, and well known speakers addressed the gathering.

MINERS at the Nevada Consolidated have struck in sympathy with the men at Bingham, and the 20-cent copper predicted by our New York correspondent becomes more than a possibility.

ARIZONA is surprised to find that its workmen's compensation law, recently enacted, does not compensate. Somebody slipped into it this proviso: "it shall be lawful, however, for the employer or workman to disaffirm an employment under the provisions of this act by written contract between them or by written notice of one to, and served upon, the other to that effect before the day of the accident."

FOREIGN capital has played an important part in the development of industry in Brazil and is showing a remarkable rate of growth. The capital of the Brazilian companies authorized last year amounted to 13,597 contos of reis (a conto of reis equals $546,000), or an increase of 103 per cent over the preceding year, while the capital of foreign companies amounted to 311,518 contos, or an increase of 232 per cent during the year. Investors are evidently not slow to recognize the possibilities of the Brazilian field, and the Rio Janeiro loan of $15,000,000 at 5 per cent, which is soon to be placed in London, is likely to be well received.

ANNOUNCEMENT has been made of the sixteenth annual convention of the California Miners' Association, to be held in San Francisco on December 9, 10, and 11 of this year. The Association is planning to assist in securing for the Panama-Pacific International Exposition a mineral exhibit which will surpass any other in this country. The effort is an admirable one, and the Association has been so effective in the past that success may be anticipated. Success can only come, however, through the participation of all engaged in the mining industry in California, and it is to be hoped that the response will be spontaneous and generous.

LIGHT upon present problems can often be best obtained by a study of that which is old, while the consideration of the growth of present ideas is always helpful in formulating more advanced concepts. We are glad, therefore, to present this week the interesting summary of the theories of ore deposition prior to the seventeenth century, which Mr. and Mrs. Hoover have prepared as a footnote to the chapter in their translation of Agricola's 'De Re Metallica,' which treats of ore deposits. The Saxon physician, George Bauer, was the first to reduce the vague medieval notions concerning mineralogy and metallurgy to a scientific basis, and his writings are of the most intense interest to students

of geology and mining. They offer almost insuperable difficulty to the ordinary Latin scholar, for he employs several hundred Latin technical terms which are not defined in a glossary, and of which the meaning can only be perceived by painstaking comparison and study. No less than seven other translators have carried the work part way to completion, only to abandon it in despair. All those engaged in mining will be correspondingly grateful to Mr. and Mrs. Hoover for their patience and persistence in rendering available to all this mine of interest and information.

AUTHORS too frequently neglect to remember the reader, and the announcement sent out by Mr. Alfred C. Lane regarding his elaborate two-volume study of the Keweenaw series, recently published by the Michigan Geological Survey, is as unusual as it is refreshing in its frankness. Mr. Lane says that the report "is so largely a mass of detail that, in view of the extreme unlikelihood that anyone but the author will ever read it through, I have thought best to reprint and distribute a few pages only, which may be of general interest." Mr. Lane's studies have been of the greatest interest to geologists, but especially we beg to compliment him upon the grateful appreciation his consideration for the overworked reader is sure to bring.

BOSTON copper circles have suffered a severe shock from the failure of the house of Stephen R. Dow & Company, members of the Boston stock exchange and widely known by reason of the firm's connection with some of the recently developed properties in Michigan—Franklin, North Lake, and Indiana. North Lake and Indiana were each sensational prospects in 1910, when the diamond-drill cores were thought to foreshadow the development of another Calumet & Hecla. The treasuries of the various copper companies under the Dow management held a total of some $300,000, all of which was borrowed by the failed firm. The whole matter is material for a sermon on the benefits to be derived from publicity in mining affairs. Compulsory independent periodical auditing and the publication of monthly reports showing mining progress and operating costs are two forward steps that mining shareholders should demand. A comparison of the methods prevailing in this country with those followed by the companies organized under the English law furnishes a large part of the reason for the different attitude prevailing in the two countries. In this country the idea that the shareholder is entitled to any specific information regarding the work under way seems not to prevail. In England the information is published and sent to the stockholders, and sudden unfavorable disclosures are, in a measure, except in case of actual fraud or misrepresentation, prevented. In the present instance there was on the part of the company no attempt to conceal the facts. It was simply a case of no sentinel on duty. Mine work is from some points of view more important than financial management. One of the most important and interesting gold producers in the world, Goldfield Consolidated, has been the cause of much bitter complaint on the part of Eastern buyers because the holders of the shares have been without authentic information on which to base any estimate of the life of the property. The energy and ability of the management has been conceded, but mining properties are owned by the shareholders, who are entitled to all of the information there is, good, bad, and indifferent, as a matter of absolute right. Nothing would be more effective to establish mining on its proper footing and to create a growing and a satisfied public following than the enactment and enforcement of a set of regulations that would place both financial and physical details before the stockholders and the public.

What Are Profits in Mining?

Fundamental concepts are seldom clearly grasped by the general public, and, if the simile be permitted, the average man knows how fast he is progressing, but rarely has any clear ideas as to whether he is headed in the right direction. To our discussion columns Mr. J. R. Finlay, who speaks with authority, contributes an interesting and suggestive letter in regard to profits in mining. The matter is one which has been too little considered, and we hope our readers will join in the discussion. Reserving our remarks until later, it will be worth while to call attention to the confusion of thought which has existed even in great minds. In his 'Wealth of Nations' Adam Smith has the following to say regarding mining:

"Of all those expensive and uncertain projects which bring bankruptcy upon the greater part of the people who engage in them, there is none, perhaps, more perfectly ruinous than the search after new silver and gold mines. It is perhaps the most disadvantageous lottery in the world, or the one which the gain of those who draw the prizes bears the least proportion of the loss of those who draw the blanks; for though the prizes are few, and the blanks many, the common price of a ticket is the whole fortune of a very rich man.

"Projects of mining, instead of replacing the capital employed in them, together with the ordinary profits of stock, commonly absorb both capital and profit. They are the projects, therefore, to which, of all others, a prudent lawgiver, who desires to increase the capital of his nation, would least choose to give an extraordinary encouragement, or to turn toward them a greater share of that capital than what would go to them of its own accord. Such is the absurd confidence which almost all men have in their own good fortune, that wherever there is the least probability of success, too great a share of it is apt to go to them of its own accord.

"But though the judgment of sober reason and experience concerning such projects has always been extremely unfavorable, that of human avidity has commonly been quite otherwise. The same passion which has suggested to so many people the absurd idea of the philosopher's stone has suggested to others the equally absurd one of immense rich mines of gold and silver.

"The dream of Sir Walter Raleigh concerning the golden city of El Dorado may satisfy us that even wise men are not always exempt from such strange delusions. More than a hundred years after the death of that great man, the Jesuit Gumila was still convinced of the reality of that wonderful country, and expressed with great warmth, and, I dare say, with great sincerity, how happy he should be to carry the light of the Gospel to a people who could so well reward the pious labors of their missionary."

Mining is often grouped with agriculture as the two industries which are creative of wealth, but the anology is not a close one, the products of agriculture being directly consumed to furnish vital energy, while metals and minerals serve as aids to human industry. It is evident that agriculturists produce more food than they eat; it is not so evident that mining operations produce more wealth than they consume, for the compilation of a balance-sheet offers insuperable difficulties. The catch phrase is often heard, "more money is lost in mining than is made," which recalls a casual remark of a friend, a professor of political economy, "more money is lost in gambling than is won." If the farmer's crop return him less wheat than he sowed, he does not despair, for the next may be a good year and recompense him a hundred-fold. But if the mine's final yield is less in value than the expenditures in developing

and operating it, there is no profitable future to hope for. Is the profit real, or is it a phantom one? Why should anyone engage in the nefarious and "perfectly ruinous * * search after new silver and gold mines"?

The Problem of Fines

The treatment of finely divided material offers one of the greatest problems in metallurgical work. In ore dressing the smallest particles offer the greatest resistance to separatory processes, and in cyaniding the fine material for a long time, and even at present to a certain extent presents great difficulties in filtering and washing, while the colloids, those curious denizens of the border land between solid and liquid, have only recently been rendered amenable to treatment. In the smelting of iron and copper ores the use of large quantities of finely divided ore in the blast-furnace is a vexing problem to the metallurgist, a problem that persists to the end of metallurgical work, for the gases escaping from the stack carry with them fine solid particles that are both a source of loss to the smelter and of annoyance to its neighbors. On another page, Mr. Anton Eilers describes the use of the bag-house to remove fine solid particles from the escaping fume of lead smelters.

It is, however, to the handling of fine ore in smelting operations that we propose to confine ourselves, referring more particularly to the smelting of copper ores. Fines have always been a problem in this work, and even in the days of the heap-roasting of lump ores the disposal of the small amount of fine ore unavoidably produced in mining was a source of worry to the metallurgist. The early conditions now seem almost like an iridescent dream to the many operators who are compelled to handle concentrate alone, or with but a small proportion of lump ore. A large and increasing part of the output of copper is derived from finely disseminated low-grade sulphide ore which must first be subjected to mechanical concentration. Smelting concentrate, practically all smaller than ⅛ inch in diameter, and unmixed with lump ore, is an irritating problem. The Gordian knot can be quite simply cut by roasting the concentrate and smelting the calcine in reverberatory furnaces, but only at a high working cost. At a plant where coke costs $10 per ton the sulphur in concentrate containing 50 per cent of pyrite is worth $2.50 per ton as a source of heat in smelting operations, and to be obliged to roast it off at a cost of about 50 cents per ton is heart-rending. In addition, the smelting cost per ton is higher in reverberatory work, though recent advances in the use of liquid fuel has increased the tonnage smelted and lowered costs. Progress in the use of gaseous fuel is of the negative order, for at the one copper smelter where it has been in use, the Great Falls plant of the Anaconda Copper Mining Company, the use of gas producers will be abandoned in the new construction now under way, and grate firing substituted. In this case the high ash of the coal used gave trouble in the regenerative checkerwork, another instance of the fines problem.

For hanlding fine ore in smelting, a great variety of ingenious methods have been devised. Since sulphides are readily fusible it would perhaps seem simplest to melt them and allow them to consolidate on cooling. Like most simple suggestions, this is impracticable. Melting and cooling sulphides, while retaining their sulphur content, offers annoying mechanical problems and can only be done at a prohibitive cost. But to fuse the fine ore to such a degree that it coheres sufficiently to act like lump ore in the blast-furnace is more practicable, and is the line upon which the most recent and satisfactory progress has been made. In this work the problems are essentially analogous to those of coke-making. The mixture must be fused sufficiently to make it cohere strongly enough so that it will not break up too much in handling nor crush under the weight of the burden in the blast-furnace. The resulting product should be porous in order to aid the penetration of the blast and to facilitate the reactions of smelting. The complexity of this single group of problems is too little realized. In coking, the components present vary in degree but not in kind, yet the most careful study of the mixture of coal and water fed to the ovens is required to procure a satisfactory product. In smelting, the components vary in kind as well as in degree, and the amount of study of each particular case thus required is correspondingly greater. It is not remarkable, therefore, that the attempt to use such methods has often been abandoned after a short period of unsuccessful experimentation. Smelting differs radically from other kinds of chemical engineering work in that it is essentially variable in its character. A variety of different products must be utilized, and their relative proportions vary from week to week because of conditions not under the metallurgists' control, and methods which would be adequate to solve a constant problem may fail utterly before a variable one. This is the fundamental problem in the use of agglomerative methods for handling fines, and both in sintering on grates and in pots the securing of a mixture which shall be uniform throughout, both in a single operation and during the day's work, is one of the criteria of success.

In the treatment of lead ores agglomeration by fusing in pots and on grates is carried out with marked success and has reached a higher stage of development than the agglomeration of copper ores. The conditions to be met differ with the two methods. With lead ores the endeavor is to eliminate sulphur, and the ore is commonly subjected to a light roast before sintering in pots, while with copper ores the sulphur should be preserved to as large an extent as possible. The hot zone of oxidation that passes through the mass to be sintered is easily controlled if a relatively small quantity of sulphur is present and can be allowed to oxidize nearly completely, but is rebellious where there is present a large percentage of sulphur, only a part of which can be allowed to oxidize. But this problem is essentially similar to that in coking, where excessive fusing is checked by the addition of a suitable amount of moisture, and it may eventually prove that the sintering of fine copper sulphides on grates is more easy to perform than has been supposed. The sintering of flue-dust, with or without a small quantity of coke dust, is now successfully done both at the Pittsmont and Mason Valley copper smelters, and the sintering of fine ore may follow as the next step in development.

Disposal of fine sulphides by adding them to the converter charge has often been proposed, but has not attained any marked success. Aside from the difficulties it gives rise to, it is evident that it cannot offer any universal solution of the problem, since the larger proportion of the ore must be otherwise treated in order to produce the matte for converting. Briquetting in its various forms is as old as the industry itself, and has been a continuous source of vexation. Under certain conditions it may be applied with marked success, as at Anaconda, but the hope of escape from its annoyances is a constant lure to the metallurgist, and there is little hope of satisfactory progress in the improvement of briquetting. Special methods serve to meet special conditions, especially where labor is cheap; thus flue-dust is mixed with converter slag at Cananea, and the nodulizing method recently described in these columns is satisfactory at Shisaka, in Japan, but everywhere the hope of devising a more satisfactory method is a potent force making for progress.

Theories of Ore Deposition Prior to the Seventeenth Century

By H. C. and L. H. Hoover

*Prior to Agricola there were three schools of explanation of the phenomena of ore deposits, the orthodox followers of the book of Genesis, the Greek Philosophers, and the Alchemists. The geology of Genesis—contemporaneous formation of everything—needs no comment other than that for anyone to have proposed an alternative to the dogma of the orthodox during the Middle Ages required much independence of mind. Of the Greek views—which are meagre enough—that of the Peripatetics greatly dominated thought on natural phenomena down to the seventeenth century. Aristotle's views may be summarized: The elements are earth, water, air, and fire; they are transmutable and never found pure, and are endowed with certain fundamental properties which act as an 'efficient' force upon the material cause—the elements. These properties are dryness and dampness and heat and cold, the latter being active, the former passive. Further, the elements are possessed of weight and lightness, for instance, earth is absolutely heavy, fire absolutely light. The active and passive properties exist in binary combinations, one of which is characteristic, that is, 'earth' is cold and dry, water damp and cold, fire hot and dry, air hot and wet; transmutation took place, for example, by removing the cold from water, when air resulted (really steam), and by removing the dampness from water, when 'earth' resulted (really any dissolved substance). The transmutation of the elements in the earth (meaning the globe) produces two 'exhalations,' the one fiery (probably meaning gases), the other damp (probably meaning steam). The former produces stones, the latter the metals. Theophrastus (On Stones, i to vii) elaborates the views of Aristotle on the origin of stones, metals, etc.: "Of things formed in the earth some have their origin from water, others from earth. Water is the basis of metals, silver, gold, and the rest; 'earth' of stones, as well the more precious as the common. . . All these are formed by solidification of matter pure and equal in its constituent parts, which has been brought together in that state by mere afflux or by means of some kind of percolation, or separated. . . . The solidification is in some of these substances due to heat and in others to cold." (Based on Hill's Trans., pp. 3-11). That is, the metals inasmuch as they become liquid when heated must be in a large part water, and, like water, they solidify with cold. Therefore, the 'metals are cold and damp.' Stones, on the other hand, solidify with heat and do not liquefy, therefore, they are 'dry and hot' and partake largely of 'earth.' This 'earth' was something indefinite, but purer and more pristine than common clay. In discussing the ancient beliefs with regard to the origin of deposits, we must not overlook the import of the use of the word 'vein' (*vena*) by various ancient authors including Pliny (xxxiii, 21), although he offers no explanation of the term.

During the Middle Ages there arose the horde of Alchemists and Astrologers, a review of the development of whose muddled views is but barren reading. They in the main held more or less to the Peripatetic view, with additions of their own. Geber (thirteenth (?) century) propounded the conception that all metals are composed of varying proportions of 'spiritual' sulphur and quicksilver, and to these Albertus Magnus added salt. The Astrologers contributed the idea that the immediate cause of the metals were the various planets. The only work devoted to description of ore deposits prior to Agricola was the *Bergbüchlin* (about 1500), and this little book exhibits the absolute apogee of muddled thought derived from the Peripatetics, the Alchemists, and the Astrologers. We believe it is of interest to reproduce the following statement, if for no other reason than to indicate the great advance in thought shown by Agricola.

"The first chapter or first part; on the common origin of ore, whether silver, gold, tin, copper, iron, or lead ore, in which they all appear together, and are called by the common name of metallic ore. It must be noticed that for the washing or smelting of metallic ore, there must be one who works and the thing that is worked upon, or the material upon which the work is expended. The general worker (efficient force) on the ore and on all things that are born, is the heavens, its movement, its light and influences, as the philosophers say. The influence of the heavens is multiplied by the movement of the firmaments and the movements of the seven planets. Therefore, every metallic ore receives a special influence from its own particular planet, due to the properties of the planet and of the ore, also due to properties of heat, cold, dampness, and dryness. Thus gold is of the Sun or its influence, silver of the Moon, tin of Jupiter, copper of Venus, iron of Mars, lead of Saturn, and quicksilver of Mercury. Therefore, metals are often called by these names by hermits and other philosophers. Thus gold is called the Sun, in Latin *Sol*, silver is called the Moon, in Latin *Luna*, as is clearly stated in the special chapters on each metal. Thus briefly have we spoken of the 'common worker' of metal and ore. But the thing worked upon, or the common material of all metals, according to the opinion of the learned, is sulphur and quicksilver, which through the movement and influence of the heavens must have become united and hardened into one metallic body or one ore. Certain others hold that through the movement and the influence of the heavens, vapors or *braden*, called mineral exhalations, are drawn up from depths of the earth, from sulphur and quicksilver, and the rising fumes pass into the veins and stringers and are united through the effect of the planets and made into ore. Certain others hold that metal is not formed from quicksilver, because in many places metallic ore is found and no quicksilver. But instead of quicksilver they maintain a damp and cold and slimy material is set up on all sulphur which is drawn out from the earth, like your perspiration, and from that mixed with sulphur all metals are formed. Now each of these opinions is correct according to a good understanding and right interpretation; the ore or metal is formed from the fattiness of the earth as the material of the first degree (primary element), also the vapors or *braden* on the one part and the materials on the other part, both of which are called quicksilver. Likewise in the mingling or union of the quicksilver and the sulphur in the ore, the sulphur is counted the male and the quicksilver the female, as in the bearing or conception of a child. Also the sulphur is a special worker in ore or metal.

"The second chapter or part; deals with the general capacity of the mountain. Although the influence of the heavens and the fitness of the material are necessary to the formation of ore or metal, yet these are not enough thereto. But there must be adaptability of the natural vessel in which the ore is formed, such are the veins, namely, *steinendegange, flachgange, schargange, creutzgange*, or as these may be termed in provincial names. Also the mineral force must have easy access to the natural vessel, such as through the *kluffte* (stringers), namely, *hengkluft, quecklufte, flachekuffte, creutzklufft*, and other occasional *flotzwerk*, according to their various local names. Also there must be a suitable place in the mountain which the veins and stringers can traverse."

AGRICOLA'S VIEWS ON THE ORIGIN OF ORE DEPOSITS.—

*A footnote to Book III of 'Agricola's de Re Metallica,' translated and annotated by H. C. and L. H. Hoover. *The Mining Magazine*, London, 1912.

Agricola rejected absolutely the Biblical view which, he says, was the opinion of the vulgar; further, he repudiates the Alchemistic and Astrological views with great vigor. There can be no doubt, however, that he was greatly influenced by the Peripatetic philosophy. He accepted absolutely the four elements—earth, fire, water, and air, and their 'binary' properties, and the theory that every substance had a material cause operated upon by an efficient force. Beyond this he did not go, and a large portion of *De Ortu et Causis* is devoted to disproof of the origin of metals and stones from the Peripatetic 'exhalations.'

No one should conclude that Agricola's theories are set out with the clarity of Darwin or Lyell. However, the matter is of such importance in the history of the theory of ore deposits, and has been either so ignored or so colored by the preconceptions of narrators, that we consider it justifiable to devote space necessary to a reproduction of his own statements from *De Ortu et Causis* and other works. Before doing so we believe it will be of service to readers to summarize these views, and in giving quotations from the author's other works, to group them under special headings, following the outline of his theory given below. His theory was:

1. Openings in the earth (*canales*) were formed by the erosion of subterranean waters.

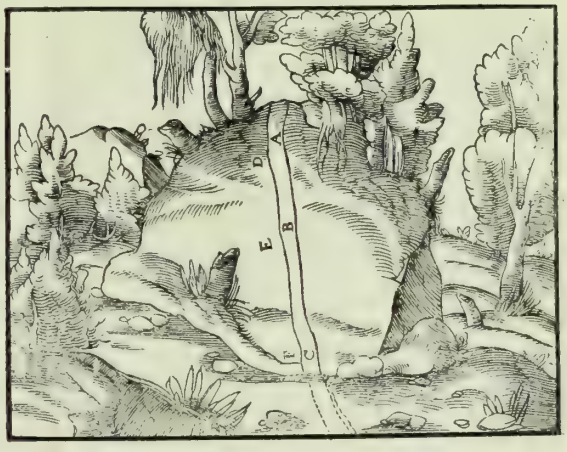
A, B, C, VEIN. D, E, F, SEAMS IN THE ROCKS.

2. These ground-waters were due (*a*) to the infiltration of the surface waters, rain, river, and sea water; (*b*) to the condensation of steam (*halitus*) arising from the penetration of the surface waters to greater depths—the production of this *halitus* being due to subterranean heat, which, in his view, was in turn due in the main to burning bitumen (a comprehensive genera which embraced coal).

3. The filling of these *canales* is composed of 'earth,' 'solidified juices,' 'stone,' metals, and 'compounds,' all deposited from water and 'juices' circulating in the *canales*.

'Earth' comprises clay, mud, ochre, marl, and 'peculiar earths' generally. The origin of these 'earths' was from rocks, due to erosion, transportation, and deposition by water. 'Solidified juices' (*succi concreti*) comprised salt, soda, vitriol, bitumen, etc., being generally those substances which he conceived were soluble in and deposited from water. 'Stones' comprised precious, semi-precious, and unusual stones, such as quartz, fluorspar, etc., as distinguished from country rock; the origin of these he attributed in minor proportion to transportation of fragments of rock, but in the main to deposits from ordinary mineral juice and from 'stone juice' (*succus lapidescens*). Metals comprised the seven traditional metals; the 'compounds' comprised the metallic minerals; and both were due to deposition from juices, the compounds being due to a mixture of juices. The 'juices' play the most important part in Agricola's theory. Each substance had its own particular juice, and in his theory every substance had a material and an efficient cause, the first being the juice, the second being heat or cold. Owing to the latter the juices fell into two categories—those solidified by heat (that is, by evaporation, such as salt), and those solidified by cold (that is, because metals melt and flow by heat, therefore their solidification was due to cold, and the juice underwent similar treatment). As to the origin of these juices, some were generated by the solution of their own particular substance, but in the main their origin was due to the combination of 'dry things,' such as 'earth,' with water, the mixture being heated, and the resultant metals depended upon the proportions of 'earth' and water. In some cases we have been inclined to translate *succus* (juice) as 'solution,' but in other cases it embraced substances to which this would not apply, and we feared implying in the text a chemical understanding not warranted prior to the atomic theory. In order to distinguish between earths (clays, etc.), the Peripatetic 'earth' (a pure element) and the earth (the globe) we have given the two former in quotation marks. There is no doubt some confusion between earth (clays, etc.) and the Peripatetic 'earth,' as the latter was a pure substance not found in its pristine form in nature; it is, however, difficult to distinguish between the two.

ORIGIN OF CANALES (*De Ortu*, p. 35).—"I now come to the *canales* in the earth. These are veins, veinlets, and what are called 'seams in the rocks.' These serve as vessels or receptacles for the material from which minerals (*res fossiles*) are formed. The term *vena* is most frequently given to what is contained in the *canales*, but likewise the same name is applied to the *canales* themselves. The term vein is borrowed from that used for animals, for just as their veins are distributed through all parts of the body, and just as by means of the veins blood is diffused from the liver throughout the whole body, so also the veins traverse the whole globe, and more particularly mountainous districts; and water runs and flows through them. With regard to veinlets or stringers and 'seams in the rocks,' which are the thinnest stringers, the following is the mode of arrangement. Veins in the earth, just like the veins of an animal, have certain veinlets of their own, but in a contrary way. For the larger veins of animals pour blood into the veinlets, while in the earth the humors are usually poured from the veinlets into the larger veins, and rarely flow from the larger into the smaller ones. As for the seams in the rocks (*commissurae saxorum*) we consider that they are produced by two methods: by the first, which is peculiar to themselves, they are formed at the same time as the rocks, for the heat bakes the refractory material into stone, and the non-refractory material similarly heated exhales its humors and is made into 'earth,' generally friable. The other method is common also to veins and veinlets, when water is collected into one place it softens the rock by its liquid nature, and by its weight and pressure breaks and divides it. Now, if the rock is hard, it makes seams in the rocks and veinlets, and if it is not too hard it makes veins. However, if the rocks are not hard, seams and veinlets are created as well as veins. If these do not carry a very large quantity of water, or if



A, B, C, VEIN. D, E, F, SEAMS IN THE ROCKS.

they are pressed by a great volume of it, they soon discharge themselves into the nearest veins. The following appears to be the reason why some veinlets or stringers and veins are *profundae* and others *dilatatae*. The force of the water crushes and splits the brittle rocks; and when they are broken and split, it forces its way through them and passes on, at one time in a downward direction, making small and large *venae profundae*, at another time in a lateral direction, in which way *venae dilatatae* are formed. Now since in each class there are found some which are straight, some inclined, and some crooked, it should be explained that the water makes the *vena profunda* straight when it runs straight downward, inclined when it runs in an inclined direction; and that it makes a *vena dilatata* straight when it runs horizontally to the right or left, and in a similar way inclined when it runs in a sloping direction. Stringers and large veins of the *profunda* sort, extending for considerable lengths, become crooked from two causes. In one case when narrow veins are intersected by wide ones, then the latter bend or drag the former a little. In the other case, when the water runs against very hard rock, being unable to break through, it goes around the nearest way, and the stringers and veins are formed bent and crooked. This last is also the reason we sometimes see crooked small and large *venae dilatatae*, not unlike the gentle rise and fall of flowing water. Next, *venae profundae* are wide, either because of abundant water or because the rock is fragile. On the other hand, they are narrow, either because but little water flows and trickles through them, or because the rock is very hard. The *venae dilatatae*, too, for the same reason, are either thin or thick. There are other differences, too, in stringers and veins, which I will explain in my work, *De Re Metallica*. . . . There is also a third kind of vein which, as it cannot be described as a wide *vena profunda*, nor as a thick *vena dilatata*, we will call a *vena cumulata*. These are nothing else than places where some species of mineral is accumulated; sometimes exceeding in depth and also in length and breadth 600 ft.; sometimes, or rather generally, not so deep nor so long, nor so wide. These are created when water has broken away the rock for such a length, breadth, and thickness, and has flung aside and ejected the stones and sand from the great cavern which is thus made; and afterward when the mouth is obstructed and closed up, the whole cavern is filled with material from which there is in time produced some one or more minerals. Now I have stated when discoursing on the origin of subterranean humors, that water erodes away substances inside the earth, just as it does those on the surface, and least of all does it shun minerals; for which reason we may daily see veinlets and veins sometimes filled with air and water, but void and empty of mining products, and sometimes full of these same materials. Even those which are empty of minerals become finally obstructed, and when the rock is broken through at some other point the water gushes out. It is certain that old springs are closed up in some way and new ones opened in others. In the same manner, but much more easily and quickly than in the solid rock, water produces stringers and veins in surface material, whether it be in plains, hills, or mountains. Of this kind are the stringers in the banks of rivers which produce gold, and the veins which produce peculiar earth. So in this manner in the earth are made *canales* which bear minerals."

Origin of Ground-Waters (*De Ortu*, p. 5).—". . . Besides rain there is another kind of water by which the interior of the earth is soaked, so that being heated it can continually give off *halitus*, from which arises a great and abundant force of waters." In description of the *modus operandi* of *halitum*, he says (p. 6); " . . . *Halitus* rises to the upper parts of the *canales*, where the congealing cold turns it into water, which by its gravity and weight again runs down to the lowest parts and increases the flow of water if there is any. If any finds its way through a *canales dilatata* the same thing happens, but it is carried a long way from its place of origin. The first phase of distillation teaches us how this water is produced, for when that which is put into the ampulla is warmed it evaporates (*expirare*), and this *halitus* rising into the operculum is converted by cold water, which drips through the spout. In this way water is being continually created underground." (*De Ortu*, p. 7): "And so we know from all this that of the waters which are under the earth, some are collected from rain, some arise from *halitus* (steam), some from river water, some from sea water; and we know that the *halitum* is produced within the earth partly from rain water, partly from river water, and partly from sea water." It would require too much space to set out Agricola's views upon the origin of subterranean heat which produced this steam. It is an involved theory embracing clashing winds, burning bitumen, coal, etc., and is fully set out in the latter part of Book II, *De Ortu et Causis*.

Origin of Gangue Minerals.—It is necessary to bear in mind that Agricola divided minerals (*res fossiles*—'things dug up') into 'earths,' 'solidified juices,' 'stones,' 'metals,' and 'compounds'; and, further, to bear in mind that in his conception of the origin of things generally, he was a disciple of the Peripatetice logic of a 'material substance' and an 'efficient force,' as mentioned above.

As to the origin of 'earths,' he says (*De Ortu*, p. 38): "Pure and simple 'earth' originates in the *canales* in the following way: rain water, which is absorbed by the surface of the earth, first of all penetrates and passes into the inner parts of the earth and mixes with it; next, it is collected from all sides into stringers and veins, where it, and sometimes water of other origin, erodes the 'earth' away—a great quantity of it if the stringers and veins are in 'earth,' a small quantity if they are in rock. The softer the rock, the more water wears away particles by its continual movement. To this class of rock belongs limestone, from which we see chalk, clay, and marl, and other unctuous 'earths' made; also sandstone, from which are made those barren 'earths' which we may see in ravines and on bare rocks. For the rain softens limestone or sandstone and carries particles away with it, and the sediment collects together and forms mud, which afterward solidifies into some kind of 'earth.' In a similar way under the ground the power of water softens the rock and dissolves the coarser fragments of stone. This is clearly shown by the following circumstance, that frequently the powdered rock or marble is found in a soft state and as if partly dissolved. Now, the water carries this mixture into the course of some underground *canalis*, or dragging it into narrow places, filters away. And in each case the water flows away and a pure and uniform material is left from which 'earth' is made. . . . Particles of rock, however, are only by force of long time so softened by water as to become similar to particles of 'earth.' It is possible to see 'earth' being made in this way in underground *canales* in the earth, when drifts or tunnels are driven into the mountains, or when shafts are sunk, for then the *canales* are laid bare; also it can be seen above ground in ravines, as I have said, or otherwise disclosed. For in both cases it is clear to the eye that they are made out of the 'earth' or rocks, which are often of the same color. And in just the same way they are made in the springs which the veins discharge. Since all those things which we see with our eyes and which are perceived with our senses, are more clearly understood than if they were learnt by means of reasoning, we deem it sufficient to explain by this argument our view of the origin of 'earth.' In the manner which I have described, 'earths' originate in veins and veinlets, seams in the rocks, springs, ravines, and other openings, therefore all 'earths' are made in this way. As to those that are found in underground *canales* which do not appear to have been derived from the earth or rock adjoining, these have undoubtedly been carried by the water for a greater distance from their place of origin; which may be made clear to anyone who seeks their source."

On the origin of solidified juices, he states (*De Ortu*, p. 43): "I will now speak of solidified juices (*succi concreti*). I give this name to those minerals which are without difficulty resolved into liquids (*humore*). Some stones

and metals, even though they are themselves composed of juices, have been compressed so solidly by the cold that they can only be dissolved with difficulty or not at all. . . . For juices, as I said above, are either made when dry substances immersed in moisture are cooked by heat, or else they are made when water flows over 'earth,' or when the surrounding moisture corrodes metallic material; or else they are forced out of the ground by the power of heat alone. Therefore, solidified juices originate from liquid juices, which either heat or cold has condensed. But that which heat has dried, fire reduces to dust, and moisture dissolves. Not only does warm or cold water dissolve certain solidified juices, but also humid air; and a juice which the cold has condensed is liquefied by fire and warm water. A salty juice is condensed into salt; a bitter one into soda; an astringent and sharp one into alum or into vitriol. Skilled workmen in a similar way to nature, evaporate water which contains juices of this kind until it is condensed; from salty ones they make salt, from aluminous ones alum, from one which contains vitriol they make vitriol. These workmen imitate nature in condensing liquid juices with heat, but they cannot imitate nature by condensing them by cold. From an astringent juice not only

A, THIN *vena dilatata.* B, THICK *vena dilatata.*

is alum made and vitriol, but also *sory, chalcitis,* and *misy,* which appears to be the 'flower' of vitriol, just as *melanteria* is of *sory.* When humor corrodes pyrites so that it is friable, an astringent juice of this kind is obtained."

ON THE ORIGIN OF STONES (*De Ortu,* p. 50) he states: "It is now necessary to review in a few words what I have said as to all of the material from which stones are made; there is first of all mud; next juice which is solidified by severe cold; then fragments of rock; afterward stone juice (*succus lapidescens*), which also turns to stone when it comes out into the air; and lastly, everything which has pores capable of receiving a stony juice." As to an 'efficient force,' he states (p. 54): "But it is now necessary that I should explain my own view, omitting the first and antecedent causes. Thus the immediate causes are heat and cold; next in some way a stony juice. For we know that stones which water has dissolved, are solidified when dried by heat; and on the contrary, we know that stones which melt by fire, such as quartz, solidify by cold. For solidification and the conditions which are opposite thereto, namely, dissolving and liquefying, spring from causes which are the opposite to each other. Heat, driving the water (*humorem*) out of a substance, makes it hard; and cold, by withdrawing the air, solidifies the same stone firmly. But if a stony juice, either alone or mixed with water, finds its way into the pores either of plants or animals . . . it creates stones. . . . If stony juice is obtained in certain stony places and flows through the veins, for this reason certain springs, brooks, streams, and lakes, have the power of turning things to stone."

ON THE ORIGIN OF METAL, he says (*De Ortu,* p. 71): "Having now refuted the opinions of others, I must explain what it really is from which metals are produced. The best proof that there is water in their materials is the fact that they flow when melted, whereas they are again solidified by the cold of air or water. This, however, must be understood in the sense that there is more water in them and less 'earth'; for it is not simply water that is their substance, but water mixed with 'earth.' And such a proportion of 'earth' is in the mixture as may obscure the transparency of the water, but not remove the brilliance which is frequently in unpolished things. Again, the purer the mixture, the more precious the metal which is made from it, and the greater its resistance to fire. But what proportion of 'earth' is in each liquid from which a metal is made no mortal can ever ascertain, or still less explain, but the one God has known it, who has given certain sure and fixed laws to nature for mixing and blending things together. It is a juice (*succus*) then, from which metals are formed; and this juice is created by various operations. Of these operations, the first is a flow of water which softens the 'earth' or carries the 'earth' along with

A, SOLID VEIN. B, SOLID STRINGER. C, CAVERNOUS VEIN. D, CAVERNOUS STRINGER. E, BARREN VEIN. F, BARREN STRINGER.

it, thus there is a mixture of 'earth' and water, then the power of heat works upon the mixture so as to produce that kind of a juice. We have spoken of the substance of metals; we must now speak of their efficient cause. . . .; (p. 75): We do not deny the statement of Albertus Magnus that the mixture of 'earth' and water is baked by subterranean heat to a certain denseness, but it is our opinion that the juice so obtained is afterward solidified by cold so as to become a metal. . . . We grant, indeed, that heat is the efficient cause of a good mixture of elements, and also cooks this same mixture into a juice, but until this juice is solidified by cold it is not a metal." . . . (p. 76): "This view of Aristotle is the true one. For metals melt through the heat and somehow become softened; but those which have become softened through heat are again solidified by the influence of cold, and, on the contrary, those which become softened by moisture are solidified by heat."

ON THE ORIGIN OF COMPOUNDS, he states (*De Ortu,* p. 80): "There now remain for our consideration the compound minerals (*mistae*), that is to say, minerals which contain either solidified juice (*succus concretus*) and 'stone,' or else metal or metals and 'stone,' or else metal-colored 'earth,' of which two or more have so grown together by the action of cold that one body has been created. By this sign they are distinguished from mixed minerals (*composita*), for the latter have not one body. For example, pyrites, galena, and ruby silver are reckoned in the category of compound minerals, whereas we say that metallic 'earths' or stony 'earths' or 'earths' mingled with juices,

are mixed minerals; or similarly, stones in which metal or solidified juices adhere, or which contain 'earth.' But of both these classes I will treat more fully in my book *De Natura Fossilium*. I will now discuss their origin in a few words. A compound mineral is produced when either a juice from which some metal is obtained, or a *humor* and some other juice from which stone is obtained, are solidified by cold, or when two or more juices of different metals mixed with the juice from which stone is made, are condensed by the same cold, or when a metallic juice is mixed with 'earth' whose whole mass is stained with the color, and in this way they form one body. To the first class belongs *galena*, composed of lead juice and of that material which forms the substance of opaque stone. Similarly, transparent ruby silver is made out of silver juice and the juice which forms the substance of transparent stone; when it is smelted into pure silver, since from it is separated the transparent juice, it is no longer transparent. Then, too, there is pyrites, or *lapis fissilis*, from which sulphur is melted. To the second kind belongs that kind of pyrites which contains not only copper and stone, but sometimes copper, silver, and stone; sometimes copper, silver, gold, and stone; sometimes silver, lead, tin, copper and silver glance. That compound minerals consist of stone and metal is sufficiently proved by their hardness; that some are made of 'earth' and metal is proved from brass, which is composed of copper and calamine; and also proved from white brass, which is colored by artificial white arsenic. Sometimes the heat bakes some of them to such an extent that they appear to have flowed out of a blazing furnace, which we may see in the case of *cadmia* and pyrites. A metallic substance is produced out of 'earth' when a metallic juice impregnating the 'earth' solidifies with cold, the 'earth' not being changed. A stony substance is produced when viscous and non-viscous 'earth' are accumulated in one place and baked by heat; for then the viscous part turns into stone and the non-viscous is only dried up."

The Origin of Juices.—The portion of Agricola's theory surrounding this subject is by no means easy to follow in detail, especially as it is difficult to adjust one's point of view to the Peripatetic elements, fire, water, earth, and air, instead of those of the atomic theory which so dominates our every modern conception. That Agricola's 'juice' was in most cases a solution is indicated by the statement (*De Ortu*, p. 48): "Nor is juice anything but water, which on the other hand has absorbed 'earth' or has corroded or touched metal and somehow become heated." That he realized the difference between mechanical suspension and solution is evident from (*De Ortu*, p. 50): "A stony juice differs from water which has abraded something from rock, either because it has more of that which deposits, or because heat, by cooking water of that kind, has thickened it, or because there is something in it which has powerful astringent properties." Much of the author's notion of juices has already been given in the quotations regarding various minerals, but his most general statement on the subject is as follows (*De Ortu*, p. 9): "Juices, however, are distinguished from water by their density (*crassitudo*), and are generated in various ways—either when dry things are soaked with moisture and the mixture is heated, in which way by far the greatest part of juices arise, not only inside the earth, but outside it: or when water running over the earth is made rather dense, in which way, for the most part the juice becomes salty and bitter; or when the moisture stands upon metal, especially copper, and corrodes it, and in this way is produced the juice from which chrysocolla originates. Similarly, when the moisture corrodes friable cupriferous pyrites an acrid juice is made from which is produced vitriol and sometimes alum; or, finally, juices are pressed out by the very force of the heat from the earth. If the force is great the juice flows like pitch from burning pine . . . . in this way we know a kind of bitumen is made in the earth. In the same way different kinds of moisture are generated in living bodies, so also the earth produces waters differing in quality, and in the same way juices."

Conclusion.—If we strip his theory of the necessary influence of the state of knowledge of his time, and of his own deep classical learning, we find two propositions original with Agricola, which still today are fundamentals: (1) That ore channels were of origin subsequent to their containing rocks; (2) That ores were deposited from solutions circulating in these openings. A scientist's work must be judged by the advancement he gave to his science, and with this gauge one can say unhesitatingly that the theory which we have set out above represents a much greater step from what had gone before than that of almost any single observer since. Moreover, apart from any tangible proposition laid down, the deduction of these views from actual observation instead of from fruitless speculation was a contribution to the very foundation of natural science. Agricola was wrong in attributing the creation of ore channels to erosion alone, and it was not until Von Oppel (*Unleitungt zur Mark scheide kunst*, Dresden, 1749, and other essays), two centuries after Agricola, that the positive proposition that ore channels were due to fissuring was brought forward. Von Oppel, however, in neglecting channels due to erosion (and in this term we include solution) was not altogether sound. Nor was it until late in the eighteenth century that the filling of ore channels by deposition from solutions was generally accepted. In the meantime, Agricola's successors in the study of ore deposits exhibited positive retrogression from the true fundamentals advocated by him. Gesner, Utman, Meier, Lohneys, Barba, Rössler, Becher, Stahl, Henckel, and Zimmerman, all fail to grasp the double essentials. Other writers of this period often enough merely quote Agricola, some not even acknowledging the source, as, for instance, Pryce (*Mineralogia Cornubiensis*, London, 1778) and Williams ('Natural History of the Mineral Kingdom,' London, 1789). After Von Oppel, the two fundamental principles mentioned were generally accepted, but then arose the complicated and acrimonious discussion of the origin of solutions, and nothing in Agricola's view was so absurd as Werner's contention (*Neue Theorie von der Entstehung der Gänge*, Freiberg, 1791) of the universal chemical deluge which penetrated fissures open at the surface. While it is not the purpose of these notes to pursue the history of these subjects subsequent to Agricola's time, it is due to him and to the current beliefs as to the history of the theory of ore deposits, to call the attention of students to the perverse representation of Agricola's views by Werner (*op. cit.*) upon which most writers have apparently relied. Why this author should be (as, for instance, by Posepny, *Trans.* Amer. Inst. Min. Engineers, 1901) so generally considered the father of our modern theory, can only be explained by a general lack of knowledge of the work of previous writers on ore deposition. Not one of the propositions original with Werner still holds good, while his rejection of the origin of solutions within the earth itself halted the march of advance in thought on these subjects for half a century.

A few years ago a coal analysis was a complicated puzzle to most people. But recently it has become an economic necessity to scrutinize the coal bill as carefully as the food bill, and we have learned that a chemical analysis, when properly made from a sample properly taken, is the surest test of a coal's fuel value. This value is generally stated in terms of the British thermal unit (sometimes abbreviated to 'b.t.u.'), the quantity of heat necessary to raise the temperature of a pound of water 1°F. Manufacturers and large commercial houses have now found it a matter of economy to determine the heating value of fuel purchased for power or heating, and the coal-testing laboratory is considered quite as important as the accounting-room. The United States Government, in making its contracts for coal, requires a guaranty not only as to burning quality, but also as to ash content. It goes even much further than this and makes analyses of samples taken from each shipment to determine whether the standard set by the contract is being maintained.

Bag Filtration Plants

By Anton Eilers

*The first large bag-house used in connection with lead smelting was built about 1887 at the Globe Smelting & Refining Company's plant at Denver, Colo. When first installed it was not successful because the furnaces were run with hotter tops than is the custom at present. Following this first attempt I made a good many experiments to determine the temperature of the gas and the quantity of sulphuric acid which it contained. As a result of this work the length of the flues in all smelting works was greatly increased and there was no difficulty in treating the gases in bag-houses. It was found that in flues of a length of from 1000 to 1800 ft. there was no difficulty in accomplishing the end sought.

Murray Plant Bag-House.—This plant is at Murray, near Salt Lake City, Utah. The outside dimensions of the bag-house are 216 ft. 6 in. by 90 ft. 6 in.; height to roof trusses being 51 ft. 6 in. The total cost for construction was $127,194 including the cost of 4032 cotton bags, distributing flue, fans, motor, fan house, etc. The original roof construction had to be modified on account of the tendency of the gases to attack the nails. After two years' service the nails holding the 1-in. board sheeting were eaten to such an extent that a heavy wind carried away about one-third of the roof of one partition. It was evident that nails could not be depended upon for holding the roof down, and a new roof was put on top of the old one, allowing an air space between the two.

The bag-house is completely divided into four partitions running from floor to roof; and each compartment is further divided below the thimble floor into four chambers. A distributing flue 16 by 16 ft. runs the entire length of the bag-house, and connects with each of the sixteen cellars by means of 42-in. bulls-eye valves. On the top of the distributing flue is a smaller one which is used to conduct the gases from any of the chambers that are in process of sintering, and return them to the main flue. Each compartment has a steel stack to conduct the gases to the atmosphere. When the stacks were built the joints were lapped in such a manner that condensed moisture finds its way to the outside of the stack, corroding the metal and giving the stacks an unsightly appearance. Considerable moisture also trickles down inside the stack and originally gave considerable trouble by rotting the bags. To overcome this a lead-lined pan is used under the stack and a lead gutter conducts the accumulated moisture out upon the roof.

The bags were originally shaken by hand, but in 1910 a new system was adopted and each row of bags was hung on a 1½-in. gas pipe suspended by a U-bolt from the old bag hooks. By means of a lever on the outside of the building this gas pipe can be given a horizontal motion of about 5 in., which effectually removes the dust from the bags. By this device forty-two bags are shaken at one time. Cotton bags were originally used and cost $2.136 each at Murray. At the end of two years it was computed that the average life of cotton bags was seventeen months, eleven days. Had it not been for the adverse experience in roof construction and in the condensation of moisture in the stacks, the life of the cotton bags probably would have been longer. One compartment was equipped with woolen bags costing $4.7185 each at Murray. These were put into use May 19, 1909, and no bags have been replaced to date. As a result of the superiority of woolen bags over cotton the use of the latter has been entirely discontinued. Filtering surface is provided at the rate of 3.45 sq. ft. per cubic foot of gas per minute. When one compartment is closed this rate is reduced to 2.59 sq. ft. per cubic foot of gas per minute, and as one compartment is usually closed most of the time, 2.5 sq. ft. was the basis used for calculating the number of bags needed.

All laborers connected with the bag-house are required to take a shower bath and change clothes before leaving the bath-house. Formerly rubber suits and helmets were furnished to the bag-shaker and foreman, but later it was found that these were not essential to the men, and that the main secret of good health was cleanliness, particularly avoiding eating their lunches with dirty hands and faces.

BAG-HOUSE, MAMMOTH COPPER SMELTER, KENNETT, CALIFORNIA.

Recovery of Fume, Etc., for Entire Operation of Murray Plant Bag-House, July 7, 1907 to Febbruary 29, 1912

	Charge smelted.	Fume recovered.	Fume recovered, per ton.	Charge smelted, %	Value of metals recovered.
Weight	1,666,857 tons	13,857,645 lb.		0.415	
Gold	256,874.986 oz.	125.595 oz.	0.018 oz.	0.049	$2,587.10
Silver	24,725,274.19 oz.	14,885.62 oz.	2.15 oz.	0.063	8,028.25
Lead	354,693,161 lb.	4,492,288 lb.	32.4 %	1.269	141,745.02
Copper	16,521,715 lb.	1,947 lb.		0.0118	330.15
Total					$152,690.52

*Abstract of a paper read at the Eighth International Congress of Applied Chemistry.

Operating Expense	
Labor	$16,440.05
Motive power	13,542.10
Supplies and repairs	46,871.28
Total	$76,853.43

Outcome	
Treatment charge 6929 tons at $10	$69,290.00
Operating cost	76,853.43
Total cost	$146,143.43
Value of metals recovered	152,690.52
Gain for 4 years and 8 months	$6,547.09

The table shows the apparent gain from the installation of the bag-house in four years and eight months. But the figure does not include interest on the original investment, nor a fair percentage of same for amortization.

If these two items were included, as they should be, we would have:

Gain in 4 years and 8 months		$6,547.09
6% interest on cost of $127,194.89 for 4 years and 8 months	$35,614.57	
5% amortization for 5 yr. and 8 mo.	29,678.80	
		65,293.37
Net loss in 4 years and 8 months		$58,746.28

On account of the advisability of extracting the high percentage of As_2O_3 from the fume, the Murray fume has to be shipped to another works of the American Smelting & Refining Co., which is equipped with a plant for that purpose and works up the fume from a number of lead smelting plants. It is not good financial policy to provide every plant with an arsenic establishment, for it would be idle three-quarters of the time. But if the Murray plant had happened to be the one provided with its own arsenic establishment, the cost of working up the fume would not have been over $5 per ton, thus diminishing the loss shown above by $34,654, leaving the loss for four years and eight months still $24,101.28.

These figures show that, taking the immediate financial outcome only, bag-houses are not profitable in lead smelting works, which treat ores low in the precious metals and especially in lead. But there is another consideration to be taken into account when smelting works are, like Murray, situated near farms and villages. This is the elimination of constant lawsuits, which are bound to be of frequent occurrence, when As_2O_3 and the sulphates of lead and other metals are permitted to drop down into the fields. It must be decided therefore in the case of each smelting plant, whether it is not good business to expend the money for constructing and operating a bag-house, though an immediate profit is not apparent.

Converter Bag-House System at Omaha.—The Omaha plant of the American Smelting & Refining Co. converts a large quantity of leady copper matte. The gases from the converters are conducted through suspended flues. The flues lead to a fan 12 ft. diam. and 6 ft. wide, running at 140 r.p.m. and requiring 25 hp. The fan discharges into a bag-house containing 940 bags, divided into two compartments. With the acid-lined converters one set of bags will filter 1600 tons of lead sulphate fume representing 4500 tons of blister copper. The secret of long life of the bags seems to be in the use of long flues, permitting rapid radiation, and a good vacuum above the bags so that the gases are removed rapidly. The average vacuum at the fan is about 0.8 of an inch of water and at the converter from 0.07 to 0.15 inch.

The average temperature in the bag chamber is 140°F., varying from 100 to 180°F. Bags are made of Osnaburg sheeting, with a loop at the closed end, through which passes a 1-in. pipe or stick to support the bag. In the following table are some pertinent figures relating to the converter bag-house operations at Omaha.

Blast-Furnace Bag-House System at Omaha.—The blast-furnace charge at Omaha is high in lead, rather above 40% than under. The recovered fume contains about 50% lead, considerable carbon, and arsenious acid. In sintering this fume, the arsenic is concentrated to about 20%. Some experiments were made to see how far the arsenic could be eliminated from the fume by roasting. Several results show a reduction from 13.1% As to 3.6% As.

The burned fume is fused in a small reverberatory, allowed to cool in pots, and then charged alone into the residue furnace of the lead refinery, reducing a little lead and removing silver. The antimonial and arsenical slag resulting from this operation is reduced in a blast-furnace, producing an impure lead which is later refined by a special process of fusion.

Average Analysis Matte			
	Per cent.		Per cent.
Pb	26.9	S	15.5
Cu	43.1	As	1.7
Ni.Co	0.4	Sb	0.76
Fe	8.0		Ounces.
Zn	2.5	Ag	98.1
SiO_2	0.3	Au	0.17

Fume Produced (Part returned to converter.)		
	Tons.	Pb.
Basic	1,849	1,115
Acid	1,629	974
	3,478	

Saved in Bag-House	
Silver	$3,002
Lead	113,983
Copper	865
	$117,650

Expenses	
Labor	$904.16
Power	1,985.29
Supervision and repairs	2,953.05
Smelting	3,102.00
Refining	6,625.00
	$15,569.50
Interest at 6%	$2,520.00
Amortization, 2½%	1,050.00
Net profit	$98,711.50

The most ancient diamond-fields known are those of India, situated in the eastern portion of the Deccan mountains. From here were obtained the valuable historical gems. They have long ceased to be worked. The Brazilian diamond-fields were discovered in 1739, and have been famous for more than a century. The diamonds are for the most part enclosed in beds of itacolumite and alluvial gravels. The genesis of the precious stones has not yet been satisfactorily ascertained, but a conglomerate was discovered containing minerals similar to those in the kimberlite of South Africa. Ultimately an area of serpentinous rocks was detected, notably analogous to those of the Cape and of Arkansas. Important deposits of diamonds occur in the United States, which are presumed to owe their origin to glacial erosion of a district not yet located, but conjectured to be situated on the south side of Hudson Bay. In California and Indiana diamonds exist in the auriferous alluvium, and, although extracted from the beds of rivers, are associated with minerals similar to those in the kimberlite of South Africa. They are also sporadically found in New South Wales, Lapland, and the Urals. All these last-named deposits are of small import compared with those of South Africa, which supplies approximately 98% of the world's production.—*Revista Minera.*

Wilfley tables numbering 17,000 are reported to be in use throughout the world.

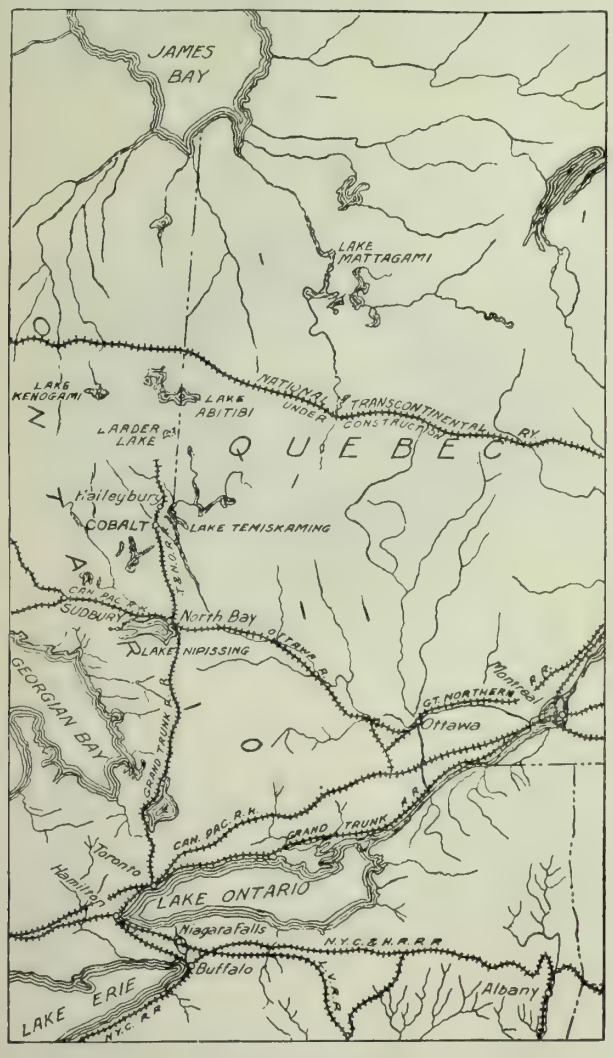
The Sudbury Nickel District, Ontario, Canada

By Kirby Thomas

The Sudbury nickel district is in western Ontario, about 260 miles northwest from Toronto, and 183 miles east of Sault Ste. Marie, the outlet of Lake Superior. It comprises an oval area, roughly 30 miles long by 16 miles wide, the longer axis being northeast and southwest.

Historical

The extensive mineral deposits of the region first attracted attention about 1883, when the Canadian Pacific



PART OF ONTARIO.

railway was in course of construction across the area. Mining work was begun about 1886 at the Copper Cliff mine, by the Canadian Copper Co., which later became the nucleus of the International Nickel Co. The early mining was largely directed toward the recovery of the rich copper sulphide ore from the easily accessible outcrops on the south range, but the association of nickel with the copper in the ore was soon recognized. The creation of a wide market for this metal in the arts and industries, particularly as an alloy for steel, for armor plate, and special purposes, gave to the nickel content of the ore great importance. It was also found that the copper content of the ore deposits of the region was irregular and generallly low, while most of the ore yielded nickel in commercial amounts. The known area of the copper-nickel bearing formation was greatly enlarged by exploration and it was found that the orebodies are generally large. For some years several companies in addition to the Canadian Copper Co. operated in the district, but chiefly owing to metallurgical difficulties and to market conditions most of them discontinued work before 1903. The International Nickel Co. was organized in 1902, based on the merging of the more important mining properties, the smelter of the Canadian Copper Co., and the plant at Bayonne, New Jersey. About the same time the Mond Nickel Co. was organized in England. This company controls the Mond nickel-refining process. Several properties were purchased and a smelter constructed at the Victoria mine in the Sudbury district to produce matte for treatment in England by the Mond method. These two companies have for nearly ten years produced practically all of the nickel and copper of the district.

Nature of the Ore Occurrences

The ore deposits of the Sudbury district are unusual, and consideration of their genesis and geological relations is of direct importance in exploration, development, and operation. All the strata of this region are early pre-Cambrian. The ore deposits are directly related to an enormous batholith, which in pre-Cambrian times was forced through the older complex eruptive and metamorphic rocks and spread out under a mass of sedimentary beds. Transportation of this vast amount of material from the interior of the earth resulted in a settling along the main fracture line of the eruption, and a subsequent tilting of the eruptive beds and of the overlying sedimentary beds so as to form a trough or basin, roughly platter-shaped, with the north and south edges dipping toward the centre and the ends somewhat flattened and more or less irregular.

The nickel-bearing eruptive is over a mile in thickness, and what now remains of it covers an area 30 by 16 miles. In the centre of this basin are the much altered remnants of the sedimentary beds. Erosion, both pre-glacial and glacial, has removed a great thickness of strata, practically all of the sedimentary beds, except in the centre of the platter, and has exposed the contact of the tilted nickel eruptive with the older rock so as to form an oval contact line. The ore is found mainly along and dipping with this contact. There are also some orebodies occurring in 'off-sets.' These are important as to size and grade. They are invariably accompanied by norite, indicating a primary genetic relation with the more numerous contact ore deposits. The 'off-sets' probably represent dikes or chimneys of the norite intrusive forced into cooling fissures or displacement fractures, presumably contemporaneously with the main intrusion. They are sometimes six or more miles long.

The lower portion of the nickel-bearing eruptive is classed as a norite, being a variety of gabbro with hypersthene. This grades toward the top, or the inner edge, of the basin into various acid rocks of the type of syenite and granite. In the norite, particularly near the contact, are found spots or 'blebs' of pyrrhotite with nickel and copper sulphides. These blend downward into the masses of pure pyrrhotite containing a uniform nickel and copper content and often platinum and palladium and traces of gold. The nickel occurs as pentlandite, a nickel-iron sulphide mineralogically similar to chalcopyrite. The copper occurs as chalcopyrite, and sometimes iron pyrite is found.

The generally accepted theory by Canadian and other geologists is that these orebodies represent the type of ore formation known as magmatic segregation, the theory being that the heavy copper, nickel, and iron minerals have settled out of the norite, their original source, by gravity. This theory is exceptionally interesting, and in the main it undoubtedly accords with the visible phenomena. However, I am inclined to believe that there has been considerable redeposition of the ores by water circulation, and that the magmatic segregation idea applies only to the primary source of the ore and not as a complete explanation of the ore occurrences as they exist today.

The Lena company has mined and hoisted 470,062 cu. yd. of gravel from October 1, 1911, to July 22, 1912, and washed 330,004 cu. yd. yielding gold worth $3,345,000. Men employed totaled 4060.

Electric Hoisting at the Hecla Mine

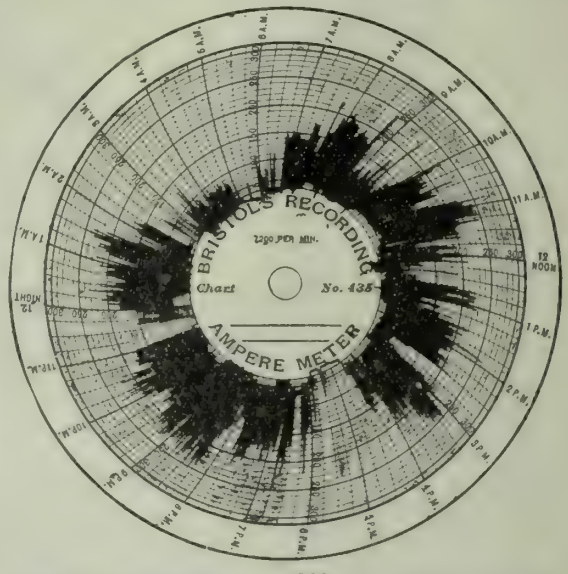
By E. M. Murphy

Eight years ago the Hecla mine, a lead-silver producer situated at Burke, Idaho, was producing ore from but two levels, the 300 and 600-ft. All hoisting was done with a 12 by 16-in. slide-valve, double-reel hoist. The hoist was operating to full capacity and was unsuitable for greater depths. As a new level was about to be opened, it became necessary to remodel the equipment or install a new hoist. The recent introduction of electric power from Spokane had made that available. By a series of tests conducted throughout the Coeur d'Alene district, it was found that it cost $109 per year to generate 1 hp. with steam. Electric power was to be had for $50 per horse-power-year. It was decided to substitute for the engines a motor-drive, of sufficient capacity to operate to the 900-ft. level, and ultimately install an entirely new hoist. After disconnecting the engines, installing a new shaft, and making a few minor changes, a 300-hp., 2300-volt, 514-r.p.m., variable-speed motor of the induction type was geared to the reel-shaft. The reels were supplied with ⅜ by 4-in. flat rope, and the duty of the hoist was about as follows: Cage, 1700 lb.; ore, 2600; car, 1400; rope, 2250; total, 7950 pounds.

The Bristol ammeter chart shows the combined current consumption of the hoist and mine motors. The large intermittent load is clearly shown; this produced harmful fluctuations in the voltage of the long lightly-loaded 60,000-volt transmission line from Spokane to the Coeur d'Alene. The power company received no compensation for the increased cost of producing power for this fluctuating load. In order to protect its system from similar excessive fluctuations of voltage in the future, the power company established a limit to the capacity of motors which it would permit to operate intermittently on its lines. When planning for its new hoist, it was therefore necessary for the Hecla company to adopt a device which would store energy during the periods when the demand for power is small, and return it during peak-loads. To meet this condition, it was decided to use an electric hoist of the Ilgner type, with the Ward-Leonard control.

The new hoist was installed during the spring of 1908, and began operation June 1 of that year. The equipment of the motor generator set is as follows: The set is self-contained, having a cast-iron sub-base, four bearings, and shaft; the driving element consists of a 450-hp., three-phase, 60-cycle, wound secondary motor, designed to operate between 2000 and 2300 volts. The generator is a 450-kw., 525-volt machine, with commutation poles to permit of its handling full-load current at any voltage between zero and maximum. Mounted on the shaft is a fly-wheel, 7 ft. 9 in. diam., weighing 29,000 lb. This fly-wheel consists of a cast steel spider, upon which is assembled a laminated steel rim. Upon the end of the shaft is mounted a 25-kw., 125-volt exciter, the armature of which is on the shaft of the set. The total fly-wheel effect of the set is 220,000 lb. at 1 ft. radius at 720 revolutions per minute.

The hoist motor is rated at 375 hp., 500 volts, 60 r.p.m., and weighs 51 tons. It is supplied with two bearings and is coupled to the reel-shaft through a forged flanged coupling. The reels are 5 ft. inner, and 12 ft. 8 in. outside diameter. Each reel is fitted with a Lane clutch and a post brake. At present each reel carries 1600 ft. of ⅜ by 4½-in. flat rope, this being sufficient to operate from the 1200 ft. level. The centre of the reels is placed 93 ft. 10 in. from the centre of the shaft. Lack of available space, preventing the placing of the hoist farther away, led to the adoption of flat rope. The sheave-wheels are 8 ft. diam., and the centres are 102 ft. from the collar of the shaft. The dump is 55 ft. 6 in. from the collar, and the skip-pockets are 25 ft. below the station at the 600 and 900-ft. levels, and 30 ft. below at the 1200-ft. level. The skips are of 50 cu. ft. capacity, weigh 3500 lb., and carry 2.6 tons of ore per trip. Double-deck cages hang beneath the skips at all times; each cage weighs 2400 lb. The motor generator set, the slip-regulator, and switch-board, are situated in a room adjacent to the hoist-room. On the switch-board are placed the following instruments and equipment: one polyphase indicating wattmeter; one polyphase integrating wattmeter; one A.C. voltmeter; one A.C. ammeter; one double-reading D.C. voltmeter; one D.C. ammeter in the motor field; one D.C. voltmeter on the exciter circuit;



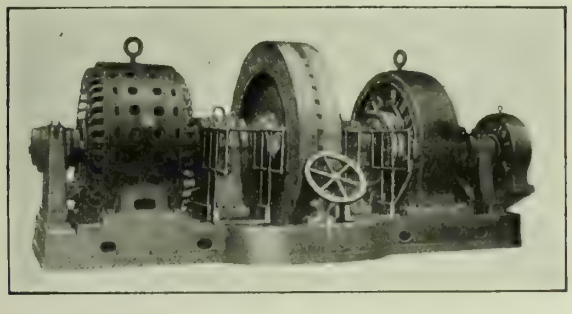
LARGE PEAKS PRODUCED BY 300-HP. INDUCTION MOTOR OPERATING OLD GEARED HOIST.

one graphic recording D.C. wattmeter; one Tirril regulator for exciter voltage; one DPST switch in the armature circuit of the exciter; one automatic, hand-operated, three-phase, 2300-volt, oil circuit-breaker; one generator-field switch; one exciter-field rheostat; one generator-field rheostat; one motor-field rheostat; one switch in the magnet circuit of the slip-regulator switches; two line-relays for the slip-regulator; one compensator for line-relays; current and potential transformers for the various instruments.

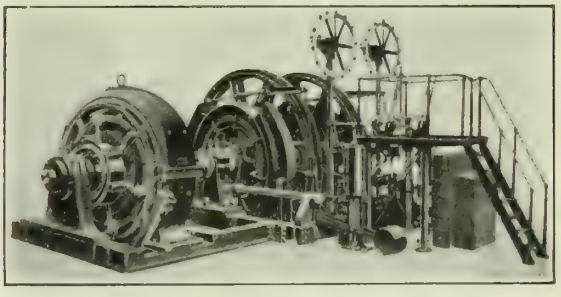
Principle of Operation.—In order that the fly-wheel shall give up part of its energy during the peaks, it is necessary to have some method of slowing down the set as the load comes on. This is accomplished by what is known as the slip-regulator. This device consists of a sectionalized resistance, of 13 sections, connected to the secondary of the induction motor. Each section can be short-circuited by means of an oil-switch operated by compressed air. The air-valves are controlled by A.C. magnets wound for 50 volts, the magnets being supplied with power from a 2300 to 50-volt transformer connected between the motor and its circuit-breaker. The magnet circuit comprises three circuits, accelerating, drop-out, and hold-in; each of the first two has a switch in series, which is opened and closed by its respective relay. The relays receive power from a compensator, which is excited from two current-transformers in the A.C. motor circuit. The relay switches can be set to operate at any desired value, within certain limits, by means of a dial-switch on the compensator, the one on the accelerating circuit being set to operate on a lower current than the one in the drop-out circuit.

*A paper presented at a meeting of the Spokane Section of the A. I. M. E., February 17, 1912. Excerpt from the *Bulletin*.

With the A.C. circuit-breaker open, all the short-circuiting oil-switches are out, and the total resistance is in the secondary. To start the set, all that is necessary is to close the circuit-breaker; the starting current, being above that for which the relays are set, operates them, thus opening the accelerating and drop-out circuits. All the oil-switches, of course, remain open. As the set speeds up, the current diminishes and the relays close, causing an oil-switch to be pulled in. This short-circuits a section of resistance, the current increases, and the accelerating relay opens. As long as it remains open, the oil-switches remain out, with the exception, of course, of the one just closed, and this one remains closed, due to the action of the hold-in circuit. When the accelerating relay closes again, due to the fall in current, another oil-switch is closed. The opening and closing of the accelerating circuit, due to the increase and decrease of current, with its accompanying closing of oil-switches, goes on until all the oil-switches are closed, and all of the resistance is cut out of the secondary. In hoisting, the reverse of this takes place. As the load comes on, the relays open, and the last oil-switch to come in is the first to go out. This introduces resistance into the secondary, and the motor slows down, letting the fly-wheel take some of the load. Should the current rise again above the set value, another switch is dropped out; this operation can continue until nine switches drop out; four of the thirteen are not connected to the drop-out circuit, and are used in starting only.



MOTOR GENERATOR SET.



HECLA ELECTRIC HOIST.

The hoist motor is shunt-wound and is separately excited from the exciter. The current in the field can be adjusted by means of the rheostat in its circuit; when the proper adjustment is obtained, it is not necessary to change the setting. The motor is now operated with a field current of 90 amperes. The Tirril regulator is seldom used to keep the exciter voltage constant, as the drop in voltage during balanced hoisting is found not to be objectionable. In unbalanced hoisting its use is essential, but the wear on the contacts is severe.

The control of the hoist motor is effected through the field of the generator. The generator armature is connected directly to that of the motor; any change or reversal in the generator voltage is accompanied by a similar change or reversal in that of the motor. The control resistance is situated under the hoistman's platform, and has a large number of points divided into four sections, connected up after the manner of the well-known Wheatstone bridge. In the off position of the controller a perfect balance exists, and no current flows in the field of the generator; the movement of the controller disturbs the balance, and this diverts voltage from the resistance circuit to the generator field. The controller is operated with a lever and quadrant similar to those on the brakes and clutches; moving the lever away from the operator starts the reels turning away from him, while a movement of the lever toward him starts the reels in that direction. In the generator-field circuit, and situated back of the switch-board, is a rheostat for adjustment purposes; when once set, this needs no further attention. Mounted in front of the operator is a double-reading D.C. ammeter, which enables him to see the load on the hoist motor at all times.

As originally equipped, the hoist had several devices, since discarded, which were intended to add to the safety of its operation and prevent abuse of the equipment by carelessness. A careless operator should not be tolerated on a hoist. The best safety appliance on any machine is a careful manipulator. In connection with the controller was an automatic retarder, designed to slow the hoist as the cage approached the top. Geared to the reels were two limit-switches, which controlled the opening and closing of a contactor. This contactor normally short-circuited a resistance in series with the generator field; within a certain predetermined distance of the dump, this contactor opened and the resistance was introduced into the generator field. The cutting in and out of this resistance was accomplished so suddenly that the commutation of the generator was affected. In addition, the failure of the apparatus to work at any time might have caused a serious accident, and it was deemed advisable to discard it.

A circuit-breaker was placed in the armature circuit of the exciter. Connected to this breaker, so as to open it, was an over-speed device on the motor generator set, it being assumed that during unbalanced lowering excessive speed might be obtained, due to the pump-back action. In practice, this high speed is not developed. An over-load trip and an under-load trip, in the motor-field circuit, could also open the breaker. There are times when the failure of the D.C. power might prove disastrous and be attended with fatalities. It is essential to prevent any accidental opening of the circuit by using nothing but manually-operated switches. The breaker was removed and a switch substituted. The over-speed device was connected so as to light a lamp, in front of the hoistman, in case the set speeded up. Should the occasion arise to cut the D.C. voltage off suddenly, it can be done by opening an exciter-field switch, placed in front and within easy reach of the hoistman.

The hoist is also equipped with an air-operated device for throwing out the clutches and applying the brakes in case of overwinding. Owing to the lack of sufficient head-room, this apparatus cannot be used. As a substitute, converging or 'tight' guides are used, together with spring hooks, which engage the cross-head and prevent the falling of the skip, should the cable break after the skip reaches the sheaves.

Cost of Operation.—Before entering into the cost of operation of the hoist, an explanation of the present contract, signed in 1908, will serve to show on what basis a settlement is made for power consumed by it. The contract runs for a period of five years and is based on a maximum demand as well as a kilowatt-hour consumption. It will be noted that it penalizes a better combined power and load factor than 61%. A power factor of 100% and a constant voltage of 2300 is here assumed in all the calculations of maximum demand. In a contract calling for a maximum demand of 100 kw., a minimum sum of $335 ($3.35 per kilowatt) is paid each month; this sum entitles the consumer to 43,550 kw-hr. (130 for each dollar). At the same time, the maximum of 100 kw. must not be exceeded at any time during the month. In case more than 100 kw. is the maximum, the minimum bill is increased by $3.35 for each kilowatt in excess. For each dollar of this increase the consumer is entitled to use 130 kw-hr. If the kilowatt-hours used exceed 43,550, the excess is paid for at the rate

of $0.0112 per kilowatt-hour. On the basis of 43,550 kw-hr. per month at $335 each kilowatt-hour costs $0.00769. This amounts to $50 per horse-power per year. The peak on the hoist never lasts 5 minutes, so the power never costs more than $50 per horse-power.

As the Hecla has but one hoist, the handling of all timbers, waste, etc., as well as the shifts, must be performed by it, in addition to the ore-hoisting. To give an idea of the work the hoist does, the following table was compiled for the period of time from August 1, 1911, to January 1, 1912:

ORE HOISTED

Monthly average.	600-ft. level.	900-ft. level.	1200-ft. level.
Skips	448.2	1,993.6	1,993.2
Tons	1,168.0	5,164.8	5,202.6

CARS OF WASTE HANDLED

	1200 to 600.	Top to 600.	Top to 300.
Cars, average	789.2	1,483.2	165.2

	Stulls.	Wedges.	Timbers, lagging, and chute.
Average	64,335.4 ft. B.M.	15.8 cars	95,028 ft. B.M.

Average power consumed, 46,925 kw-hr., equaling $361 per month. Total cost for power for each ton of output, $0.0313.

In order to determine the cost per ton for power used during actual hoisting, a series of tests was taken, with the following results: From the 1200-ft. level 32 skips (83 tons) were hoisted in 33 minutes, with a kilowatt-hour consumption of 142. On the basis of $0.00769 per kilowatt-hour, the cost of hoisting the 83 tons was $1.092, or $0.0131 per ton. From the 900-ft. level 14 skips (36.4 tons) were hoisted in 11 minutes, with a kilowatt-hour consumption of 50, and a cost of $0.3854, or $0.0105 per ton. From the 600-ft. level 14 skips (36.4 tons) were hoisted in 10 minutes, with a kilowatt-hour consumption of 40, and a cost of $0.3076, or $0.00485 per ton.

To run the set light for 1 hour requires 48 kw-hr., costing $0.368. In service the set runs continuously during the 24 hr., with the exception of a period of about 4 hr. after midnight. After the power is cut off, the set will run for 1¼ hours, unless it is slowed down by hoisting, or the band-brake on the fly-wheel is applied. The hoist was guaranteed to maintain one-quarter output of the mine working unbalanced from the 2400-ft. level (its ultimate depth). In order to test this feature, a load of 1773 lb. was added to compensate for the extra weight of cable to 2400 ft. This weight was obtained by placing a car with the required amount of ore in it on a cage-deck. The car was allowed to remain on the cage during the entire time of hoisting. Unbalanced hoisting was maintained at the rate of 11 trips an hour from 900 ft. for 3 hours. All temperatures at the end of this time were well within the guarantees. In May 1911 one of the clutch-arms broke, and the hoist operated unbalanced for a period of 20 hours, part of the hoisting being from the 1200-ft. level.

It would seem as though it would be desirable to keep the setting that would give the minimum input at all times. The objection to doing this is that the lower the setting, the greater the number of switches that drop out, and the slower the speed of the set becomes. When all nine switches drop out, it takes 55 seconds for them to come in again and for the set to accelerate to full speed. It takes from 6 to 8 seconds to load and dump a skip, and if the speed in hoisting is not to be sacrificed, the switch-setting should be such that the number that drop out can come in again in the time it takes to load and dump. In practice this is found to be about three. The setting, of course, has to be made for the lowest level hoisted from, or else the setting be changed for different levels. The upkeep of the equipment for the three years and eight months it has been in service has been extremely low. The hoist motor has needed no repairs, while the exciter has had but one new set of brushes. The generator requires about one new set of brushes per year. The A.C. motor has been the only source of expense, and like trouble could occur to any motor. Three times it has suffered a grounded coil during a lightning storm. The winding is a three-bank concentric winding, and replacement of coils is a tedious affair. A new set of collector-rings was also put on this machine last December.

One noticeable feature of this installation is its noiseless operation and the ease of control. The motor can be reversed in an incredibly short space of time, and during loading and dumping the brakes are seldom applied. The wear of the brake-blocks is inappreciable, and the original set will no doubt last the life of the mine. The effect of the smoothness of operation is particularly noticeable on a cable, a service of from 10 to 14 months being obtained from each sewing, while the strands will last for years. The control is so accurate that no chairs are needed in the shaft to run on and off the waste-cars. Should the brake be removed when the skip is empty, the speed with which it will descend unbalanced is remarkably low. No matter how slow the speed is, the pump-back action is taking place, and during the trips that waste and timber are being lowered into the mine, power is actually restored to the line.

The hoist requires but one man per shift to operate it. Another advantage of the hoist is its ability to operate for a short time, even though the power be accidentally interrupted. The running-lights in the hoist-room are all lighted from the exciter, which enables the operator to see as long as hoisting can be continued. This installation has the disadvantage of consuming power, even though the hoist motor is not in actual operation. This is more apparent than it would be if the hoist were operating from greater depths, or handling greater tonnage. The effect greater depth has on the efficiency is shown from the tests. From the 600-ft. level, the cost per 1000 foot-tons is $0.014, from 900 ft. it is $0.0116, and from 1200 ft. it is $0.0109. The effect greater tonnage would have on the cost per ton of output is shown by the following: Assuming that the mine double its output, the kilowatt-hour consumption per month would be increased by 17,231, at a cost of $132.50. The total cost for power for each ton of output would be lowered from $0.0313 to $0.0213. Each hoisting problem has its own solution, and the Hecla company appears to have solved this one in a most satisfactory manner.

New Method of Galvanizing Iron

The *Frankfurter Zeitung* reports as follows with respect to a new method of galvanizing iron: In order to protect iron objects from rust, it is customary to coat them with zinc either electrolytically or by plunging them in a bath of melted zinc after careful cleaning. The disadvantage of these methods is that a real fusion of the two metals is not obtained. As a result the zinc coating is likely to be attacked by the atmosphere. This may be avoided by a recently patented process which consists in so preparing the iron that the zinc gets into its pores. After steeping in sulphuric acid the iron is placed in a solution of mercury chloride and then heated, resulting in decomposition of the mercury chloride and precipitation of metallic mercury, which forms an amalgam with the iron on the surface. The iron is then plunged into a zinc bath heated to 500°C., where it remains three minutes. Iron galvanized by this process shows unusually strong adhesion of coating to metal. Microscopic investigation shows that the zinc penetrates into the pores of the iron, and in case a portion of the coating is worn or broken off, iron does not rust owing to the presence of sufficient zinc in the pores.

SALE of the Sayapullo Mining Co., of Peru, to Paris investors, has been sanctioned by the directors and also by a general meeting of the shareholders, thus validating the contract already made by Jose Balta. The shareholders' meeting also voted to issue the £10,000 in bonds which had been held in reserve.

Cyanidation of Concentrate

By Robert Linton

*A series of tests recently made by me to determine the advantage or the reverse of cyaniding raw concentrate in place of shipping it to a customs smelter developed some interesting metallurgical features. The analysis of the concentrate was as follows:

	Per cent.		Per cent.
Insoluble	44.00	MgO	0.47
Fe	26.50	As	0.03
Cu	1.30	S	18.20
Zn	1.20	Ag	4.29
MnO_2	0.41	Au	0.06
Al_2O_3	1.40		
CaO	1.75	Total	99.61

The silver occurred as sulphide, chiefly or perhaps wholly, in the form of argentite. The gold was in the silver sulphide. Agitation in water indicated that the concentrate was neutral, but when agitated with N/10 acid and titrated with N/10 NaOH it showed an alkalinity of 0.44%. The concentrate was ground to pass 200 mesh and the treatment carried on in a model Pachuca tank 10 in. diam. by 30 in. deep, with 1½-in. pipe for air lift and ¼-in. pipe for air feed. The first tests showed a constantly increasing alkalinity in the solutions used, although no lime was added to the charge after commencing agitation. An analysis of the solution after agitating five hours gave the following results:

	Per cent.		Per cent.
Total cyanide	0.0970	Ferrocyanides	0.0289
Free cyanide	0.0920	Sulphocyanides	0.0358
Protective alkali	0.1433	Alkaline carbonates	0.1407
Alkaline hydrates	0.0762	Zinc	0.0040
Hydrocyanic acid	0.0033	Copper	0.0688

There was no reaction for alkaline sulphides, although K_2S probably formed and immediately combined with more potassium cyanide to form potassium thiocyanate, KCNS. This would seem to explain the increase in alkalinity observed, and to indicate that this increase in alkalinity involves a direct loss in cyanide. The reactions would be as follows:

(1) $FeS + 6KCN = K_4Fe(CN)_6 + K_2S.$

(2) $K_2S + KCN + H_2O + O = KCNS + 2KOH.$

First Test

The increasing alkalinity of the first test is shown in the following records:

Hours agitation.	Sodium cyanide added per ton concentrate, lb.	Solution KCN	Solution P. A.
2	..	0.045	0.10
2¼	20	....	...
4	..	0.16	0.11
6	..	0.09	0.23
6¼	10	....	...
8	..	0.195	0.207
12	..	0.115	0.22
12¼	10	....	...
16	..	0.165	0.235
16¼	10	....	...
20	..	0.235	0.268
20¼	10	....	...
23	..	0.285	0.28
23½	15	....	...
26	..	0.33	0.29
28	..	0.23	0.34
30	..	0.205	0.35
32	..	0.165	0.358

*From the *Jour. Chem., Met. & Min. Soc. of S. A.*, July 1912.

No alkali was added during the test, the increase in alkalinity resulting from the decomposition of the solutions. Several bottle tests were made to determine whether or not lead acetate would react with the K_2S and prevent the excessive consumption of cyanide. With less than 1% lead acetate, it appeared to have little if any effect; with 1% or over the increase in alkalinity above noted gradually disappeared, but at the same time the consumption of cyanide greatly increased. The results of five tests of agitating 10 gm. of concentrate with 50 c.c. solution titrating 0.73% KCN for 72 hours are as follows:

Test No.	Lead acetate added, %	KCN after 72 hr. agitation, %	P.A. after 72 hr. agitation, %
1	None	0.22	0.056
2	1	0.21	0.036
3	2	0.205	0.025
4	4	0.185	0.002
5	8	0.047	0.000

The extraction of gold and silver in each case was practically the same.

Second Test

From a study of the preliminary tests an outline of treatment was formulated and a test run of 76 hours was made in the small Pachuca agitator. Details of this run are as follows:

Hours agitation	Cyanide added per ton conc., lb.	Lime added per ton conc., lb.	Solution. KCN, %	Solution. P.A., %	Extraction. Au, %	Extraction. Ag, %
2	...	109	...	...	...	...
4	62.6	...	...	...	...	...
7	...	...	0.58	0.31	17.4	20.8
13	...	...	0.18	0.35	54.9	40.5
19	...	...	0.12	0.35	79.2	52.6
22	62.6	62.6	...	...	...	...
25	...	...	1.30	0.36	...	...
31	...	...	0.91	0.44	79.2	63.2
37	..	...	0.75	0.47	...	...
43	...	...	0.59	0.48	...	...
45	...	...	0.56	0.48	82.6	74.6
46	62.6	93.9	(Fresh So'n)			
48	...	...	1.17	0.30	82.6	80.8
54	...	...	1.08	0.35	87.3	82.2
57	...	...	0.98	0.35	87.3	85.2
60	...	...	0.92	0.39	88.5	87.8
62	...	...	0.88	0.39	90.2	87.9
64	...	...	0.87	0.39	...	...
66	...	...	0.85	0.39	...	...
68	...	...	0.82	0.40	90.2	89.1
70	...	...	0.78	0.40	90.2	90.5
72	...	...	0.78	0.40	91.1	90.6
74	...	...	0.77	0.40	91.8	92.5
76	...	...	0.77	0.40	92.1	92.7

Third Test

A third test was run, using less cyanide in solution, but higher protective alkalinity, and lead acetate equivalent to 3.5% of the weight of the concentrate treated, also raising the ratio of solution to concentrate to 3:1 (previous tests having been at 2.5:1). The results of this test were as given in the table on the following page, which also shows a progressive increase in protective alkalinites.

The results of all the tests run seemed to indicate that the most economical treatment was to grind the concentrate in a solution of about 0.2% KCN, then agitate in a 0.6% KCN solution, raising to about 0.8% toward the end of the treatment. Maintaining a high protective alkali proved to be of little benefit, about 0.10 to 0.15 being sufficient. The use of lead acetate appeared to be of no benefit in pre-

venting consumption of cyanide, although the use of a small amount serves to keep the solutions clear.

Hours agitation...	Cyanide added per ton conc., lb....	Lime added per ton conc., lb....	Solution. KCN. %	Solution. P.A., %	Extraction. Au, %	Extraction. Ag, %
2....	...	74	...	...	...	...
3....	23	...	0.15	0.39	...	...
4....	26	...	...	...	...	...
6....	...	...	0.37	0.44	...	...
7....	16.4	...	...	...	...	...
8....	...	...	0.27	0.55	45.0	36.8
14....	...	...	0.09	0.57	46.8	49.0
20....	...	...	0.06	0.58	54.0	68.3
22....	32.8	...	...	...	...	...
26....	...	...	0.45	0.66	55.2	68.4
32....	...	...	0.19	0.69	56.4	68.3
38....	...	...	0.17	0.70	58.1	69.2
44....	...	...	0.15	0.71	61.0	70.9
46....	...	...	0.15	0.72	63.3	71.4
47....	49.2	93.8	(Fresh So'n)			
50....	...	...	1.0	0.39	63.8	73.5
54....	...	...	0.88	0.41	65.0	76.7
58....	...	...	0.78	0.45	67.4	77.2
62....	...	...	0.70	0.47	75.0	88.8
64....	...	...	0.67	0.48	75.0	90.6
66....	...	...	0.67	0.48	76.4	91.6
68....	...	...	0.65	0.49	80.0	91.7
70....	...	...	0.63	0.50	82.0	91.8
72....	...	...	0.62	0.50	82.0	92.2
74....	...	...	0.61	0.50	84.0	92.2
76....	...	...	0.61	0.50	85.0	92.5
78....	...	...	0.57	0.50	88.0	92.6

Copper Markets of the World

The following is taken from reports from the cities mentioned, published in *Daily Consular and Trade Reports.*

The use of copper for manufacturing purposes in the London consular district constitutes but a small portion of the total consumption of the United Kingdom. The greater part of the copper is required in the Midlands and the north of England, which contain such great industrial cities as Birmingham, Manchester, Newcastle, Sheffield, and Leeds. Liverpool, by reason of its situation, is the port which receives most of the copper imported into the United Kingdom from the United States. Some American copper is delivered at Swansea, but it forms a very small proportion of the total imports.

Liverpool is the principal port in the United Kingdom for the importation of copper ore and unwrought copper, taking about three-fourths of the former and nearly one-half of the latter. It may be accepted that all of the copper ore imported into Liverpool is smelted in this district, but diligent inquiry fails to obtain exact figures as to the local consumption of the unwrought copper. Neither manufacturers nor brokers will give definite information or even satisfactory estimates. The closest figures obtainable are that 70% of the imports of unwrought copper is used in manufacture in this district, 20% forwarded outside of the district, principally to Leeds and Birmingham, and about 10% re-exported to foreign countries. This re-export varies and was found to be one-third less in 1909 than in 1910, although the imports in 1909 were about double those of 1910.

Two of the manufacturers in the Liverpool district principally produce sheets, bars, and heavy plates for working into shape by coppersmiths, and known to the trade as 'copper bottoms.' Birmingham is the centre of manufacture of copper for kettles, pans, etc., and is the largest purchaser. Copper plates are also purchased by Egypt and India for use in the manufacture of utensils, trays, etc. A third manufacturer produces copper telegraph and telephone wire. There are no copper smelters in Liverpool itself, but this district is probably the greatest centre for smelting in England; Swansea, which previously led, being now second. Near Liverpool there are 7 firms operating 9 smelting works, and 4 have offices in this city.

The sale of copper ore is principally through brokers on commission, and not on the market. In the case of the unwrought copper, which is warehoused in Liverpool, the manufacturers purchase it on the London Copper Exchange, and the product of the smelters is purchased either in this way or through agents, and through dealers who buy large quantities to dispose of later. This copper is sold on what is known as 'standard copper' terms, which include various grades, the basis being 97% pure copper. If upon delivery the percentage should be below 97% and not less than 96%, the purchaser is entitled to a deduction accordingly, but if below 96% and not less than 93%, a double deduction is allowed. If under 93%, the copper can be refused. On the other hand, if over 97%, excess must be paid.

Birmingham, by the variety of its industries, probably uses more copper for manufacturing purposes than any other city in the United Kingdom. There is a large and increasing consumption of copper, however, in London owing to the electrification of railways. Of the total imports of unwrought copper into the United Kingdom in the last three or four years, only about one-third was imported into London, but most of the re-exports were shipped from this district. The smelting and refining of copper and the making of articles of brass and copper have been important industries of Birmingham for many years. Not so very long ago nearly all of the copper or brass articles within the United Kingdom were of Birmingham origin, and this district properly claimed supremacy in the metal trades; but copper manufacture of various kinds has developed in other British cities, so that while Birmingham is still first, its leadership is by no means so unchallenged.

Several firms engaged in refining copper in Birmingham and vicinity are generally referred to as smelters, but as a matter of fact the copper that comes to them for refining has already been smelted and contains only traces of a few other metals. In the past, when it was customary for the copper ore to be brought to England, refining proper or smelting was really an important industry in Birmingham; but with the development of smelting and refining in the United States and in other copper-producing countries, and because of heavy freight charges for carrying crude ore from the seacoast to Birmingham, it became impossible for local smelters to compete with those more favorably situated on waterways, so what was left of the industry in England remained in the hands of refiners on the coast. Copper is used in the Birmingham district for the production of copper and brass sheets, tubes, and wire, for the manufacture of cartridge cases, bedsteads and bedstead mounts, fenders, brass foundry, lamps, pins, church bells, gas and electric fixtures and plumbing, motor accessories, and many other articles in which copper is required. The output of these products is immense, and the quality usually excellent, the copper, brass, and light metal trades generally giving employment to thousands of people.

Estimates as to Birmingham's proportion of the copper required for manufacturing in the United Kingdom vary materially. Unfortunately, there is no way of ascertaining the truth, because there are no statistics of the raw copper that comes into Birmingham, while the same copper will be used over and over again in various degrees of manufacture. The six largest Birmingham firms with copper and brass rolling mills are said to consume at least 30,000 long tons of copper annually, while other mills and industries are thought to consume as much more. The quantity of copper from America and other copper-produc-

ing nations that comes to Birmingham or Great Britain fluctuates each year with trade requirements. Much depends upon the price at which the copper is offered and the supply available. At one time it may be more profitable for a copper manufacturer to buy Japanese or Chilean, Mexican, or other copper, while at another the American article may be more profitable to him because of the prices at which and the readiness with which it can be obtained at the moment. However, as American copper represents more than 50% of the production of the world, it necessarily stands pre-eminent in the market and must always command a considerable sale. Then the almost perfect purity, 99.9%, of the American cathodes, ingots, cakes, or wire bars that come to Great Britain gives American copper a high reputation with manufacturers, but what is regarded as the "independent attitude" assumed by the American companies that sell copper to England causes serious complaint on the part of those who are in the market for copper supplies. American copper companies are said to refuse to sell to England except on the American certified weight and not upon the weight of the copper on arrival. As copper cathodes must be lifted and handled about eight times on the way to the consumer in England, and as they are rough and easily abraded, it can be seen that the percentage of loss in weight is considerable. Copper merchants generally, at the normal price of copper, calculate this loss as an increased cost to them of about 60c. per long ton.

Another objection made to American copper is that cathodes are frequently of too great weight. Sometimes a cathode will be 86 lb., which is most strongly objectionable, although even this must be cut before it can be used in manufacture; but American cathodes are said not infrequently to weigh 125 to 160 lb. each, when they become a serious nuisance and occasion many complaints because of the great difficulty in handling them. It is stated that reduction in the size of cathodes from the United States would popularize American copper considerably, while if all American copper were shipped in cakes, ingots, or wire bars of reasonable weight, and not in extremely heavy cathodes, the objections raised on account of the loss during shipment and as to difficulty of handling would be met.

It was suggested by one manufacturer that if there were representatives of American copper companies with offices in Birmingham who went after the business with great energy, the sales of American copper might be further increased, particularly when the demand is slack and prices comparatively low. At such a time the services of a representative or merchant who is in touch with all manufacturers, who knows their requirements and the quality and character of the copper that they need, would be invaluable and materially broaden the sale of the American product. However, there are representatives of the great copper merchants in Birmingham who appear to be ready and willing to meet most of the requirements of the market.

It would seem as if there should be a good market in Birmingham for copper and brass sheets and electric and telegraph wires of American origin if regular supplies were available, provided, of course, pains were taken to study the market and ascertain the exact kinds, quantities, and sizes that manufacturers of brass and copper goods require, the usual terms of sale, and conditions of delivery; but the effort to sell such products by correspondence and without the most careful investigation would be futile. Some organization such as that by which semi-finished steel and iron from the United States and Germany are sold in England would be wholly desirable.

At Havre 65 to 75 tons of copper per day is used in manufactures, practically all by one consumer, La Société des Trefileries du Havre; the total local consumption is between 20,000 and 25,000 tons annually. Havre's imports of copper, however, are nearly three times this tonnage, having amounted in 1911 to 74,977 tons, consisting of 2569 tons of ore, 68,370 tons of pigs and sheets, and 4038 tons of scrap and filings. The United States supplied 5680 tons of the pigs and sheets and 1510 tons of scrap and filings. Havre is the principal importing point for American stock and has practically a monopoly of the American copper trade with France. It must be understood, however, that this tonnage of copper received at Havre from America has heretofore not been traded in at Havre itself but at London. It is to handle the sales directly at Havre, and to save a present expense in London commissions, etc., amounting possibly to as much as 50c. per ton, that the Havre traders are endeavoring to create an independent exchange. Local bank conditions are quite adequate to such a market, and the hope is to buy direct from America hereafter, in so far as American importations into France are concerned. There is very little copper of any character exported from Havre. The total in 1911 was only 6634 tons to all countries, 5266 tons of which was copper wire manufactured in this city. The trade in scrap copper is insignificant.

The important element in the development of a direct American copper market at Havre will be the establishment of close relations between American and French shippers, without the intermediary of London or other traders. Steamship transportation is fairly adequate and cheap. British control of the Atlantic carrying trade and the necessity of making charters in London may possibly be used against the development of a direct market, but the consulate believes that American exporters will have no great difficulty on that score if they will make the proper connections at Havre. The transportation facilities of the port are excellent and are being enlarged to conform to the most modern practice. Freight connections with the United States are excellent. It is the expectation among French engineers that the French consumption of copper will continue to advance in fully the ratio shown for the past few years. Any artificially increased importations on account of the low prices prevailing in 1910 and 1911 will evidently be offset by greater consumption in manufacturing, the demand in France corresponding, as in other countries, to the expansion of industrial enterprises in the domestic field, and in the extensive enlargements of electric traction, transmission, and other systems which are heavy users. It is further to be pointed out that the Havre market is in direct touch with all parts of Europe and the United Kingdom, and that it is already headquarters for extensive direct dealings in coffee, cotton, rubber, woods, and other raw materials.

Russia, from January to May 1911, produced 454,526 poods (pood = 36.112 lb.) of copper, while the production for the same period of this year totaled 660,437 poods, an increase of 45.3%. This production for 4 months was distributed as follows: Urals, 350,664 poods; Caucasus, 198,906 poods; Siberia, 83,300 poods; smelters and refineries, 27,567 poods; total, 660,437 poods. It will be seen that the highest percentage falls to smelters and refineries, but the increased production of the Ural works is of much more substantial importance to Russia. Among the concerns of that region the largest gain in production is shown in the Kyshtim district, where the amount of copper produced rose from 56,675 poods in 1911 to 150,719 poods in 1912. The Akhtalsky works output advanced from 63,939 poods in 1911 to 89,230 poods in 1912. In the Bogoslov district 84,895 poods was produced during 1912, against 83,395 poods in 1911. The Spassky works increased its production from 48,767 poods in 1911 to 75,981 poods in 1912. The Caucasus Copper Co. (see *Mining and Scientific Press*, January 27, 1912) increased its output from 28,786 poods in the first four months of 1911 to 68,362 poods in the corresponding months of 1912.

EXPORT of coal from Formosa shows a considerable increase, while that of sulphur is declining. The principal market for both is in China. Favorable reports come from the gold mines in north Formosa. The production is somewhat larger, and by installing improved machinery the companies will be able to treat lower-grade ore in larger quantities.

Mining in Korea

In Tung Chang 224 Korean 10-stamp mills are in operation, according to the *Seoul Press*. They still have 150,000 bags of ore to mill (20 bags to the ton). The ore averages 1 oz. of gold. The French company expects about Y60,000 royalty on this ore. The Korean methods are very wasteful, losing one-third of the gold. The French company is now putting up a 10-stamp mill on the property. The Allgemeine Electrictats Gesellschaft (A. E. G.) of Berlin, represented by Okura & Co. of Japan, has closed a deal to erect a 3000-kw. electric power plant to furnish power to the Oriental Consolidated Mining Co. in Yusan and the Chosen Mining Co. in Yeng Byen district. Contracts for power have been signed by these companies. The A. E. G. company expects to have the power plant in running order by March 1, 1913. Coal from Fushun will be used to generate power.

A new postoffice was opened June 14, 1912, by the Japanese Government at Kosung, Yeng Byen district,

NATIVE GOLD WORKING, KOREA.

Korea, for the special convenience of the Chosen Mining Co. Pyongan reports that the Mitsui Bussan Kaisha has decided to work the gold mines in Kaichon district, South Pyongan province, from August next, investing Y2,000,000 in the enterprise, and that the gold mine at Changsong, North Pyongan, will be worked by K. Yasikawa with a capital of Y1,800,000. The amount of gold exported through the Bank of Chosen during January 1912 was valued at Y516,080 (179,786 momme), and February 1912 176,367 momme, valued at Y493,217. A Korean named Whang, living at Kapsan, South Hamgyong province, found a nugget of gold as large as a man's first, weighing 245 momme, and sold it to a Japanese, who sold it to the Bank of Chosen for Y1050 in March. The gold mines at Yusan (O. C. M. Co.) during February produced a total output of 738 lb., valued at Y252,800.

According to a report, the total amount of gold produced in the various districts in North Pyongan province during six months from January to June last was as follows:

District.	Value of gold produced. (Yen.)	Value of alluvial gold produced. (Yen.)
Kusong	33,600	.....
Sakuj	29,056	.....
Changsong	41,055	.....
Wiju	860	145
Unsan[1]	1,556,215	.....
Yeng Byen[2]	561,680	13,450
Taichon	6,260	.....
Totals	2,228,726	13,606

[1]O. C. M. Co. operating.

[2]Chosen M. Co. operating, but no reduction plant yet.

Of these amounts, about 70% was purchased by the local branch of the Bank of Chosen, 10% was exported to Antung prefecture by the Japanese, and 20% was purchased by the Japanese and Koreans of the province and other provinces.

Queensland Mineral Land Law

The Queensland Government is introducing a bill dealing with prospecting and mining for coal and mineral oil, and this, it is proposed, should come into operation in May next. Among other things, this bill provides: That any person who desires to prospect Crown lands for coal or mineral oil may make application to the nearest warden for a license to occupy any Crown land described in the application, and not being of greater area than 2560 acres, for the purpose of searching thereon for coal or mineral oil, as the case may be, and shall pay to the warden a sum equal to one penny for every acre of the land applied for. The warden shall report on the application, and the Minister may grant a license for 12 months or refuse it. If an application for renewal is made before the expiration of the period of 30 days thereafter, the Minister may renew it for a further period of 12 months on payment of a sum of 1d. for every acre held. The license shall be canceled if the licensee fails to commence searching within 90 days of its issue, or such further time as the Minister allows, or if he does not make reasonable excuse, to take a lease of the land or part of it. Leases may be granted of land up to 640 acres for coal and 600 acres for oil, on payment of survey fee, and the first year's rent, which shall be at the rate of 6d. an acre. The period shall not exceed 21 years.

The surface area of the leases or licenses is restricted to 100 acres in the aggregate, and royalty must be paid in respect of leases as follows: For coal, during the first 10 years, 2d. for every ton of coal raised from the land, if it is situated more than 100 miles from a seaport or other place of delivery, and at the rate of 3d. for every ton of coal raised from the land if it is situated not more than 100 miles from a seaport or other place of delivery; and during the remainder of the term, in the first-mentioned case, at the rate of 4d., and in the second case at the rate of 6d., for every ton of coal raised; in every lease for mineral oil, at the rate of 5% of the gross value of all crude oil obtained during the term.

Conditions as to labor and expenditure are imposed, including: To work coal land by not less than one man to every 40 or part of 40 acres during the first two years, and by not less than one man to every 20 acres for the rest of the term; in the case of oil land, by not less than one man to every 15 acres during the period. As an alternative, the Governor-in-Council may, in the case of coal-mining, impose the following conditions: To spend during each half-year of the first two years of the term at least £100 for every 40 or part of 40 acres, and during the remainder of the term £100 in each half-year for every 20 or part of 20 acres of the land. In the case of oil mining, the sums to be expended under these alternate conditions are: To spend £100 at least in each half-year for each 15 or part of 15 acres, or such sum to be specified in the lease as the Minister may determine for each acre. The penalty for the first and second breaches of these covenants is a fine not exceeding £100, as the Minister may impose, and on non-payment of penalty or on a further breach, the lease may be forfeited. Work done under tribute will satisfy the labor covenant.

INVESTIGATIONS are being conducted by French and English engineers on behalf of the concessionaries who secured the exploitation of the Kolochugin mines, the Salirsky silver and gold mines, the chalk hills at the source of the River Tom, and the construction of a 150-mile railway from Yurga on the Siberian trunk line. It is assumed that the Yurga line will be the starting point for the projected railway which is to connect Siberia with Turkestan.

Discussion

Readers of the MINING AND SCIENTIFIC PRESS are invited to use this department for the discussion of technical and other matters pertaining to mining and metallurgy. The Editor welcomes the expression of views contrary to his own, believing that careful criticism is more valuable than casual compliment. Insertion of any contribution is determined by its probable interest to the readers of this journal.

Water as an Indication of Ore

The Editor:

Sir—M. W. von Bernewitz' letter in your issue of September 21 reminds me that I had forgotten to write a few words on this subject. I agree with Mr. Rickard that the presence of water—*in a lode*—is a favorable indication. It marks a broken and shattered area, which would naturally be better suited for the reception of ore-bodies and their enrichment by subsequent migratory processes. Furthermore, a damp condition of the freshly broken face, in contrast to a dry or harsh appearance, is according to my experience one of the best signs of approach to valuable ore. But large flows of water are often due to post-mineral fissuring, and may be of no value as a sign of ore, except as indicating that the mine has not yet penetrated below the horizon to which surface waters may penetrate. A dry, dusty condition in the bottom of deep mines often seems to coincide with a lessened amount of quartz in the gangue, and a vein-filling consisting mainly of clay and crushed 'country.'

GEORGE E. COLLINS.

Denver, Colorado, September 26.

What are Mining Profits?

The Editor:

Sir—I was rather surprised to notice that in a recent issue you criticized adversely the decision of a Colorado judge that the removal of ore from a mine is not depreciation. Carried out logically, the theory that ore removed is depreciation means that there will be no real profits in mining, and that no mining corporation need pay the corporation tax. This argument is rank sophistry. It is akin to a statement that because human activity does not add anything to or subtract anything from the material universe there is no profit in doing anything.

The profits of mining are just like any other profits—the difference between what money you put in and what money you take out. The steel maker buys his pig iron, converts it into steel, rolls it, and sells it. All these things cost money. If the selling of his steel gives him more money than he has spent, he has a profit. Similarly, a mining company buys a piece of ground, finds ore on it, puts up a plant to take out the ore, takes it out, sells it, and shuts up shop. Every dollar taken in over what is spent is profit.

But here we come to the point where the sophist gets in his work. The price paid for the ground is either made to appear vastly greater than it really is by attaching to it some fanciful capital stock valuation; or the real profits of the mine are paid to the owners of the ground as a cash purchase price. Practically all the mining land in the United States has been secured from the Government for a few dollars per acre. As soon as that land is sold at an advance for mining purposes a profit is reaped. The capital valuation of a mine can so easily be juggled in this way, and it is so often done, that the depreciation of it is certain to be a farce—a fanciful calculation for tax-dodging purposes. The word 'billion' is just as easily pronounced as 'million', and is just as easily attached to the articles of incorporation. The only depreciation the Government can afford to allow to mining companies is the full amount of their actual expenditure on actual plant and operation. Purchase of real estate should be considered as an investment purchased with profits. If profits are employed to make such purchases, that is no reason why they should not be taxed.

If the Government is going to allow depreciation of capital stock it will always be in a hopeless muddle. It should forget all about capital stock and make the companies pay on a plain statement of expenditures which should be interpreted by a plain and simple rule. Such a rule should exclude from the list of expenditures all sums spent for the acquisition or defense of mining rights. Let us suppose a mine takes ten years before it begins to pay. During that time the cost for prospecting, development, and plant is $1,000,000. It then begins to earn $200,000 a year. At the end of the first year of such earnings the mine has no profits, but instead a debit balance of $800,000. It will not make any profits until at the end of its fifteenth year $1,000,000 has been earned back. Its depreciation is then complete. From that moment it should pay its corporation tax on whatever surplus of income it may have over properly chargeable expenditures. If the plant is worn out or inefficient and it becomes necessary to renew it, all such renewals should be allowed as a direct cost. For instance, if during the sixteenth year of the company's operations it should decide to build a new mill and spend $300,000 in so doing, while at the same time it earned $200,000 with its old mill, the net result for the year would be a loss of $100,000. The $300,000 spent would be properly chargeable to 'depreciation.'

If during the seventeenth year the operation of the new mill should enable the concern to earn $400,000, it could pay off the balance of $100,000 due to depreciation, and for the first time in its history have a balance of real profits, namely, $300,000. Thereafter, so long as the income exceeds the annual expenditures, and by exactly that amount, it should pay the corporation tax and it would be paying on real profits. The depreciation of the mine itself can never be undertaken intelligently. No one ever knows until it is worked out what it was really worth. The working out of it along the line briefly outlined above is what finally establishes its value. That value is in itself only the sum total of its profits. I have avoided all reference to the interest to be allowed on investments and the calculation of present values in order not to complicate the very simple line of reasoning.

J. R. FINLAY.

New York, September 26.

[We hope our readers will contribute their opinions on this important topic, which has not been adequately discussed by mining engineers. Our own will be reserved until later.—EDITOR.]

Names, Right and Wrong

The Editor:

Sir—In your review of my 'The Hydrometallurgy of Copper,' in the issue of September 14, 1912, there are certain statements which I think require comment. In the spelling, or misspelling, of proper names the blame is thrown entirely on the author and on the proofreader, as for example: "It is too much, of course, to expect any metallurgist to spell the name of McDougall correctly, but a higher average of correct renderings of the other proper names throughout the book ought not to present unusual difficulty." But the difficulty *is* unusual, notwithstanding that the reviewer excuses the matter by the statement that "Typographical errors in a journal have some excuse." Since the book has gone to press I have found, in the various journals, different renderings of the same proper name, and unless one is aware of this in time, he has a right to assume that the name, as he finds it, is correct.

A very good illustration of this is found in the reviewer's own article. He uses two proper names, not referred to in the 'Hydrometallurgy of Copper': 'Mackay' and 'Braxeres', both of which are wrong, assuming that the patent record of one, and the official circular of the other, contain the correct rendering, which should be 'MacKay' and 'Baxeres', respectively. This shows an error of 100%

in the spelling of new proper names. Paraphrasing his 'jolt' to the metallurgists, it might be said that 'it is too much to expect a higher average from the editors of great mining journals.'

Now, it seems to me that instead of criticizing the professional metallurgist, who has neither the time nor the inclination to waste his life in the study of the vagaries and barbarisms of the English language, the blame should go where it properly belongs. If Bayonne is spelled with two n's instead of one, the culprit who originated the spelling is the one who should be executed.

I think, also, that a wrong impression is given in the matter of roasting. The statement is made, "Thus chapter III is largely composed of descriptions of experiments on the roasting of the gold telluride ores of the Cripple Creek district; an interesting subject, but one which has no visible bearing on the hydrometallurgy of copper." This is clearly a misstatement and a misconception. Out of the 62 pages of chapter III, only 2½ pages are devoted to tellurium, and only a little more than this out of 151 pages devoted to roasting in Part I. This mention was made to make the subject complete and on the basis that most copper ores contain some tellurium.

Anyone familiar with the Cripple Creek milling ore knows that it takes a very delicate test to show even a trace of tellurium, and the roasting operations are based entirely on the elimination of the sulphur from the iron sulphide. This being the case, there is no essential difference between roasting Cripple Creek ores for the extraction of gold and in roasting a similar cupriferous ore for the extraction of copper. These illustrations were used in preference to others, because it is not often that such data are available for tests passing through the stage of laboratory experiments and checked up in practice in a 100-ton furnace. The reviewer thinks that Part I, on roasting, might well have been omitted on the basis that the subject is fully treated in one of several texts that are generally available. Where? With the exception of short references in recent books on the general subject of metallurgy, most of which refer more particularly to roasting for smelting, there is little data in convenient form, on the subject of oxidizing roasting, especially in reference to copper leaching. Kustel's book, published in 1880, is still a valuable one on the subject, but much progress has been made since then. Hofmanns' book on the 'Hydrometallurgy of Silver' contains the best exposition of chloridizing roasting in reference to silver ores, but this is largely confined to his personal experience.

I should like to have given much more space to the important subject of roasting as a preparatory treatment for copper ores, and copper ores containing gold and silver, but this would have gone beyond the limits of what was thought best. Most of the copper ores are sulphides, and my contention is that, as a rule, the best way to treat the sulphides by wet methods is to give the ore a preliminary roast. Any book which did not adequately take into account this important step would certainly be defective. In this respect, 'The Hydrometallurgy of Copper' has followed good precedents, such as Peters' books on copper smelting, Hofman's book on lead smelting, Ingalls' book, the 'Metallurgy of Zinc,' and Hofmann's book on the 'Hydrometallurgy of Silver.' Surely, if these authors have found it necessary to devote a very considerable portion of their treatises to roasting, it would be necessary in a book on the hydrometallurgy of copper in the treatment of sulphide ores, for it is well recognized that there is a wide gulf between roasting for smelting and roasting for subsequent treatment by wet methods.

WM. E. GREENAWALT.

Denver, Colorado, September 19.

[Mr. Greenawalt evidently labors under a common confusion of thought in regard to the essential difference between works of reference and periodical publications. As he remarks, different renderings of the same name can be found in journals, but it does not follow that an author may properly adopt in a work of reference the first form he may chance upon, without any attempt at corroboration. Journals are, except in the case of well known names, dependent upon their correspondents and contributors for accuracy in this regard, and most contributors and correspondents are somewhat careless. Not the least of an editor's tasks is the deciphering of proper names in the manuscripts submitted to him. Errors are not uncommon, and though deplorable, have the excuse that in the preparation of a weekly publication there is no time to carry out an extended search to secure accuracy. But in the preparation of a book, which is presumably to serve for permanent reference, the author owes it to his readers that all the material he presents shall be corroborated before committing it to print. Carelessness in this regard is evidence of hasty preparation and detracts greatly from the value of a book. Mr. Greenawalt cleverly scores a point with the names of MacKay and Baxeres, which form a case in point. Neither name is well known, and the first is given as Mackay in the list of members of the American Institute of Mining Engineers; the second does not there appear and the reviewer had never seen it in print. The effort which Mr. Greenawalt has made to discover the correct rendering (for which we are grateful) is very proper on the part of an author, but an utter impossibility for a reviewer, who is popularly supposed to rarely have time even to read the book under review. If reviewers and editors could be certain that the spelling given in the nearest reference work at hand was correct, their labors would be much facilitated. To condone inaccuracy in books of reference because errors can be found elsewhere is to set up ideals of imperfection. There is a present drift toward books written 'while you wait', which is the reverse of commendable. If an author has "neither the time nor the inclination" to make his book as accurate as possible he should refrain from writing it.

Mr. Greenawalt is conservative in his estimate of the amount of space he has devoted to Cripple Creek ores, since some reference is made either to tellurium or Cripple Creek on 19 of the first 34 pages of his book. It is not unnatural that he should believe that his presentation of the subject of roasting excels that of others, just as many college professors seem to find it necessary to write text-books for their classes. But most metallurgists will find that the elaborate presentation of the chemistry of roasting processes by Plattner, or the more condensed one by Peters in his 'Principles of Copper Smelting,' will amply meet their needs when supplemented by the works on the hydrometallurgy of silver and gold which are readily available. The authors our correspondent cites have discussed roasting at some length because the type of furnace required and methods of work are quite different for zinc, lead, and copper. Even in their case it is a question whether so detailed a treatment is altogether necessary. The output of modern technical literature is so great as to almost overwhelm the professional man, who is correspondingly grateful to authors who eliminate from their productions everything except that which is novel and necessary.—EDITOR.]

In tearing down an old iron blast-furnace, according to W. Heike in *Metallurgie*, a piece of galena weighing several kilograms was found beneath an old sow. The analysis showed lead, 80%; zinc, 3%; sulphur, 8%; there being an excess of metal over sulphur. Under the microscope metallic lead could be seen. Apparently the metallic part was a solid solution of tin in lead, while the sulphide was a solid solution of SnS and PbS. Experiments with artificially prepared material showed a eutectic at 80% ZnS and another at 40% SnS.

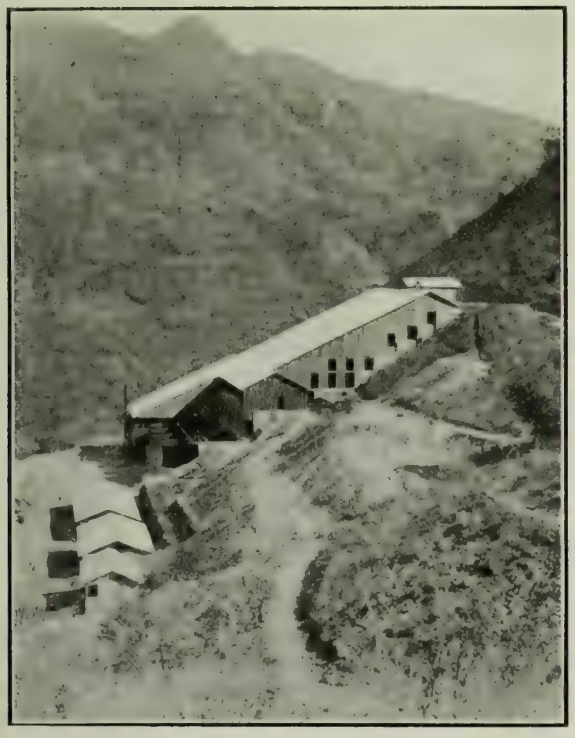
WATER consumed by the twelve mines comprising the Kalgoorlie and Boulder Mines Water Trust, amounted to 29,932,600 gal. in June, a decrease of 3,305,400 gal. compared with the preceding month.

Special Correspondence

MEXICO CITY

REBEL ACTIVITY IN SONORA.—EXPORT TAX ON OIL.—PROGRESS IN HOSTOTIPAQUILLO.

Shifting of the scene of rebel activity from Chihuahua to Sonora has recently caused exciting times at three of the most important American mining districts in that state: namely, Nacozari, El Tigre, and Cananea. El Tigre was captured by rebels, but a little later they were driven out by federal forces, and when they left they took with them bullion valued at $20,000. Federals and volunteer defenders prevented the taking of Nacozari, and plans for an attack on Cananea were not carried out. Americans in Cananea asked for arms and ammunition from the United States, and these were shipped from a Government arsenal. The Nacozari railroad, extending from Douglas to Nacozari, and the Southern Pacific line connecting Cananea and Naco, a border gateway, were cut, and serious interruptions of traffic resulted. However, operations have been continued, and the railroad lines now have been repaired. August was the best month reported



EL FAVOR MILL, HOSTOTIPAQUILLO.

by the Greene-Cananea so far this year, with the exception of April, May, and June, and the September figures are expected to show an increase over the August production of 4,044,000 lb. of copper. For the eight months ending with August, Greene-Cananea reports a production of 30,942,000 lb. of copper, 908,877 oz. of silver, and 4546 oz. of gold. The Moctezuma Copper Co., operating at Nacozari, had a production in the first eight months of this year of 23,056,321 lb. of copper, as against 17,140,003 lb. in the corresponding period of 1911.

Plans for putting into effect the new federal export tax on crude oil were stopped some time ago by an appeal to the Supreme Court of Mexico by the oil producers, headed by the Doheny and Pearson interests. The matter is still pending. The tax would amount to about 10 centavos per barrel, and is held to be excessive at this stage of oil development in Mexico. The Doheny interests estimate that the tax would cost them, at their present rate of export, ₱900,000 per year. The Texas Oil Co. and the East Indian Refining Co., two concerns that are exporting Mexican oil, are reported to have plans for the construction of pipe-lines from the Tampico territory to Texas points. The Doheny interests have entered into a contract with the Peñoles Mining Co., operating the mines and smelter at Mapimi, state of Durango, to furnish oil for fuel. It is expected that about 800,000 bbl. will be required annually.

The Cinco Minas Co., controlled by the Marcus Daly interests of New York, is getting ready for the erection of a 250-ton plant at the old Cinco Minas in the Hostotipaquillo district of Jalisco. Final bids have been received, and it is expected to let the contract within thirty days. Foundation work is in progress, and a surface tramway is being built to carry ore to the mill. A branch transmission line is being completed by the Chapala Hydro-Electric Co. Negotiations for a working bond on the San Pedro Analco mines in the Hostotipaquillo district in favor of the United States Smelting, Refining & Mining Co., which were practically concluded, have been dropped, due to a disagreement as to terms. A 9-kilometre extension of the Southern Pacific line in Jalisco, from Magdalena to La Quemada, which will be of much benefit to many of the Hostotipaquillo district mines, has been completed. Shipments from the El Favor and Mololoa mines of the Makeever interests, in the Hostotipaquillo district, continue. From eight to ten carloads of El Favor ore, ranging in value from ₱3000 to ₱3500 per car, are sent to the smelter monthly. Only enough Mololoa ore to cover development expenses is being shipped at present.

NEW YORK

THE COPPER SITUATION.—ANACONDA DIVIDENDS.—THE MEXICAN SITUATION.

The copper situation is as involved as it was a fortnight ago. Copper sales, both for export and for home consumption, are said to justify further advances in price, and 20-cent copper is apparently a certainty in the very near future. Sales are now being made for January, February, and March delivery. The engaging of copper for next year's delivery is considered a healthy sign, indicating that consumers are no longer fighting the advance in the market. A sale made by the United Metals Selling Co. for the account of the Copper Range, at 18.10c., attracted much attention. The sale was for immediate delivery and amounted to over 40,000 lb. The strike situation at the Utah Copper plant has had more effect on the metal market than on the shares of the company. None of the Guggenheim group have suffered by reason of the labor trouble, though despatches have indicated the possibility of the spread of trouble to Ely, Nevada.

As has been predicted for some weeks, the directors of the Anaconda Copper Co. ordered an increase in the dividend from 50c. per share to 75c. per share. Anaconda has paid a total of 134% in dividends: in 1900 and 1901, 13% per year; in 1902, 1903, 1904, 4%; in 1905, 11½%; in 1906, 19½%; in 1907, 26%; in 1908, 1909, 1910, 1911, 8%; and in 1912, so far, 7%. The chief interest in the Anaconda dividend is the possible action of the Amalgamated, which will receive from the current disbursement of Anaconda some $2,338,000. It is undoubtedly the intention to make Amalgamated sell at par, and it is fairly safe to predict an increase in the dividend when the directors meet in October.

The 'atmosphere' of the New York Stock Exchange is hostile to mining ventures. Goldfield Consolidated lost a great part of its following when it 'went inside', and it is stated that steps are now being taken for withdrawing the shares from the Stock Exchange list. The Guggenheim enterprises are mostly listed on the Exchange, but it is probably a fact that they were more active when traded in on the Curb. Ray and Chino have evidently been in course of distribution, and are not yet as fully into the hands of the public as is desired. Both are to be important factors. Ray is conceded to be second in magnitude only to Utah Copper, while Chino will un-

doubtedly usurp the place of Nevada Consolidated as the cheapest large producer. Six-cent copper at the rate of three million pounds per month goes a good way toward justifying some of the things Lawson said about this property just before and just after the formation of the Chino Copper Company.

Conditions in Mexico are adding strength to the copper market in forcibly curtailing some production. The Phelps-Dodge company has been unable to make any September shipments from Nacozari, and the Douglas smelter output for September will show a consequent shrinkage of some 31,000,000 lb. Cananea is in better shape and shipments have been resumed. The Miami ores go to Cananea, and the smelter output is something like 7,000,000 lb. per month. W. H. Paul, manager of the Dolores, in Chihuahua, now controlled by the Mines Company of America, has just come from Mexico to attend the annual meeting of the company. He says that conditions are nearer to anarchy than at any time since the overthrow of Diaz, the chief trouble being that Madero's army is hardly lukewarm in its loyalty and makes no real effort to put an end to the revolution. Mr. Paul says further that intervention is the only solution, but that the policing of the country would be a staggering task, especially as all factions would unite and fight fanatically against the United States. One interesting angle to which Mr. Paul directs attention is the fact that Germans and Englishmen who from time to time are treated as was Mr. Paul, whose company was pillaged to the extent of $50,000 or more, are simply waiting to present a bill for damages to the the United States, on the ground that owing to the Monroe Doctrine neither England nor Germany is allowed to protect its citizens, and the United States must assume responsibility for damages incurred.

BUTTE, MONTANA

PROGRESS AT BUTTE & SUPERIOR—BULLWHACKER LEACHING PLANT—GLENGARRY CHANGES HANDS.

The work of the Butte & Superior Copper Co. is the most important feature of Butte these days. Besides the importance of the zinc ore developed, the concentrating methods employed are new in several respects. The oil flotation section of the concentrator is working satisfactorily, but many changes and experiments are being carried out with the jigs and tables. At present the mill is averaging about 400 tons per day, practically all coming from the stock pile accumulated by the mine in past months.

The Chicago, Milwaukee & Puget Sound railway has begun the construction of its own tracks through Durant canyon. This will relieve the traffic pressure on the Butte, Anaconda & Pacific track, which is now being used by both roads, causing considerable inconvenience. Patrick Clark, of Spokane, president of the Bullwhacker Copper Co., says that a 50-ton leaching plant will be at once constructed on the property. If the leaching of copper silicate ores proves a success, the plant will be enlarged to 300 tons daily capacity.

The Tuolumne Copper Co. is sinking its shaft to the 2400-ft. level. This expense, together with lean ground found on the lowest levels, has decided the company to discontinue dividends for the remainder of the year at least. The Glengarry mine, in the southeastern part of Butte, has been purchased from the Glengarry Silver Mining Co. by F. M. Bell & Co., local mining brokers. The consideration is said to be $100,000. The Glengarry was a famous silver producer in early days.

Churn-drilling of the dredging ground on Trout creek, in Missoula county, has been in progress during the past season. It is stated that the results were satisfactory. The Stoney Creek Coal Co. is preparing to ship coal from its property near Soudan. In the Bald Mountain mine, in Lewis and Clark county, belonging to Thomas Cruse of Helena, rich ore has been found at a depth of 800 ft. The 20-stamp mill and cyanide plant is running full capacity and turning out about $10,000 per week.

Eastern investors have bonded the Blowout property at Rochester, in Madison county. Machinery will be provided to sink a shaft 500 ft. in search of copper ore. The Butte-Alex Scott Copper Mining Co., owner of the Alex Scott mine in Butte, has purchased the Moffat copper property in Bear gulch. This property is on a contact between granite and limestone, and has considerable development work. The new owners expect to begin operations immediately. The Boston & Corbin Copper & Silver Mining Co. expects to have its 200-ton concentrator, in Jefferson county, completed and in operation by next February. The copper occurs chiefly as chalcopyrite. The Montana Pulp & Paper Co. is to erect a paper mill at the mouth of the Yakt river in Lincoln county. The capacity of the plant will be 60 tons per day. This will create a market for magnesite and other non-metallic minerals used as fillers in paper manufacture.

BOSTON

FAILURE OF DOW & CO.—AMSTER'S RETURN.—EXPANSION OF BUTTE & SUPERIOR.

The suspension of the firm of Stephen R. Dow & Co. from the Stock Exchange, and Mr. Dow's assignment to F. H. Williams, came as a surprise to Boston, though it was known that Dow was embarrassed, and had in fact been embarrassed for over a year. In August 1911 a crash came in the Dow stocks, but the firm was saved then from an assignment through various Stock Exchange houses subscribing to a fund which took care of its bank collateral, making an orderly liquidation possible. Mr. Dow's suspension and assignment affect a number of Lake companies and also the Corbin Copper Co., in the Corbin district, Montana. Richard M. Edwards, of Houghton, Michigan, who has been acting as president, was made Mr. Dow's successor as president of the Franklin, Indiana, North Lake, and Algomah copper companies. Since the first announcement the failure has taken on a more serious aspect. It is found that Dow & Co. owed North Lake $157,000, Franklin $80,000, Algomah $28,000, and North Lake $157,000, a total of $297,000 indebtedness to these four Lake companies. Franklin has already asked for an assessment of $2 per share and Indiana for $1 per share. North Lake and Algomah will find it necessary to call assessments also, but have deferred the matter for the present. The directors of Franklin and Indiana, in their statement to the stockholders, say that the notes of $80,000 and $32,000, respectively, due these companies represent loans made by the treasurer, authorized by Stephen R. Dow, and without the knowledge of the board of directors. North Lake and Algomah are doing but little development work at present, but Indiana has a shaft 1100 ft. deep, with some 300 ft. more to go to reach the depth at which copper was found in the No. 2 drill-hole. Franklin is the only producing property in the Dow group, having, it is said, just reached the point where it is operating at profit. The Dow failure is a bad one, and will have a very depressing effect on many of the Lake shares for some time to come. The Corbin Copper Co. was not involved in the Dow troubles, as the company itself is a borrower. A little over a year ago, when the Dow difficulties first developed, the firm owed $625,000 to the banks, having $620,000 up in collateral. At that time a committee of bankers took over the liquidation of the loans, which has been accomplished, it is said, except about $100,000, which is said to be fully secured. Dow had too many irons in the fire and was too risky a market plunger.

N. L. Amster, whose failure took place two years ago, is now recouping his fortunes very satisfactorily, it is said. His new purchase, the R. R. R. mine, near Patagonia, Arizona, has proved to be a winner, as the company is shipping regularly to the El Paso smelter. Mr. Amster has recently acquired other mining properties in the Southwest and appears determined to reinstate him-

self as a factor in the Boston copper market. He is an able technical manager, and assisted the Anaconda people in the early days in doing the deep development work which resulted in starting that company off on its remarkable career as a copper producer.

The stockholders of the Butte & Superior have authorized the proposed increase in capital stock from 250,000 to 350,000 shares, par value $10. This increase is for the purpose of exploring properties under option and to provide funds in a measure for exercising options where it is found desirable to do so. Shareholders are offered 30,000 shares for subscription at $37.50 in the ratio of one share for each eight shares held. Payments are to be made in two instalments, $15 per share on October 15 and $22.50 December 14. A. B. Wolvin, president of the Butte & Superior, has taken under option fifteen additional mining claims lying north of Butte & Superior ground. The transaction involves $535,945, on which a preliminary payment of $50,000 has been made. These claims include the Blaine, $40,000; Robert Smith, $60,000; William J. Bryan, $35,000; Stonewall, $60,000; Sunday, $12,000; Lillie H., $18,000; North Butte, $18,000; Ella Curtis, $18,000; Arctic, $60,000; Sarah Alice, $30,000; Washington, $33,500; Peoria, $20,000; Christie, $50,000, and Copper King, $29,465. These claims are in addition to about 20 which were previously taken under option for Butte & Superior interests. It should be pointed out that this ground a few years ago was considered worthless, being thought to lie outside of the ore-bearing boundaries of Butte. It is said that properties are being optioned and prospecting is being done 2½ miles north of the Speculator mine, or North Butte, which was once considered to be outside the mineralized zone.

TORONTO, CANADA

Activity in Silver Mining.—Copper from Cobalt.—Kerr Lake Statement.

Cobalt has been prominent lately owing to the marked revival of activity in the silver industry and the reopening of many old mines under the stimulus of the increased price of silver. The Nipissing has declared its regular quarterly 5% dividend and 2½% bonus, and presented a statement showing cash, bullion, and ore on hand to the value of $1,368,876. The company has so far spent $250,000 on the new low-grade mill out of this year's earnings, and the expectation is that it will be completed in November, after which the company will only ship bullion. There are 600 men and 50 drills at work. In the Meyer drift, at the 250-ft. level, an orebody several hundred feet long has been found which shows 4 in. of rich ore in addition to abundant milling ore. The 4th of July vein is yielding rich ore at a depth of 200 ft. La Rose stock keeps falling, owing to heavy selling supposed to be by insiders. The usual quarterly dividend of 2½% has been declared, but there is apprehension that it will not be maintained, as the 'silver sidewalk' of the Lawson property is gone and development at depth on that location has been disappointing. The company is developing the Fisher-Epplitt at a depth of 200 ft. and the Violet at 100 ft., and it is hoped that the results may be of a reassuring character. The 10-stamp mill that has been installed on the Casey-Cobalt will begin operations in a few days.

The Cobalt Lake appears likely to 'make good' before long. It produced 100,000 oz. of silver in July and a like amount in August, and the output for September will be about 120,000 oz. It is yielding ore from five good veins at the 220-ft. level. The Cobalt Central shipped this week a car of concentrate and high-grade ore, being the second since operations were resumed on the property. The Timiskaming has the deepest working in Cobalt, having started cross-cutting to tap No. 3 vein on the 650-ft. level. This vein yielded well at a depth of 575 ft. The formation at the lower level remains unchanged. The company recently sent 30 tons to the smelter at Denver and was surprised to receive a payment of $5 per ton for the copper contained in the ore, which is the first time that this constituent of the Cobalt ores has been paid for. The Silver Queen has been leased by the Cobalt Aladdin company, in which British capital is interested, and is being unwatered. The Cobalt townsite has undertaken the exploration of the portion of its property which underlies the tailing pond of the Northern Customs concentrator. The Waldman has been taken over on option by W. L. Malcolmson of London, on behalf of a British syndicate. The Beaver company is diamond-drilling on the Erie property underlying Kirk Lake, which it recently purchased.

The annual statement of Kerr Lake for the year ended August 31 shows a total income of $1,044,418 and expenses of $275,242. Dividends of $762,000 were paid, leaving $7179, which added to the previous surplus of $709,817 leaves a balance of $716,993. The gross production was 1,855,494 oz. of silver, as against $2,388,420 for the previous year, and the cost of production was 18.30c. per ounce, as against 14.69c. the previous year. The estimated ore reserve was 6,690,091 oz. W. G. Nickerson, of Boston, has been elected president in place of Julius A. Lewisohn. The Trethewey has issued a statement for the first seven months of the year showing a production of 389,000 oz., valued at $207,605; operating expenses and costs, $106,311; leaving a profit of $101,294.

RHODESIA

Gold Output for July.—New Mines Producing.—Promising Discoveries.

The July gold output of Southern Rhodesia was 57,122 oz. fine gold, valued at £240,514; an increase of 3248 oz., worth £13,647, over the preceding month. This is the third largest Rhodesian output and, coming at this time, is especially encouraging. Despite the prevailing drought, mining in Rhodesia is maintaining the rate of progress in production and development shown in the earlier months

WANDERER MINE, SELUKWE.

of the year. During June there were 168 producers, but the value of the gold output (£226,867) was slightly less than in May. In addition to the 53,875 oz. of gold produced, 16,014 oz. of silver was recovered, also 58 tons of lead, 16,539 tons of coal, and 6160 tons of chrome iron ore. On the whole, the mineral production for June was in excess of that announced by the Chamber of Mines for May.

The Shamva will be crushing at the rate of 40,000 tons per month in about 12 months time, and the Cam & Motor (which is now reported to have come under the Abe Bailey group control) will be milling on a fairly large scale by then. This latter property is stated to be in an excellent state of development, having about a million tons of 10-dwt. ore. Other mines which will enter the productive list soon are the Falcon and the Antelope. The former is a gold-copper property in the Blinkwater district and is being equipped on a 15,000 tons per month basis. The Antelope is situated to the southwest of Bulawayo, in a dry and arid part of Matabeleland. The property is therefore being equipped with a dry-crushing plant of about 4000 tons per month capacity.

A number of smaller concerns are in a fairly advanced state of development and may be expected to help swell the output within the next month or two. Several mines are increasing their reduction plants, the Bushtick in the Essexvale district, for example. Important discoveries have been announced within the past week or two. Rich specimens have been brought into Salisbury from Lomagundi district, and it is claimed that a second 'Eldorado' has been found near the Ayrshire mine on the road to Sepolilo. In the Hartley area a large quartz deposit has been located. While little value can be attached to some of the reports which are being circulated, there seems no doubt that something of importance has been found, and further developments will be awaited with much interest. The native labor situation continues to cause anxiety. The number of natives employed in May showed a decrease of 4102 as compared with May 1911. The distribution during the month of April was: producing gold mines, 23,342; non-producing gold mines, 13,279; coal and other mines, 1124. The average number of natives employed on the mines for the first five months of the current year has been 35,786, or 3000 less than for the corresponding period of 1911. Colonel Heyman, however, presiding at the Chamber of Mines meeting recently, spoke most hopefully of the general outlook and anticipated an improvement in the unskilled labor position in the near future.

JOHANNESBURG, TRANSVAAL

Diamond Mining Prosperous.—Output for the Year.—Transvaal Mines.

Diamond mining in South Africa is prosperous just now, the demand for diamonds from all the old markets being brisk, while India has of late become a considerable buyer. In consequence prices are advancing, and in the fields more activity is being displayed, especially in prospecting operations. The total yield of diamonds in South Africa during 1911 was 4,891,998 carats, valued at £8,746,724, the average price per carat being 35s. The figures for the first six months of the present year have appeared, and form some interesting reading. They show the output to have been 2,392,255 carats and the estimated value £4,541,451. The production is somewhat less than anticipated, but the value shows an appreciation from an average of 35s. per carat from the whole of 1911 to nearly 38s. per carat for the first half of the present year. The Orange Free State possesses nine producing mines, several small mines having recently been started, but the total output of the Free State mines is only about equal in weight to one-half the output of the single diamond mine in the Transvaal. The value of the Free State diamond output is, however, practically equal to that of the Transvaal, the stones averaging nearly double the value per carat as compared with those of the Premier mine in the Transvaal. Of course, the principal centre of diamond mining in South Africa is Kimberley, where the De Beers mine produces about two-thirds of the value of the whole diamond output of South Africa, but probably less than one-half the number of carats. In the matter of output the Kimberley mines are being closely approached by the Premier mine in the Transvaal. There are only 17 producing diamond mines in the Union of South Africa, and their combined output will for the present year closely approach, if it does not exceed, a value of £10,000,000, of which more than one-half will come from Kimberley alone. Nine of these mines are in the Orange Free State, seven in the Cape province, and only one, the Premier mine, in the Transvaal. There have been strenuous efforts made of late to raise working capital for several worthless diamond-mining ventures at Rayton in the Transvaal, not far from the celebrated Premier mine. These are mainly resuscitated prospects, such as the Montrose and Schuller mines, which in the past, after lengthy trials, have proved worthless, and it is at least doubtful if they can now be made profitable.

MELBOURNE, AUSTRALIA

New Broken Hill Railway.—Australian Labor Ideals.—Proposed Tasmanian Amalgamation.

The most important news of the month has been the announcement that the Public Works Committee has reported to the New South Wales Parliament in favor of the construction of a railway line from Condobolin to Broken Hill. This will be an extension of the main western line of the state, which runs from Sydney through Lithgow to Bathurst, and Blayney to Condobolin. This line will need to be extended some 373 miles to bring it to the great silver-lead-zinc centre, and the result should be of the utmost importance. Hitherto, although the field is situated in New South Wales, its output has had to make its way to a South Australian port, there being direct railway connection between Broken Hill and Adelaide, but none with Sydney save by the long roundabout route through Adelaide and Melbourne. Even when the proposed line is completed, it is not to be expected that Sydney will displace Adelaide as the port and the field, since the distance from the silver-lead city to the New South Wales capital will be about 700 miles as compared with a short run of only 334 miles to the South Australian metropolis. Why, then, should the line be regarded as of such great importance? The chief reason is that the Sydney-Condobolin line, with which Broken Hill is to be connected, passes through the western coalfield of New South Wales, a field of which Lithgow is the centre. Here is an abundance of coal of the highest quality, and there are also large deposits of ironstone and limestone. The annual consumption of coal on the 'Barrier' (as the Broken Hill field is still called in many quarters) is set down at 180,000 tons, and the New South Wales railway department expects that some of this will be taken from Lithgow once connection has been established. There is also the possibility of establishing a zinc industry at Lithgow, and if that comes about, there should be a heavy freight traffic from the Barrier to Lithgow, as well as from Lithgow to the Barrier. But there is also another aspect of the railway, which is of great consequence, not to Broken Hill merely, or even to the state of New South Wales alone, but to the whole of the progressive portion of the continent, since it will shorten by 24 hours the journey from Fremantle in the far west to Sydney.

The extraordinary attitude adopted by the Australian 'worker' toward work was illustrated last week in a speech made by the secretary of the Woodworkers Union at Melbourne. Solemnly and seriously this gentleman argued in favor of 'loafing', which he described as the ambition of every man who wishes to get on. W. Curtain justified the workmen in taking six weeks to do five weeks work, on the ground that by so doing they were saving men from unemployment. He did not, however, urge that for the five weeks work in six weeks, they should receive only five weeks pay. That is not a part of his creed.

An important amalgamation of Tasmanian mining interests is contemplated, the companies concerned being the Hercules, Primrose, and the Tasmanian Smelting Co. At present there is a keen struggle proceeding in the Hercules company, one group of shareholders being anxious to bring about the amalgamation, and a majority of the directors being opposed to it. There are two processes involved, those in favor of the amalgamation desiring the employment of the Oker process, through the medium of the Tasmanian Smelting Co., which is largely in the hands of the Bank, and those opposed to it desiring that the process adopted should be that which the Metals Extraction Co. of London has prated about for some years past but never done anything with. It seems likely that the amalgamation will gain the day, but even then they will have several stiff problems before them. Whether the Papa (Oker) process can be made to pay in Tasmania as it pays in Germany is a matter of grave doubt, and whether it will satisfactorily treat the ores of the district concerned on a large scale is also not proved.

General Mining News

ALASKA

Cordova

An automobile factory at Seattle designs and manufactures special cars for Alaska. The Burch auto-sleigh is equipped on the front with runners and at the rear with a pair of large disc screws in place of rear wheels and propelling device. The machine will be made suitable for towing freight in sleds.

Fairbanks

There will be 16 stamp-mills, with 60 stamps, in the Fairbanks district this fall. Cleary creek will have the most mills, as the district between Fairbanks creek and Cleary was the scene of the first quartz development and is much further advanced than others. There have been a number of hold-ups and robberies of sluice-boxes of late, and trouble is promised the offenders, if caught. There has been a fair at Tanana which had exhibits of all descriptions, the mineral section being under the supervision of J. M. Drury, who also lent his private collection.

Juneau

During August the 240 and 300-stamp mills at the Alaska Treadwell mine worked 28.15 and 30.68 days, crushing 31,080 and 51,716 tons, respectively. The yield from free gold was worth $104,953, and from 1633 tons of concentrate $94,386, making a total of $199,399. Operating expenses amounted to $79,596, and construction $40,871, leaving the estimated net profit at $76,879, the realizable value of the yield being $197,346. Development covered 1047

Chichagof Mine and Mill Golden Gate Mine and Mill

KLAG BAY MINES AND MILLS, NEAR SITKA, ALASKA.

ft., and the stock of broken ore decreased by 30,271 tons.

The 120-stamp mill at the Alaska Mexican worked 30.70 days and crushed 20,643 tons of ore yielding free gold worth $29,086, and $33,309 from 413 tons of concentrate, the realizable value of the total being $61,771. Operating expenses were $28,045, and construction $11,281, leaving an estimated profit of $22,444. Development covered 299 ft., and the stock of broken ore increased 7990 tons.

Valdez

After a four-days trial, L. Gorman was found guilty of stealing $29,000 worth of gold-dust from the Flat creek claim. The second trial of Bronson has begun. Mt. Wrangell, the best-known active volcano in Alaska, is again in eruption and throwing out volumes of smoke and lava. There are now at least seven vents, and with field-glasses lava may be seen coming from these openings and flowing across the glaciers. This is believed to be the cause of high water in the streams draining that district. From Kotsina it is reported that sulphur fume is so strong as to drive prospectors away from claims near Kotsina glacier.

ARIZONA

Cochise County

Negotiations are under way for the transfer of the World's Fair mine, in the Patagonia district, from F. Powers to the Copper Queen company; the purchase price is said to be about $800,000. This district was one of the earliest opened in Arizona, the ores carrying silver. The World's Fair mine is 600 ft. deep. The R. R. R. mine, adjoining, is shipping 50 tons of copper ore per day to Douglas. There are a number of abandoned plants in the Patagonia and Harshaw districts. Owing to railroad communication being stopped, transport of concentrate to smelters has been delayed, and the Copper Queen company has shut down two reverberatory furnaces. This company is to erect a new hoist at the Sacramento, and a change-room at the Uncle Sam. A big mining suit is being heard at Tombstone. The infant heirs of P. Cunningham, through their guardian, E. Marks, are suing the estate of M. Costello for a half interest in 17 claims which sold for $962,000 several weeks ago. Cunningham and Costello were old-timers in Arizona, and a partnership is alleged to have existed.

An examination of the metal contents of the porphyry formations of the district is now taking place at the Sacramento workings of the Copper Queen company. Results are being studied with interest. Orebodies at Bisbee have often been found between lime and porphyry, and it has been customary to look for them at such contacts.

Gila County

(Special Correspondence.)—About 75 men are employed at the Superior & Boston mine, and ore shipments, mostly from the Limestone vein, are being made to the Old Dominion smelter. At the Arizona Commercial mine the steel head-frame has been moved from the Eureka to the Copper Hill shaft. The shaft is being enlarged and retimbered. The Inspiration company has started a new inclined shaft which will connect with the main adit and will be used for lowering men and timber below the adit level. No. 1 shaft at the Live Oak mine is 575 ft. deep. No. 3 churn-drill hole at the South Live Oak has been stopped at 945-ft. depth, and is reported to have passed through 65 ft. of 2% copper ore. No. 7 and 8 drill-holes at the Southwestern Miami are 1206 and 910 ft. deep, respectively, in chalcocite-bearing schist.

Globe, September 26.

The Douglas Copper company, which owns 15 claims in the Ray district, is pushing work at its new shaft. At 40-ft. depth similar ore to that found in the Magma at 400 ft. was taken out. The Calumet & Arizona recently bought the property of the Consolidated Holdings & Trust Co., adjoining the Douglas claims. The American Smelting & Refining Co. now has control of the Lake Superior & Arizona group, and a smelter may be erected. A great area of country between Ray and Superior is either under option to or has been bought by large copper companies.

Railroad connection having been restored, it is stated that the Miami company has resumed shipments to the Greene-Cananea smelter. The mill has been making a recovery of 70.5% of late, and the September production should be about 3,000,000 lb. of copper. The Old Dominion is running four furnaces and employs 1200 men. The so-called east orebody has been cut on the No. 16 level and assays 16% copper.

Greenlee County

The Detroit Copper Co. has a large number of men working on its power plant. The Arizona Copper Co.'s new steel and concrete warehouse, to replace the one destroyed by fire some time ago, is well under way.

Maricopa County

The Swansea smelter people have been examining the Wickenburg district for sulphide ores for their plant, which is handling 450 tons per day, but its capacity is 750 tons. A reverberatory furnace is also being installed.

Navajo County

Mining men interested in the Arizona-Belmont mine have just inspected the property at Silver Bell. The main shaft is down 350 ft., and the ore carries 13% lead and

20 oz. of silver per ton. On the fourth level the vein is opening well in shipping ore. It is intended to increase the number of men, sink the shaft to 500 ft., and probably erect a 100-ton mill at an early date.

YAVAPAI COUNTY

Two hundred tons of the so-called onyx at the Mayer quarries is being shipped to the Swansea smelter for fluxing, and if suitable the smelter may require 2000 tons per month. This rock carries a high percentage of lime. The Pocahontas company has developed good ore carrying gold and silver, a short distance from the old shoot which yielded high-grade silver ore. A hoist is to be erected, and the mill shifted near the mine. The Climax company will drive its new plant with electric power. The Harmony group of claims, in the Copper Basin district, is to be explored by drilling as well as by shafts.

YUMA COUNTY

Work has been started at the Arizona-Empire mine, and about 30 miners will be employed. High-grade ore, carrying 20% copper, is being sacked and hauled to Parker for shipment to smelters. Roads are being put in order for the use of auto trucks carrying ore from the mine to Parker.

CALIFORNIA

KERN COUNTY

Work is being done at the 235-ft. level of the Merced mine, in the Stringer desert district. The vein is 12 in. wide, and 25 tons of high-grade ore is being hauled to the Sunshine mill. At the Red Dog mill, the Santa Ana property cleaned up $5600 from 59 tons of ore.

PLACER COUNTY

The Bay company is building a dredge to work the gravel on the Freeman ranch, between Rocklin and Loomis. The Beaver Dredge Co. is taking out good gravel on the flat at the Captain Hawk ranch. The Barton gravel mine has been leased, and the Lost Camp property is to be sold.

The dredge at the Cash Rock, on the Middle Fork, is still handling profitable gravel, although part of it has previously been worked. All the lumber for the new dredge at Poverty Bar has been hauled, and building will soon commence. Moss and Young, after sinking 80 ft., have found rich gravel on the channel between Succor flat and Indian canyon. It runs as high as $16 per car. The channel is drained through Watts adit. A new adit is to be driven 350 ft. at the Buckeye, and will open the mine 15 ft. below the channel. The Sierra Nevada Development Co. is employing a fair number of men on Ralston divide. It is developing the Pat Goggins mine, which is still profitable. Last year $17,000 worth of gold was recovered. The Red Star mine is also being opened, and a 150-ft. adit and cross-cuts have been driven. The gravel is of a chocolate color, and is rich. The contact on the east is granite.

PLUMAS COUNTY

Extensive improvements are being made at the claim of the Gold Mountain Hydraulic & Dredging Co. on Willow creek near Bucks ranch. Mr. Fagg is in charge.

SHASTA COUNTY

The Riley-Bliss property, situated eight miles west of Kennett, has been leased for six months to C. Kunze. For the past 17 years the mine has been idle. At one time a 10-stamp mill crushed high-grade ore. Over 2000 ft. of development has been done. The main adit has a depth of 300 ft. from the surface, and has 4 ft. of ore in the face. The adit will be extended and ore sent to the Mammoth smelter, seven miles by road. The old stamp-mill is past repair.

SIERRA COUNTY

Due to the good showing at the Sierra del Oro mine, a good deal of attention is being given to what is termed the 'old Ironsides gold-bearing slate belt,' lying between the Sierra Buttes and the Alleghany-Downieville serpentine lodes. This belt has a width of from three to eight miles, and extends north and south for about 20 miles. In Nevada county its richness has been amply proved. At the Sierra del Oro the results of driving the adit to get under old workings are being watched. The adit at the Bigelow quartz mine has been cleaned out, and the property examined.

At Forest, last week, 42 horses hauling mining machinery and other goods, passed through the town on one day, an unusual sight. A locomotive which used to haul gravel trains at the old Bald Mountain and Union Blue mines, at North Bloomfield, is being installed at the North Fork for the same purpose. The Wisconsin claim will be worked through the North Fork. G. F. Stone is superintendent.

Electric power will be used at the Quicksilver mine, near Alleghany. Arrangements have been made with the Middle Yuba Hydro-Electric Co. to construct a power line. Plant driven by motors has been ordered from New York and San Francisco. The mine will be unwatered and opened. At present the mill contains three stamps, but it will be enlarged. Ore 4 ft. wide has been cut by J. J. Guentherodt at the Thunderbolt claim, and San Francisco men have taken an option on it. The adit at the Steamboat gravel mine, above Poker Flat, is in 550 ft., in hard rock. A raise is being driven from the end of the adit. The Kenton mill had a short run, and is shut down for a few repairs. T. B. Garnier is in charge. An electric hoist is to be installed at the Bear Creek quartz mine, at American hill, and the shaft will be sunk deeper. Later on, the company may have to drive an adit in from the Middle Yuba slope of the hill, a length of 3000 ft., before reaching ore.

COLORADO

CLEAR CREEK COUNTY

The orebodies at the Mendota are improving, and the mill is working steadily. The Mineral Chief mill is now treating ore from veins which have been opened during the summer, and is producing a good grade of zinc and lead. J. Hurley and B. O. Banner, lessees on the Harris lode, in East Argentine, have cut 14 to 18 in. of rich silver ore. The drill working from the top of Griffith mountain to connect with the Capital workings has been delayed for three weeks on account of the bit getting stuck at 600-ft. depth.

A number of lessees at the Gambetta property, on Republican mountain, are making shipments of high-grade zinc ore. Cunningham and O'Connell have a lode 4 ft. wide of good ore. A concentrating plant on the property, which is owned by the Joplin Mining Co., is proposed. Ore from the Boston mine, on Democrat mountain, is sent down by train to the mill-bins, then hauled to the Linn mill for concentration. The new assay office at the Capital mine is finished, and a branch from the Colorado & Southern railroad has been put in to the mill. Two cars of lead ore were shipped last week from the Santiago mine to the Salida smelter. The long drift at the Centennial mine shows 6 ft. of ore.

DENVER COUNTY

The Colorado zinc works was destroyed by fire on September 28, entailing a loss of about $250,000, being uninsured. The building was a heavy frame structure of two stories, 60 by 200 ft., covered with corrugated iron, and had been there for 17 years. The plant was closed about 18 months ago, but used to concentrate zinc ores from the big mines at Leadville and Breckenridge, and employed from 25 to 50 men in treating 200 tons per day. The plant was owned by the Randolph Guggenheim estate, of New York.

LAKE COUNTY (LEADVILLE)

The Anderson adit, being driven from the Birdseye side into Prospect mountain, is in 635 ft., but no large orebody has been found, although several veins have been passed through. At the Mt. Champion, 40 men are working at the mine and mill, and the latter will be ready during the week. The mine is in good shape; on three levels the vein

is from 54 to 72 in. wide, worth $12 per ton. The La Platte, lessees at the old Lime adit, Jonny, Forfeit, and Dome are all shipping regular lots of carbonate of zinc.

San Miguel County

During August the Tomboy mill treated 9500 tons of ore, which yielded $33,500 in bullion and $57,000 in the concentrate, a total of $90,500. Operating expenses were $46,500, and other $10,345, leaving a profit of $33,655.

Teller County (Cripple Creek)

Work at the new electric pumps on the 1600-ft. level at the Golden Cycle shaft, has been delayed several times on account of flooding of the level. The frame of the foundations is in place, and it is hoped to fill in the concrete at once. Negotiations are said to be under way for leasing the Homestake mill, owned by the Rex company. The output of the district for the past eight months of the current year was $9,640,000. Gas has been troublesome in the mines along the eastern side of Beacon hill, and the western end of Raven hill, of late, and is attributed to the indifferent weather. Ore has been opened a length of 65 ft., and 5 ft. wide, on No. 7 level of the main shaft, at a point 400 ft. west of the Nichols shaft, at the El Paso mine. As broken out, the basalt ore will average $65 per ton. This orebody is a new one, and is south of the main or C. K. & N. vein. .

IDAHO

Shoshone County

At the election of officers of the Stewart Mining Co., held at Butte, E. Hickey was elected president, and E. H. Wilson, also of Butte, vice-president. W. Beaudry, of Kellogg, was appointed superintendent; M. W. Bacon, general manager; and R. A. Carnochan, treasurer. The Surprise and Highland Chief properties, now under one management, will use water power for all purposes. About 200-ft. head can be had, and water is said to be ample throughout the year. The Blaine & Emmett company has opened some promising veins which contain gold, silver, copper, and lead, by means of open-cuts and shallow adits. An adit is being driven to cut the ore at depth. The Sabina Mining & Milling Co. has been incorporated, and will prospect four claims situated at the Summit. E. J. Duff is president and manager. On October 4 the Bunker Hill & Sullivan company will pay dividend No. 181, amounting to $65,400, making the total to date $13,780,950.

MONTANA

Silverbow County

(Special Correspondence.)—Before long it is expected that the companies operating in the district will discontinue Sunday work, as enough ore can be mined and hoisted in six days to keep the smelters at Anaconda and Great Falls going for seven. Owing to hard ground, slow progress is being made in cutting through from the Gagnon to the Davis-Daly. So far about 700 ft. has been finished out of a total of 1600 ft., and it will take about 150 days to get through. This connection is for the purpose of getting under the rich orebody which is thought to be in the Silver King at depth. The Barnes-King has 25 men at work; the shaft was found in good order, and work is being pushed to make connection with the orebody in the North Moccasin. The Kendall Electric Co. will supply all the power needed. J. D. Ryan has been inspecting the Amalgamated company's properties, and appeared to be quite satisfied with the general appearance of the mines. The extension of the Butte, Anaconda & Pacific railroad will be finished to Georgetown by November 1. At the Southern Cross mine 35 men are busy enlarging the shaft to 300 ft., when it will be sunk a further 200 ft. Unless a settlement is soon brought about, it is likely that a big lawsuit will take place, involving property in the northern district and in the vicinity of Butte & Superior. The case is somewhat complex. T. F. Cole and associates have several properties under option, east of the Butte & Superior, and adjoining the Butte & London, and are said to be preparing to float another large Butte company, in connection with which they have taken control of the Butte & London Development Company.

Butte, October 1.

NEVADA

Churchill County

During August the Nevada Hills company treated 3386 tons of ore yielding bullion worth $86,678, with an extraction of 93.3%. The month's profit was $53,338. Recovery from concentration was 26.9%, and from cyanide treatment 66.4%, while the total cost was $9.85 per ton.

Esmeralda County

The Southwestern Mines Co. has completed the deal whereby it now owns the Great Western company's property at Hornsilver. In a cross-cut from the west drift on the 800-ft. level at the Jumbo Extension, not far from the boundary line of the Clermont claim of the Consolidated, a new orebody of good grade has been opened. The drift between the 800 and 900-ft. levels, east toward the Velvet claim of the Merger is all in ore, 24 in. of which is worth over $100 per ton. The Florence-Goldfield company is shipping high-grade ore again, which is coming from an intermediate drift between the 250 and 350-ft. levels, 800 ft. north of the shaft. The Yellow Tiger company is to be reorganized, and the capital may be increased from $2,000,000 to $4,500,000.

Humboldt County

Twenty-four lessees are working at the Seven Troughs property, mining about seven tons of fairly low-grade ore daily. On the 52-ft. level, the south drift is in 215 ft., with 18 to 24 in. of ore averaging under $20 per ton; a south drift on the 110-ft. level is being started on the silver vein; from the 300-ft. level north the best ore is being mined; on and above the 230-ft. level, there is 12 in. of quartz worth about $20 per ton; the 300-ft. level has been stoped within 20 ft. of the 230-ft. level; and a good deal of ore is being stoped from between the 600 and 700-ft. levels.

Lyon County

Within the next 30 to 60 days, the Nevada-Douglas company hopes to increase its ore shipments to 500 to 700 tons per day, instead of the present 300 to 400 tons. The 900-ton furnace of the Mason Valley company, at Thompson, has been blown in; and the other furnace will be overhauled and enlarged, making the plant capacity of 2000 tons per day. J. Sommers, former owner of the Ludwig mine, has taken an option on the Blue Jay claims for $50,000. About 16 years ago diamond-drilling showed 40 ft. of 6% copper ore below the 400-ft. shaft. At this time there was a long wagon haul to railroad, and no smelter nearer than San Francisco, but there have been changes since then in the district. A complete plant will be built as soon as possible. At the New Yerington the engine and compressor house is about finished, and men are now stoping ore in the adit. Twelve miners are driving No. 2 adit of the Yerington Mountain Copper Co. It is in 300 ft., and about 70 ft. remains before cutting ore.

Nye County

The mines at Tonopah produced 10,874 tons of ore, valued at $271,850, during the week ended September 28. At the North Star the drift on the new orebody at 1250 ft. was extended 14 ft., where it is 4 ft. wide, assaying about $810 per ton. The ratio of gold to silver is about 1 to 1, against the usual ratio of 1 to 100 for Tonopah ores. A shipment of this ore is now mined. On the 600-ft. level of the Jim Butler, the Fraction vein is over 40 ft. wide in the cross-cut. It shows a series of small veins of ore from 1 to 36 in. wide, carrying fair average bullion content. The Tonopah-Belmont has opened a new orebody on its No. 12 level. Last week 66,239 oz. of bullion, worth $51,000, was shipped. The West End mill is now treating 150 tons per day, by crushing through a coarser screen at the batteries, and giving the tube-mills more work. The Tonopah Mining Co. has declared a dividend amounting to $400,000, payable

October 21. The MacNamara mill is treating 67 tons per day.

STOREY COUNTY

About 40 tons of old tailing is being handled daily by the experimental machines at the Morgan dredging and concentrating plant on the Carson river. It is said that results are satisfactory, and 100 tons per day will be treated later on. During the week ended September 28 the centrifugal pumps at the 2500 and 2310-ft. levels of the C. & C. shaft, at the Comstock, worked 168 hours, and the pump at the 2500-ft. winze station of the Ophir also worked full time. Twenty-one shifts were worked at the Mexican and Ophir south air-drift. At Ward shaft the water is 50 ft. below the 2150-ft. station. The Mexican mill treated 438 tons of ore valued at $38.40 per ton, with 95% extraction. Joint work was done with the Union and Sierra Nevada, and shipments included five bars of bullion to the California smelter. The southwest drift on the 2500-ft. level of the Ophir shows an improvement in formation over the previous week. The new cyanide plant is being pushed ahead. The new air-compressor at the Union shaft is at work. The Crown Point mined 521 mine-cars of ore assaying from $7.96 to $9.85 per ton. Milling will be started at the Yellow Jacket mill this week.

WHITE PINE COUNTY

The following letter has been issued by the general manager of the Nevada Consolidated and sent to the various departmental officials: "Based on copper selling price of 16c. per pound, and effective October 1, 1912, the wage-scale of all employees of the Steptoe Valley Smelting & Mining Co. will be increased over the present schedule as follows: All employees now receiving $3 and over, will receive an increase of 25c. per day; all receiving less than $3, will receive an increase of 20c. per day; this increased wage to be subject to adjustment when the market selling price of copper metal falls below 16c. per pound." The Federation of Labor does not consider the above offer enough and wants an increase of 50c. per day and recognition of the union by the company.

At 8 o'clock on October 2 the Nevada Consolidated mines were shut down following the strike order issued the night before. About 3500 miners in the district are affected. The county commissioners have closed all the saloons. The wage demanded by the union is $3.50 per day for shovelers and carmen; $4 for miners and timbermen; $4.50 for shaftmen; $5 for work in wet shafts; $3.50 minimum for skilled mill and smeltermen; and $2.25 to $2.50 for common labor. The recognition of the union is demanded as at Bingham.

OREGON

BAKER COUNTY

A considerable number of men are now employed at the Bonanza mine, and much development is planned. For some time they have been driving on one of the numerous small veins which seem to connect with the orebody which made this mine of note years ago. A good while ago an adit was driven 1800 ft. into the mountain, and it is intended to clean this out and extend it. The mine is owned by F. Moore, of Pittsburg.

UTAH

JUAB COUNTY

It is reported that the Telluride and Knight power companies will consolidate before long, thus controlling nearly all the power business in the State. Both are doing business in the Tintic district, and some of the larger mines may change their steam-plants to electric. The new ore-house at the Eagle & Blue Bell is almost finished. Twelve carloads of ore were sent out last week, and good ore is opened at the 700, 1000, and 1300-ft. levels. The Swansea maintains a daily output of 100 tons of ore, which contains 8 oz. of silver, 50c. in gold, and $4 in iron, which up to 20% brings 10c. per unit, and above this, 15c. per unit. In August the Chief Consolidated shipped over 4000 tons of ore. Another boiler of 150 hp. has been built in, making the boiler capacity at 450 horse-power.

The annual report of the Swansea Consolidated company gives the following details:

Development done, feet	2,428
Ore production, by lessees, tons	181
Ore production by company, tons	10,700
Metal content:	
Gold, ounces	452
Silver, ounces	123,276
Lead, pounds	97,885
Receipts	$92,625
Expenses	$83,497
Cash balance	$8,128

The new 4-drill electrically-driven air-compressor, recently erected, and the electric station pump, have reduced working expenses. The main shaft is down 940 ft., and a pump station will be cut out. All work has been concentrated on the 800, 850, and 940-ft. levels.

SALT LAKE COUNTY

The United States S. R. & M. Co. has paid its regular quarterly dividend of 87½c. per share on the preferred stock. The common stock received 75c. per share, an increase of 25 cents. The lead furnaces at the Midvale plant are running practically full time of late. The Centennial-Eureka has been one of the best holdings of this company. The new coal property acquired is proving of great value. There is plenty of coal, and it is clean and of good quality. Present shipments are about 750,000 tons per year.

Thirty-four tons of concentrate has been sold by the Columbus Consolidated company for a net return of $1537. The average contents were 0.015 oz. gold, 44.5 oz. silver, 9.5% lead, 9.05% copper, 7.8% zinc, and 17% iron.

During the past week there has been little of importance happening at Bingham, the district is quiet, and a waiting game is being played by the mine operators and the strikers. The sheriff has about 400 armed police in his charge; he has toured the hills about the mines; and gave orders to arrest any strikers who fired, and to clear the hills or breastworks at the first sign of hostile action. There have been reports that the mine owners are making preparations to resume work, and strike-breakers arrived to start, but no work is being done yet. The state governor tried to make arrangements for a conference between both parties; but the Western Federation of Miners will not meet the operators, without reference to the unions. L. G. Skliris, the Utah Copper company's employment agent, who was accused of accepting bribes for employment, has resigned, and denies such allegations, although the men say they can prove them. C. Darrow offered to arbitrate at Bingham, but nothing has come from his offer. Three boxes of dynamite were found under the Freeman canyon bridge, but union men deny knowledge of its being there. The district produces 12% of the copper output of the United States. At the Tooele smelter, three McDougall furnaces have been shut down, being short of concentrate for roasting. F. A. Heinze and S. Guggenheim passed through the district during the week.

SUMMIT COUNTY

The new mill of the Mines Operating Co., at Park City, is ready for work to treat the complex ores of the Ontario mine, of which there are said to be 700,000 tons worth $8.67 per ton. The plant is of 50-ton capacity and uses lixiviation.

There are about 1400 men employed at the Park City mines, which are producing 6000 tons of ore per month. During the week ended September 21 four mines sent out 1288 tons of ore. Encouraging developments have been proved on the 200-ft. level of the New York mine. A shipment of ore is ready for the market. Work at the Snake Creek adit is going on as usual, and over 5000 gal. of water has to be handled per minute.

CANADA

BRITISH COLUMBIA

(Special Correspondence.)—During the week ended Sep-

tember 21 the Granby company smelted 26,683 tons of ore, a total for the year of 905,782 tons. Blister copper shipments for the week were 523,000 lb. The Mother Lode mine, of the British Columbia Copper Co., sent 8201 tons of ore to the smelter at Greenwood. The Panama, near Kaslo, has commenced shipping silver-lead ore. Ore production for the week from the Boundary, East Kootenai, Nelson, Rossland, Slocan, and Ainsworth districts was 52,666 tons, and for the year to date, 1,764,904 tons.

Spokane, September 26.

Cobalt

During the quarter ended August 31 the Beaver Consolidated company did 964 ft. of development. Before more cross-cutting is done, it is intended to sink to 700-ft. depth. The credit balance is $68,553, which will enable the payment of next dividend of 3%. The usual quarterly dividends of the Nipissing and La Rose have been declared, amounting to $450,000 and $187,500, respectively. During the week ended September 20 nine mines shipped 382 tons of ore, and six shipped 160,648 oz. of silver bullion. The newly formed British Canadian Smelting Co., which intends to erect a large plant at Chippewa, will treat ore from Cobalt. The annual report of the Kerr Lake company shows that its total revenue was $1,044,417, and net profit $769,175. Dividends paid totaled $762,000, and the surplus August 31 was $716,992. Ore reserves are estimated to contain 6,660,000 oz. of silver. Much more waste has to be handled than formerly.

Porcupine

At Sandy Falls, six miles northwest of the Hollinger mine, the Porcupine Power Co. has installed a hydro-electric plant for supplying power to the Porcupine district. The plant consists of two pairs of 43-in. turbines of 1700 hp. each, under 34-ft. head, coupled to two generators of 1500 hp. each, 25 cycle, 3 phase, 12,500 volt, running at 214 r.p.m. Foundations for a third unit have been prepared. Light and power are being supplied to the towns of Porcupine and South Porcupine, and the Hollinger, Dome, McEneany, and Plenaurum mines. The North Dome mine is to be sunk to 250-ft. depth. The McEneany is down 370 ft. On the 300-ft. level the lode is worth $50 per ton. The Dennis claims have been sampled a third time. The Foley-O'Brien mine is to be unwatered for examination. Since it started operations, the Ray mine has cost the company about $905,470. There is a good quantity of ore above the 200-ft. level.

MEXICO

Chihuahua

A 99-year concession has been granted by the Mexican government to D. J. Spillane, of San Luis Potosi, which permits the use of 75,000 litres of water per second from the Santa Maria and Gallinas rivers for the generation of electric power. Plans of the hydraulic plant are to be submitted before May 1914, and work is to be started within 60 days of their approval. The power available at the junction of the rivers is about 40,000 hp. The height of the falls is 106 metres. It is said that a company formed in the United States has purchased the concession.

Sonora

(Special Correspondence.)—During August the Tigre Mining Co. milled 6130 tons of ore and cyanided 7478 tons of tailing. With the shipping ore produced, the total value of the output was $146,023. Total costs were $83,298, leaving the profits at $62,725. Full details are not available on account of delay to mail service. At the mill and in transit are over two-months supply of ore and concentrate, owing to the fact that heavy rains have destroyed part of the mountain road between the river and mine. The river itself has been too high to ford for over a month. Combined with the movements of the rebel forces in the surrounding territory, freight arrangements have been upset during August and the early part of September.

Kansas City, Missouri, September 20.

Personal

Professional men are invited to send news of their engagements and travels. Such news is interesting to friends.

L. L. Patrick is at the Palace.

F. A. Heinze has been at Bingham.

J. A. Burgess is at the St. Francis.

Philip Bradley has gone to Nevada.

S. M. Wright was here during the week.

F. G. Clapp is in the province of Quebec.

W. H. Luce is here from Sterling, Colorado.

H. S. Graves was in San Francisco recently.

Edmund Juessen has gone to Sierra county.

L. A. Friedman was at Salt Lake City recently.

J. Gordon Hardy has left El Paso for Scotland.

H. C. Hoover is in the southern part of the state.

Whitman Symmes has returned to Virginia City.

Pope Yeatman was at Hayden and Ray recently.

G. B. Van Arsdale has been in town from Yuba City.

A. J. Ralston has left for Japan on a pleasure trip.

Edwin T. F. Lewis has returned from Antofagasta, Chile.

J. Stuart McKaig is now at Franklin Furnace, New Jersey.

S. E. Bretherton has returned from an extended trip in the East.

Henry Krumb has returned from his vacation to Salt Lake City.

R. B. Stanford has returned to New Orleans from Central America.

J. H. Rodgers has returned to Seattle from the Stikine River district.

F. LeRoi Thurmond is now assayer for Cliff Mining Co., Valdez, Alaska.

Willard S. Morse was here during the week and has gone to Tacoma.

J. C. Remond and H. Wrighton were in San Francisco during the week.

N. J. Martin was in town recently and has returned to Loomis, California.

Herbert C. Enos has been examining mines in Chihuahua and has gone to Durango.

A. L. Sweetser is at San Juancito, Honduras, expecting to remain over the winter.

Stuart Rawlings sailed on the *Peru* for Mazatlan, returning to San Dimas, Sinaloa.

A. H. Jones, superintendent for the Belmont Milling Co., was in the city during the week.

Dorsey Hager was in San Francisco during the week and has returned to Los Angeles.

W. C. Phalen is in San Francisco investigating the salt industry along San Francisco bay.

M. K. Rodgers passed through San Francisco on his way to Guanajuato by way of New York.

C. M. Derby has resigned as manager of the dredging department of the Natomas Consolidated.

F. Julius Fohs has been engaged in professional work in the Black mountains of North Carolina.

Ralph Stokes has accepted a position on the staff of the Canadian Mining & Exploration Company.

E. M. Hamilton is at the Nipissing mine, Cobalt, where he plans to remain until the end of the year.

Millard K. Shaler was married in Lawrence, Kansas, on October 2, and, with his bride, is returning to Brussels.

F. F. Grout and E. K. Soper have returned to Minneapolis from a field study of the clay resources of Minnesota.

L. S. Cates, general manager for the Ray Consolidated Copper Co., has returned to Ray from a short business trip to Globe.

Louis Wright, consulting engineer for the Lewisohn properties, has just returned to El Paso after a week's visit to the Miami mine.

Norman Carmichael, general manager for the Arizona Copper Co., has returned to Clifton after spending a day at the Miami and Inspiration Consolidated mines.

Market Reports

LONDON QUOTATIONS

(By cable, through the courtesy of C. S. Burton & Co., New York.)

	October 3.
Camp Bird Ltd	$ 6⅜
El Oro	3⅜
Esperanza	10
Oroville Dredging	1⅜
Santa Gertrudis	7⅜
Tomboy	6⅜

COPPER SHARES—BOSTON

(By courtesy of J. C. Wilson, Mills Building.)

	Closing prices, October 3.		Closing Prices October 3.
Adventure	$ 6¾	Mohawk	$ 67½
Allouez	46½	North Butte	34¼
Calumet & Arizona	82½	Old Dominion	63½
Calumet & Hecla	600	Osceola	114
Centennial	21	Quincy	89
Copper Range	59	Shannon	16
Daly West	4	Superior & Boston	1¼
Franklin	7½	Tamarack	46
Granby	68½	Trinity	5
Greene Cananea, ctf.	10¾	Utah Con	12
Isle-Royale	36½	Victoria	2⅜
La Salle	5½	Winona	5¼
Mass Copper	7	Wolverine	79

NEVADA STOCKS

(By courtesy of San Francisco Stock Exchange.)

San Francisco, October 3.

Atlanta	$ .20	Midway	$ .55
Belcher	.31	Montana-Tonopah	2.30
Belmont	9.80	Nevada Hills	1.70
B. & B.	.04	North Star	.33
Big Four	.40	Ophir	.50
Booth	.05	Pittsburg Silver Peak	.95
Combination Fraction	.12	Round Mountain	.38
Con. Virginia	.35	Savage	.12
Florence	.81	Tonopah Extension	2.70
Goldfield Con.	2.65	Tonopah Merger	1 10
Jim Butler	.77	Tonopah of Nevada	6.25
Jumbo Extension	.34	Union	.33
MacNamara	.22	Vernal	.12
Mexican	2.40	West End	1.67

OIL SHARES

(By courtesy of San Francisco Stock Exchange.)

San Francisco, September 28.

Associated Oil	47.87	Monte Cristo	$ 1.40
Brookshire	.58	New Pa Pet	.59
Caribou	.65	Palmer	.28
Claremont	.60	Palmer Union	.18
Coalinga Central	.20	Premier	.40
De Luxe	.70	Republic	.26
Maricopa 36	.35	United Oil	.25
Maricopa National	.20	W. K. Oil	1.75

MINING STOCK QUOTATIONS—NEW YORK

(By wire from C. S. Burton & Co., New York.)

	Closing Prices, October 3.		Closing Prices. October 3.
Amalgamated Copper	$ 92⅛	Miami Copper	$ 29¼
A. S. & R. Co.	89⅜	Mines Co. of America	3
Braden Copper	7	Nevada Con	23⅜
B. C. Copper Co.	5	Nipissing	8½
Chino	44	Ohio Copper	1⅜
First National	2	Ray Con	23
Giroux	5	Tenn. Copper	46
Goldfield Con.	2⅜	Tonopah Belmont	10
Greene-Cananea	10	Tonopah Ex.	2⅜
Hollinger	14	Tonopah Mining	6½
Inspiration	19⅜	Trinity	6
Kerr Lake	2⅜	Tuolumne Copper	3
La Rose	2½	Utah Copper	66½
Mason Valley	12⅜	West End	1⅜
McKinley-Darragh	1⅜	Yukon Gold	3½

ASSESSMENTS ON COMSTOCK MINES.

Company	No.	Del. Board	Sale Day	Amt.
Sierra Nevada	31	Sept. 21	Oct. 16	.10
Andes	77	Sept. 23	Oct. 17	.05
Savage	25	Sept. 23	Oct. 24	.10
Seg. Belcher	51	Sept. 28	Oct. 25	.02
Hale & Norcross	31	Oct. 1	Oct. 24	.05
Union Con.	31	Oct. 12	Nov. 6	.15
Bullion	24	Oct. 13	Nov. 6	.0

LOCAL METAL PRICES

San Francisco is not a primary market for the common metals except quicksilver. The prices quoted below therefore represent sales of small lots and are not such as an ore-producer could expect to realize. Ore contracts usually call for settlements on the basis of Eastern prices, less freight and treatment charges. The prices quoted are in cents per pound, except in the case of quicksilver, which is quoted in dollars per flask of 75 pounds.

San Francisco October 3.

Antimony	11—11½c	Quicksilver (flask)	41.50
Electrolytic Copper	18—18½c	Tin	62—63½c
Pig Lead	5.35—6.30c	Spelter	8½—8⅝c

Zinc dust, 1400 lb. casks, per 100 lb., small lots $9.50—9.75; large $7.50—8.50

METAL PRICES

(By wire from New York.)

NEW YORK, October 2.—Copper quiet but firm; decline in Europe due to political disturbances scaring off buyers. Lead firm; demands fair. Spelter quiet; buyers not anxious; market easier on account of European importations. Average daily prices for the past week, in cents per pound, based on wholesale transactions, standard brands, are given below.

Date.	Electrolytic Copper.	Lead.	Spelter.	Silver, per oz.
Sept. 26	17.53	5.10	7.48	63⅝
" 27	17.53	5.10	7.48	63⅝
" 28	17.53	5.10	7.48	63
" 29	Sunday.	No market.		
" 30	17.50	5.10	7.48	63¼
Oct. 1	17.45	5.10	7.48	63¼
" 2	17.45	5.10	7.48	64¼

SILVER

Below is given the average New York quotation, in cents per ounce, of fine silver for the months indicated:

	1911.	1912.		1911.	1912.
Jan.	53.81	56.25	July	52.57	60.67
Feb.	52.23	59.06	Aug.	52.17	61.32
Mch.	52.76	58.37	Sept.	52.43	62.95
Apr.	52.32	59.20	Oct.	53.37	....
May	53.31	60.88	Nov.	55.77	....
June	53.04	61.29	Dec.	54.85	....

COPPER

Daily quotations on copper as published in this column represent average wholesale transactions on the New York market and refer to electrolytic copper. Lake copper commands normally from 1-5 to 1-4c. per lb. more. Below are average monthly quotations in cents per pound:

	1911.	1912.		1911.	1912.
Jan.	12.29	14.09	July	12.47	17.19
Feb.	12.26	14.08	Aug.	12.41	17.49
Mch.	12.14	14.68	Sept.	12.20	17.56
Apr.	12.02	15.74	Oct.	12.19	....
May	11.99	16.03	Nov.	12.61	....
June	12.39	17.23	Dec.	13.55	....

COPPER SURPLUS

Figures showing the visible supply of copper at the beginning of each month are now widely available. Below are given the amounts, in pounds, known to be available at the first of each of certain months.

		U. S.	European.
January	1910	141,766,111	244,961,280
January	1911	122,030,195	230,264,280
January	1912	89,454,695	178,329,920
February	"	66,280,643	153,820,800
March	"	62,939,988	141,125,680
April	"	62,367,557	137,806,000
May	"	65,295,368	134,176,000
June	"	49,615,643	117,801,600
July	"	44,335,004	107,817,920
August	"	50,281,280	113,285,760
September	"	46,701,376	112,743,680

UNITED STATES PRODUCTION AND CONSUMPTION

(Compiled from reports of the Copper Producers' Association)

	Production.	Domestic deliveries.	Exports.
August	125,493,667	59,935,364	69,885,660
September	115,588,950	57,311,584	50,824,011
October	118,255,442	64,068,656	60,084,349
November	111,876,601	68,039,776	67,049,279
December	122,896,697	65,988,474	79,238,716
Total for 1911	1,431,938,338	709,611,945	754,932,733
January 1912	119,337,753	62,343,901	80,167,904
February	116,035,809	56,228,368	63,148,096
March	125,694,601	67,847,556	58,779,566
April	125,694,001	69,513,846	53,252,326
May	126,737,836	72,702,237	69,485,945
June	122,315,240	66,146,229	61,449,650
July	137,161,920	71,093,120	60,121,600
August	145,628,521	78,722,418	70,485,150

(Continued on Page 454)

Concentrates

Most of these are in reply to questions received by mail. Our readers are invited to ask questions and give information dealing with the practice or mining, milling, and smelting.

WASTES of the past are daily being converted into the dividends of the present.

MINERAL WATER, the product of 732 springs, amonting to 63,923,119 gal., was sold in the United States in 1911. The average price per gallon was 10.7 cents.

BELTING used at the Baku (Russia) oilfields is principally that made from camel's hair; leather, cotton, and rubber belting not standing the action of the oil so well.

WEIGHT of the atmosphere has been calculated as 5,000,000,000,000,000 tons, containing 3,850,000,000,000,000 tons of nitrogen and 1,150,000,000,000,000 of oxygen.

MIXTURES of air and acetylene containing 3 to 8% of the latter gas are explosive. Explosive mixtures are thus readily found in pipes and in the external neighborhood of leaky joints.

BREAKAGE of cam-shafts and stems is often attributed to camming and jarring in the former, and crystallization in the latter case, and is still a subject of debate. As a rule, these breakages are fairly heavy in all stamp-mills.

MANY ore deposits are so low grade that they cannot be mined today, but should be left in position, so that they can be mined in the future; as many ores, formerly too low grade to work at a profit, are now sources of wealth.

WASTE of carbon in modern economy is almost staggering. "In mining coal in the United States," says C. L. Parsons, "probably one-third of the bituminous and one-half of the anthracite coal are left in the mines. Fully 80,000,000 tons of anthracite is now being left behind in mines each year, and it is estimated that since mining began in this country fully 2,000,000,000 tons of anthracite and 3,000,000,000 tons of bituminous coal have been left in the ground, under conditions which make future recovery highly impossible."

THE Imperial steel works of Japan, at Wakamatsu, on the straits of Shimonoseki, a government institution, is doing a lot of work, although it has been run at a loss until recently. The 1910 output was 62,000 tons of rails; 5000 tons of railway accessories; 28,000 tons of sheets and plates; 58,000 tons of bars and shapes; 2000 tons of bolts, nuts, etc.; 3000 tons of crucible steel, tires, axles, etc.; and 6000 tons of wire rod. Iron ore smelted totaled 218,000 tons, and pig iron produced was 130,000 tons. About 7500 workmen and 2000 coolies are employed. Figures for 1911 are not available, but are expected to exceed those given.

COAL converted into coke in the United States in 1911 amounted to 53,278,248 tons, yielding 35,551,248 tons of coke. The quantity of coal consumed in the manufacture of coke and by-product in retorts was 10,446,584 tons, yielding 7,847,845 tons of coke. By-products consisted of 33,274,861,000 ft. of surplus gas, 69,410,559 gal. of tar, 72,920,056 lb. of ammonium sulphate, 23,180,118 lb. of anhydrous ammonia, and 4,660,596 gal. of ammonia liquor. The value of the recoverable contents now being wasted of the coal made into coke in beehive ovens would, at prices obtaining in 1911, have been worth between $35,000,000 and $40,000,000. The quantity of boiler-horse-power obtainable from this source would be about 400,000 hp. per hour for every day of the year.

Decisions Relating to Mining

Specially reported for the MINING AND SCIENTIFIC PRESS.

GAS LEASE—ROYALTIES PAYABLE FROM ADJACENT WELLS

A gas lease providing for royalties and not specifying the number of wells to be drilled, requires the lessee to develop the land with reasonable diligence, and entitles the lessor, at least, to royalties on the gas taken by the lessee through wells on adjoining land.

Culbertson *v.* Iola Portland Cement Co., (Kansas) 125 Pac., 81. July 6, 1912.

POSSESSION OF SURFACE AND MINERALS DISTINCT

A purchaser of mineral rights in land from one not shown to have been in possession was put on inquiry as to the rights of persons claiming under an unrecorded deed where it appeared that the land had been cultivated. Possession of land in which mineral lies may exist and be exercised of the mineral as distinct from the surface, or of the surface as distinct from the mineral.

Sloss-Sheffield Steel & Iron Co. *v.* Taff (Alabama), 59 Southern, 658. June 29, 1912.

DEED TO LAND CARRIES SUB-SURFACE RIGHTS

Where, at the time of a gift of coal land by a father to his son, there had been no severance of the title to the coal, and the son took actual and exclusive possession of the surface, such posession carried with it actual possession downward perpendicularly through the various strata so as to confer title to the coal on the son as against a subsequent grantee of the coal by the father.

Greenwich Coal & Coke Co. *v.* Learn, (Pennsylvania) 83 Atlantic, 74. Jan. 2, 1912.

ASSESSMENT WORK—FORFEITURE AND RE-LOCATION

Where a mining location was made in December 1905 and the locator ceased to do assessment work in the year 1908, without having done $100 worth of labor during either 1907 or 1908, the claim became subject to re-location. The work of the first locator done in 1907 and 1908, having been of less value than $100, the re-locator was not required to wait until the expiration of the year 1908 in order to make his re-location.

Galbreath *v.* Simas, 161 California, 303.

AGRICULTURAL ENTRIES ON OIL AND GAS LANDS IN UTAH

Unreserved public lands of the United States in the state of Utah, which have been withdrawn or classified as oil lands, or are available for oil, shall be subject to appropriate entry under the homestead laws by actual settlers only, under the desert land law to the extent of 160 acres only, to selection by the state of Utah under Congressional grants and the Carey Act, to withdrawal under the Reclamation Act, and to disposition by the Secretary of the Interior under the law providing for sales of isolated tracts; reserving always to the United States the oil and gas rights in such lands, with the right to prospect and remove the same upon payment of damages to the agricultural patentee for actual injuries suffered by him.

Act of Congress, Approved August 24, 1912. (Not yet published.)

GUATEMALA'S mineral wealth is great, though but little explored as yet. In the northern part of the country, silver-lead ores occur, extending through to the frontiers of Honduras and Salvador. In the eastern part are gold placers, some of which are now being worked by American engineers. The gold belt extends along the entire frontier of Honduras, and rich ore is sometimes found. Silver ores in the province of Santa Rosa assay $40 per ton. The Government is liberal in its dealings with miners, and foreigners who engage in mining receive all assistance possible.

LEAD

Lead is quoted ordinarily in cents per pound or dollars per hundred pounds delivered at St. Louis or New York. The difference is normally 15c. per hundred pounds, and any larger or smaller difference is promptly met by sales. The daily price in New York is published each week in this column. Below are the average quotations by months:

	1911.	1912.		1911.	1912.
Jan.	4.48	4.43	July	4.50	4.71
Feb.	4.44	4.03	Aug.	4.50	4.54
Mch.	4.39	4.07	Sept.	4.48	5.00
Apr.	4.41	4.20	Oct.	4.27	....
May	4.37	4.20	Nov.	4.30	....
June	4.34	4.40	Dec.	4.45	....

ZINC

Zinc is quoted as spelter, standard Western brands, and based upon St. Louis or New York delivery. While New York quotations, as a matter of convenience, are commonly used, relatively little spelter actually goes to or comes from New York. The bulk is shipped direct from the plants in the Mississippi Valley to manufacturers, due allowance being made for freight. New York daily quotations are published in this column each week. Below are given averages by months:

	1911.	1912.		1911.	1912.
Jan.	5.45	6.42	July	5.70	7.12
Feb.	5.52	6.50	Aug.	5.95	6.96
Mch.	5.56	6.57	Sept.	5.86	7.45
Apr.	5.40	6.63	Oct.	6.10	....
May	5.35	6.68	Nov.	6.38	....
June	5.50	6.88	Dec.	6.30	....

Zinc-dust is quoted separately, the price being based upon the cost of spelter in Illinois and the cost of preparation. About half the zinc-dust used in the United States is imported through San Francisco. Delivery prices are determined largely by quantities and contracts.

QUICKSILVER

The primary market for quicksilver is San Francisco, California, being the largest producer. The price is fixed in the open market, and, as quoted weekly in this column, is that at which moderate quantities are sold. Buyers by the carload can usually obtain a slight reduction, and those wanting but a flask or two must expect to pay a slightly higher price. Average monthly quotations, in dollars, per flask of 75 lb., are given below:

	1911.	1912.		1911.	1912.
Jan.	44.60	43.75	July	48.00	43.00
Feb.	48.40	46.00	Aug.	50.00	42.50
Mch.	52.50	46.00	Sept.	47.50	42.12
Apr.	50.90	42.25	Oct.	46.12	....
May	46.50	41.75	Nov.	45.50	....
June	46.50	41.30	Dec.	44.50	...

TIN

New York prices control in the American market for tin, since the metal is almost entirely imported. San Francisco quotations, averaging about 5c. per lb. higher than New York, are quoted weekly in this column. Below are given average monthly New York quotations in cents per pound:

	1911.	1912.		1911.	1912.
Jan.	41.25	42.53	July	42.40	44.25
Feb.	41.61	42.96	Aug.	43.32	45.80
Mch.	40.16	42.58	Sept.	39.75	48.64
Apr.	42.18	43.92	Oct.	41.18	....
May	43.11	46.05	Nov.	43.12	....
June	44.61	45.76	Dec.	44.65	....

Current Prices for Chemicals

(Corrected monthly by Braun-Knecht-Heimann Co.)

Prices quoted are for ordinary quantities in packages as specified. For round lots lower prices may be expected, while in smaller quantities advanced prices are ordinarily charged. Prices named are subject to fluctuation. Other conditions govern Mexican and foreign business.

	Min.	Max.
Acid, sulphuric, com'l, 66°, drums, ℔ 100 lb.	$0.75	$1.00
Acid, sulphuric, com'l, 66°, carboy, ℔ 100 lb.	1.00	1.50
Acid, sulphuric, C. P., 9-lb. bottle, bbl., ℔ lb.	0.13	0.18
Acid, sulphuric, C. P., bulk, carboy, ℔ lb.	0.09½	0.12
Acid, muriatic, com'l, carboy, ℔ 100 lb.	1.60	3.00
Acid, muriatic, C. P., 6-lb. bottle, bbl., ℔ lb.	0.15	0.20
Acid, muriatic, C. P., bulk, carboy, ℔ lb.	0.10½	0.15
Acid, nitric, com'l, carboy, ℔ 100 lb.	5.25	6.50
Acid, nitric, C. P., 7-lb. bottle, bbl., ℔ lb.	0.16	0.22
Acid, nitric, C. P., bulk, carboy, ℔ lb.*	0.12½	0.15
Argols, ground, bbl., ℔ lb.	0.20	0.25
Borax, cryst. and conc., bags, ℔ 100 lb.	2.75	3.85
Borax, powdered, bbl., ℔ 100 lb.	3.00	4.00
Borax glass, gd. 30 mesh, cases, tin lined, ℔ 100 lb.	10.00	13.00
Bone ash, 60 to 80 mesh, bbl., ℔ 100 lb.	4.50	5.50
Bromine, 1-lb. bottle, ℔ lb.	0.55	0.65
Candles, adamantine, 14 oz., 40 sets, ℔ case.	4.60	4.80
Candles, adamantine, 14 oz., 60 sets, ℔ case.	5.25	5.45
Candles, Stearic, 14 oz., 40 sets, ℔ case.	5.00	5.20
Candles, Stearic, 14 oz., 60 sets, ℔ case.	5.70	5.90
Clay, domestic fire, sack, ℔ 100 lb.	1.50	2.00
Cyanide, 98 to 100%, 100-lb. case, ℔ lb.	0.20½	0.24½
Cyanide, 98 to 100%, 200-lb. case, ℔ lb.	0.20	0.24
Cyanide, 129%, 100-lb. case, ℔ lb.	0.27½	0.28½
Cyanide, 129%, 200-lb. case, ℔ lb.	0.26½	0.27½
Lead acetate, brown, broken casks, ℔ 100 lb.	8.75	9.65
Lead acetate, white, broken casks, ℔ 100 lb.	10.00	10.25
Lead acetate, white, crystals, ℔ 100 lb.	11.75	12.25
Lead, C. P., test., gran., ℔ 100 lb.	13.00	15.00
Lead, C. P., sheet, ℔ 100 lb.	15.00	18.00
Litharge, C. P., silver free, ℔ 100 lb.	10.50	13.00
Litharge, com'l, ℔ 100 lb.	7.50	9.00
Manganese ox., blk., dom. in bags, ℔ ton	20.00	25.00
Manganese ox., blk., Caucasian, in casks, ℔ ton (85% MnO_2—½% Fe)	42.50	50.00
Nitre, double ref'd, small cryst., bbl., ℔ 100 lb.	7.00	8.00
Nitre, double ref'd, granular, bbl., ℔ 100 lb.	6.50	7.50
Nitre, double ref'd, powdered, bbl., ℔ 100 lb.	7.25	8.00
Potassium bicarbonate, cryst., ℔ 100 lb.	12.00	15.00
Potassium carbonate, calcined, ℔ 100 lb.	15.00	18.00
Potassium permanganate, drum, ℔ lb.	0.11	0.12½
Silica, powdered, bags, ℔ lb.	0.03	0.05
Soda, carbonate (ash), bbl., ℔ 100 lb.	1.50	1.75
Soda, bicarbonate, bbl., ℔ 100 lb.	2.00	2.50
Soda, caustic, ground, 98%, bbl., ℔ 100 lb.	3.15	3.50
Soda, caustic, solid, 98%, drums, ℔ 100 lb.	2.65	2.85
Zinc shavings, 850 fine, bbl., ℔ 100 lb.	12.05	13.60
Zinc sheet, No. 9—18 by 84, drum, ℔ 100 lb.	10.25	11.50

*Extra charge for packing nitric acid for shipment to conform to regulations.

Current Prices for Ores and Minerals

(Corrected monthly by Atkins, Kroll & Co.)

The prices are approximate, subject to fluctuation, and to variation according to quantity, quality, and delivery required. They are quoted, except as noted, f.o.b. San Francisco. Buying prices marked *.

	Min.	Max.
Antimony ore, 50%, ℔ ton	*$22.00	$25.00
Arsenic, white, refined, ℔ lb	0.05½	0.05½
Arsenic, red, refined, ℔ lb	0.08	0.09
Asbestos, according to length and quality of fibre, ℔ ton	100.00	350.00
Asbestos, lower grades, ℔ ton	5.00	50.00
Asphaltum, refined, ℔ ton	10.00	20.00
Barium carbonate, precipitated, ℔ ton	42.50	45.00
Barium chloride, commercial, ℔ ton	* 42.50	45.00
Barium sulphate (barytes), prepared, ℔ ton	20.00	30.00
Bismuth ore, 10% upward, ℔ ton	*75.00	upward
Chrome ore, according to quality, ℔ ton	10.00	12.50
China clay, English, levigated, ℔ ton	15.00	20.00
Cobalt metal, refined, f. o. b. London, ℔ lb	2.50	
Coke, foundry, ℔ 2240 lb	14.50	15.00
Diamonds:		
Borts, according to size and quality, ℔ carat	2.00	15.00
Carbons, according to size and quality, ℔ carat	50.00	90.00
Feldspar, ℔ ton	5.00	25.00
Firebrick:		
Bauxite, ℔ M	175.00	
Magnesite, ℔ M	190.00	275.00
Silica, ℔ M	42.50	47.50
Flint pebbles for tube-mills, ℔ 2240 lb	19.50	22.50
Fluorspar, ℔ ton	10.00	15.00
Fullers earth, according to quality, ℔ ton	20.00	30.00
Gilsonite, ℔ ton	35.00	40.00
Graphite:		
Amorphous, ℔ lb	0.01½	0.02½
Crystalline, ℔ lb	0.04	0.13
Gypsum, ℔ ton	7.50	10.00
Infusorial earth, ℔ ton	10.00	15.00
Magnesite, crude, ℔ ton	5.00	7.50
Magnesite, dead calcined, ℔ ton	20.00	25.00
Magnesite, brick (see firebrick).		
Manganese ore, oxide, crude, ℔ ton	10.00	25.00
Manganese, prepared, according to quality, ℔ ton	30.00	70.00
Mica, according to size and quality, ℔ lb	0.05	0.30
Molybdenite, 95% MoS_2, ℔ ton	400.00	500.00
Monazite sand (5%thoria), ℔ ton	150.00	200.00
Nickel metal, refined, ℔ lb	0.45	0.60
Ochre, extra strength, levigated, ℔ 100 lb	2.25	3.25
Platinum, native, crude, ℔ oz	40.00	45.00
Silex lining for tube-mills ℔ 2240 lb.	32.50	35.00
Sulphur, crude, ℔ ton	20.00	25.00
Sulphur, powdered, ℔ ton	40.00	45.00
Talc, prepared, according to quality, ℔ ton	20.00	50.00
Tin ore, 60%, ℔ ton	450.00	475.00
Tungsten ore, 65%	425.00	475.00
Vanadium ore, 15%, ℔ ton	150.00	180.00
Wolframite (see tungsten ore).		
Zinc ore, 50% up, ℔ ton	*15.00	20.00

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EDITORIAL

REHEARING of the case of the East Tintic Consolidated Company has been denied by the Interior Department, and a precedent is thus firmly established.

MILITARY men claim that airships have made war impossible. Unnecessary would perhaps be the better word, since 13 aviators were killed during September.

KELP deposits at Point Wilson, Washington, have been filed upon by a potash company. The old problem of what is a placer deposit will doubtless at once revive.

BALTIMORE has become an important shipping point for oil. The export trade of the United States in refined mineral oil during the year ended June 30, 1911, was valued at $92,098,000. Two new tank steamers, the German *Adorna*, of a capacity of 2,000,000 gallons, and a Brazilian ship of a capacity of 1,000,000 gallons will sail from Baltimore, and its place in the oil-carrying world will be correspondingly strengthened.

COAL consumers in the Eastern states are troubled over a condition bordering on shortage due to lack of labor, shortage of cars, and higher prices prevailing in the West. Even the railroads feel the pressure, and a leading official ventures the opinion that coal prices will rise $1.50 per ton at Albany in the course of next year. Private consumers near New York who have had their winter supply ordered since early in the summer have not yet been supplied.

KANSAS now has a State School of Mines, which has begun work in temporary quarters at Weir City. To discourage endeavor is an ungrateful task, but it may well be questioned whether further additions to the already considerable number of poorly supported and attended state schools of mining are desirable. The local paper ingenuously remarks that the citizens of Weir City have incurred considerable expense in starting the school, but that hereafter it will draw its support from the state and national governments. The ideals which lead to the founding of state schools and universities should have a higher origin than the fount of appropriations.

ELSEWHERE we publish the data required by the new regulation of the Post Office Department, referred to editorially in our issue of September 21. Not the least interesting phase of the effects of the new law is the almost complete silence which daily journals have observed regarding it, a news item in the Chicago *Tribune* and our own editorial comment being the only references to it that came to our attention before the date fixed by law for making returns. It has become evident of recent years that daily journals have lost influence over public opinion with a growing general belief that their utterances are often distorted to suit the owner's ends. But the power to suppress news can never be shorn from them.

TO this issue Mr. T. A. Rickard contributes an account of the development of printing, and the growth of the technical journals, which will be of value to our readers. It is interesting to note that the oldest journal in the world, the *Peking Gazette*, suspended publication, in its original form, upon the abdication of the Manchu dynasty last year. This official record of the doings of the Peking court is known to have been published since the ninth century, though, like our own *Congressional Record*, it contained no news, being an official journal of the Government.

LEASING of public coal lands to private corporations is to be undertaken in Wyoming. The Owl Creek Coal Company has now leased for 30 years the right to mine coal from beneath 2480 acres of public coal land near Lander, at the rate of 6½ cents per ton for the coal mined during the first five years, and 8 cents per ton during the following five years, after which the company has preferential right of renewal for periods of five years to a total of 30 years. Further details will be found in the Washington correspondence, elsewhere in this issue. The United States Geological Survey has now classified and appraised coal lands in the Western states of an estimated value of over $700,000,000 and the introduction of logical and effective methods of coal land development will react to benefit Western industry.

COPPER producers' figures show an increase in domestic stocks of over 16,000,000 pounds during September, though, on the other hand, the mines at Bingham, Utah, and Ely, Nevada, remain idle, and the situation in the Balkan states has, at the time of going to press, passed beyond control. The situation is, therefore, somewhat complex. Whether the metal market will respond to the enforced curtailment of production by bidding copper to higher levels, whether the demand for munitions of war will create an added demand, or whether the European political unrest will cause a slackening of what is regarded as over-extended industrial activity is difficult to prophesy. Large blocks of shares in leading copper mines are held in France and the exchanges in Paris, Berlin, and London have been quick to reflect the parlous situation of Turkey. It is quite within the range of possibility that this month may see a sharp advance in the price of copper, though producers are doubtless sincere in their professed aversion to an increased price, which would inevitably be reflected in a slackened demand.

A Wyoming Golconda

Wyoming is a celebrated state, through the activities of Messrs. Owen Wister, F. E. Warren, and others. Mr. Charles Martin, "one of the foremost citizens of Encampment," also contributes his mite, to which the *Centennial Post* devotes a two-column head on its front page. Mr. Martin is interested in the holdings of the American Mineral Development Company, in comparison with which he thinks the Camp Bird will eventually appear a mere toy. In response to an inquiry as to ore reserves he has given out this alluring statement: "Take your pencil; take the length of the vein—7000 feet—which is opened up; multiply it by 60—although the four veins are 63 feet wide—and then multiply this result by 1000, because there is an average depth of 1000 feet above the water-level of the Middle Fork or the Little Laramie; and you have 420,000,000 cubic feet.

"Divide this by 15 cubic feet to the ton and you have 28,000,000 tons. Understand now," emphasized Mr. Martin, "this is above water-level, and all oxidized ore. How much will be found below water-level and what the values will be, in the sulphide ores, of course, is conjecture, although we all know it is the history of gold mines that they grow richer with depth.

"As above stated you have 28,000,000 tons, which it is my candid belief and judgment will show an average gold value of better than $10 per ton; but suppose you estimate it at $5 per ton and you will find it will give you the tremendous result of $140,000,000.

"Oh, yes, I realize these figures are staggering; but nevertheless it is my judgment as a miner of many years experience that the American Mineral Development Company's holdings will with development stagger even the most credulous with its phenomenal values." We begin to stagger already.

The Institute Meeting

Institute members everywhere will be gratified to learn that the differences of opinion which have existed among the members during the past year have been settled, and the way is now clear for constructive changes which will make the Institute more effective and bring the members more closely in touch with the society they constitute. On another page we give a brief telegraphic report of the proceedings at New York on Monday, and it is interesting to note that the action taken was substantially in accord with the suggestions made by the Los Angeles and San Francisco members, published in our issue of September 28. The Western members are now well informed in regard to the needs and possibilities of the Institute, and it is to be hoped that they may retain their interest. The formation of vigorous local sections, as nearly autonomous as possible, will do much to keep this interest alive, and their organization, should be encouraged. The local section at Spokane, largely through the efforts of its capable secretary, Mr. L. K. Armstrong, has done commendable work, and its example should be imitated.

The constructive program proposed by Mr. C. R. Corning, who as a member of the Committee of Five has given careful study to the financial and other problems of the Institute, is a commendable one upon the whole, though detailed comment must be reserved until the exact text of the proposed changes is available. But, in our opinion, over-legislation is undesirable, and it is neither necessary nor wise to incorporate into the constitution and by-laws of a society provisions in regard to management which may safely be left to the directors and council. These gentlemen are trustees for the members, and their actions should reflect the wishes of the members who are interested enough to become well informed on Institute affairs and to make their opinions known to the council. Whether delinquent members should be dropped at the end of four months or a year is a detail of business management which can well be left to the governing body to determine, since its action is more easily subject to change in correspondence with possible changed conditions. The appointment of a business manager for Institute affairs is unreservedly commendable. The larger part of the present activities of the Institute are those of a publishing house, and in these days of high cost of living the publishing house which can succeed without the careful attention of a business manager is indeed unusual. But what will awaken most general commendation among members is the creation of the office of secretary emeritus, as a recognition of the long and devoted service of the veteran secretary, Dr. Raymond. To his long term of unremitting effort the present standing of the Institute is in large part due, and the amendment only voices the sentiments of all the members of the Institute in acknowledging their debt to the greatest editor in the field of mining and metallurgy.

The Newspaper

By T. A. Rickard

On September 10, 1912, the greatest of all newspapers, *The Times*, published at London for a century and a quarter, celebrated its forty thousandth daily issue by giving its readers a compendium of special articles on printing and all that pertains thereto. Among the 60 pages of beautifully printed matter published on that day is to be found a history of printing and of the newspapers that grew therefrom, to develop into one of the great forces of civilization.

From this record we learn that the Chinese published books from wooden blocks as early as the year 922, and that Pi Shêng invented movable type centuries before it was first known in Europe. We are told that the lack of suitable ink delayed printing and that the preparation of such ink gave the Chinese their early preëminence. It is a fact that the invention of an ink made from a mixture of lamp-black and oil, by Jan van Eyck, in Holland, in the early part of the fifteenth century, was the immediate precursor of the adoption of printing in western Europe. Picture-printing from wooden blocks preceded text-printing by about two centuries; then came the engraving of lettering or text on blocks, for block-printing had some of the advantages of stereotype plates. It was the need of the schoolboy that brought the craft into existence, the first books printed, in Holland, being Donatuses or school-books. The invention of type-printing is usually accorded to Johann Gutenberg, but he seems to have been largely a composite hero, and must share the honor with Johann Fust and Peter Schoeffer, the former the business-man and the latter the type-cutter to whom the first success is to be credited. The traditional date is 1440, with Mainz as the place, but earlier printing is recorded at Strassburg, also by Gutenberg, who in turn was preceded by the printing of school-books in Holland. However, the first fully authenticated work in Europe was the printing of Letters of Indulgence for Pope Nicholas V in 1454 by Gutenberg, Fust, and Schoeffer at Mainz. Thus the art of printing at its beginning, as often since, was prostituted to a miserable purpose, for these Papal Letters of Indulgence are symptomatic of an ignorance and superstition worthy of the dark ages, then about to be punctuated by the Reformation. The first type was cut in wood, before tin, lead, and other alloys were found more suitable. Many will remember the old story of how Laurens Coster, once the employer of Gutenberg, first cut letters out of birch-bark and by inking them was enabled to stamp paper for the amusement of his children. When printing was invented, the finest vellum was being made in France and Italy, concurrently paper-mills were increasing, libraries and schools were multiplying, and the intellectual thought of Europe was about to break from the shackles of ecclesiasticism. Thus the times were ripe for the spread of recorded knowledge.

In 1501 the scholar Aldus Manutius, working at Venice, issued a series of classics in small octavo printed in a new type simulating the handwriting then in vogue. Thus originated *italics*, from Italy, where Aldus invented the type. This fashion dominated the sixteenth century, but it yielded to the Roman characters soon therafter. "A matter of unmixed rejoicing," says the chronicler in *The Times*. Undoubtedly, for even to this day the sympathetic editor will delete the underlining that in manuscript calls for italics, for he knows what a nuisance it is to the compositor, who has to go out of his way to pick such type out of a special font, and return it after use.

Printing is responsible for the newspaper. The newspaper was developed from the ballads of battles, murders, and other notable events that were sold and sung in the streets at the close of the sixteenth century. Then came the news-letters prepared by 'intelligencers' hired by statesmen and others requiring to be kept informed concerning current events. These news-letters grew, in the time of the Stuart kings, to 'relations,' or pamphlets relating in detail the big news of the day. With the slow growth of the postal service the exchange of printed news-letters was commenced across the Channel, from England to France and Holland. But regular periodicals were slow to evolve.

Printing, like coinage, was a right of the Crown; no printing was legal without the sanction of a licenser appointed by the King. Regulations on the subject were strict. Hence printed news was first issued in Italy, France, and Spain, as is suggested by words still surviving, such as 'novel' and 'gazette.' Translations from 'relations' published in Dutch or German had vogue long before the first newspaper appeared in England, in 1665.

Previous to the newspaper, the printed medium of publicity was the 'pamphlet,' from *pampe*, a fourteenth century French word for a small book of parchment leaves. The 'coranto' (an Italian word) or serial pamphlet was the sequel to the 'aviso' (from the French *avis*) and 'relation.' Then came the newsbook or 'diurnall' (hence 'journal'); the first English periodical of domestic news being *The Perfect Diurnall*, which was published from 1641 to 1655. The 'intelligencers' and 'mercuries' that flourished during the days of the Great Rebellion were political diatribes issued for party purposes. The most famous were those of Henry Walker, Cromwell's journalist, who was placed in the pillory by the followers of Charles I.

Early in its development, and before the occasional pamphlet had become a daily newspaper, the Press incurred the animosity of those in power. The Star Chamber, Cromwell, James II, each in turn, whether Puritan or Cavalier, Whig or Tory, suppressed the Press whenever the discussion of current events became too free or too incisive. Charles II appointed Sir Robert L'Estrange as censor, under the title of 'Surveyor of the Presses,' in 1662. That "brave and upright English gentleman" was "intolerant both in politics and religion," as the chronicler allows. Hence his fitness to be a newspaper moderator! He it was who fastened the term Whig on "circulators of fraudulent literature." He, it is recorded, was actually the first Tory. We believe it. His notion of the function of the newspaper is wholly in character. In the first place, he proceeded to run a paper of his own, *The Intelligencer*, which appeared first in 1663. In the first issue he confessed his objection to 'newsbooks' of any kind, asserting: "A publick mercury should never have my vote, because I think it makes the multitude too familiar with the actions and counsels of their superiors, and gives them not only an itch, but a kind of colourable right and license to be meddling with the Government." How delicious! Thank the Lord the idea that there must be mystery in government and secrecy in industry has been smashed to the four winds since the day when this cavalier had the insolence to express such a sentiment. The idea still survives in musty corners, among tyrannic governors and reactionary managers, but it has been stultified so thoroughly as no longer to command respect.

In 1665 L'Estrange lost his right to be sole journalist. The Court had fled to Oxford and there printed a bi-weekly periodical called *The Oxford Gazette*. L'Estrange was pensioned. On February 6, 1866, *The Oxford Gazette* became *The London Gazette*, which still survives as the authorized record of official events. As first published it was "a bi-weekly printed in two columns on both sides of half a sheet of folio." Its appearance marked the commence-

ment of the newspaper era and an end to the period of pamphlets. In 1680 the *Gazette* published a proclamation against the unlicensed press, which, of course, were guilty of a breach of the Royal prerogative. The immediate result was to stimulate a recrudescence of scurrilous pamphleteering. The first unlicensed paper was that of Benjamin Harris, who had to flee to America, and, on September 25, 1690, at Boston, published the first American newspaper. It was christened *Publick Occurrences*, and appears to have been worthy of the later ideals of Pulitzer and Hearst, being suppressed by the Governor of the colony for marketing a revolting accusation against Louis XIV, who, for the moment, was a friend of the British Government. In 1695 the press in England won its freedom at last; the Royal prerogative of printing was no longer claimed and the Parliamentary ban on the publication in print of the legislative proceedings was no longer enforced. *The London Gazette* still remained the leading newspaper and set the fashion to its juniors, but it was already being relegated to that background in which it is now comfortably established. The founding of the Royal Society by Charles II and his scientific friends led to the publication, in 1681, of an illustrated periodical, called *Philosophical Collections*, by Moses Pitt. This may be claimed as the first example of technical journalism.

It is a curious fact that the early history of *The Times* is associated with that of the United States. The founder, John Walter, was a London merchant who was ruined by underwriting ships during the War of Independence. In order to retrieve his fortunes he started a printing business, receiving the support of his friends and his creditors, to whom he had proved himself an honorable man. He had a scheme for using type consisting of whole words or syllables instead of single letters, and it was to use this logographic printing that he started a newspaper called *The Daily Universal Register*, on January 1, 1785. Three years later, in the year when the independence of the States was formally recognized, he changed the name of his paper to *The Times*. He reduced the number of logotypes to 1500, and used this method for three or four years, when he was compelled by his compositors and the printing trade generally to abandon his pet scheme. His paper prospered. After him came other Walters, worthy men who maintained a fine tradition from generation to generation. Even to this day, when the family is no longer so dominant in the management, at least two Walters are to be found on the staff of *The Times*. But it to its editors that the paper owes its fame. John Delane it was who first gave this British newspaper a worldwide influence, and other editors, such as George E. Buckle, who retired recently, maintained the high standard of intellectual honesty that has kept *The Times* in the primacy of journalism. In its forty-thousandth number it gives that history of printing from which I have quoted, but the editor of *The Times* can fitly say: *Si monumentum requiris, circumspice*. No more appropriate monument to the art of printing need be instanced than *The Times* itself. In behalf of the oldest mining paper in America I offer my hearty felicitations, with the wish that the leading newspaper in our language may long continue to set a good example and wield a beneficent influence by means of that art and that craft of which for 125 years it has been a leading exponent.

ACCORDING to statistics published by *Moniteur de Pétrole Roumain*, the production of crude petroleum in Roumania during the first six months of the calendar year 1912 was 864,901 tons, or 171,548 tons more than during the corresponding period of last year. Moreover, this increase might have been further augmented had transportation facilities been better. There not being sufficient cars available, a number of wells were obliged to shut down.

The Grain of Igneous Rocks

By A. C. LANE

*Some rocks are coarse grained and some fine grained, just as grocers sell coarse and fine granulated sugar, but it is not at all necessary that all the different minerals that make up a rock should be of the same grain. This is not generally true. It is also quite possible that in comparing different parts of one rock mass, one mineral may be coarser, another finer. Whether this is so is a matter of observation. In any precise work the grain of one mineral must be considered at a time. Still it is a matter of common observation that some rocks like pegmatites have a generally coarse effect, others mineralogically alike, aplites say, are generally much finer grained.

The coarseness of grain of a given mineral may be determined by the linear dimensions of its crystals or by the areas covered by them in cross-section. Practically, it is generally more rapid and convenient to compare linear size,† though the areas appear to vary more directly with the slowness of cooling. The grain of a mineral may then be determined by taking the average of breadths of the grains. I have sometimes used the average of five of the grains (making sure of full-sized ones and not working on clipped corners, by taking the largest within a given area large enough to include numerous grains, like the field of view of the microscope, or a square centimetre, etc.). Another way of measuring the grain is by varying magnification. If one section, magnified five diameters, appears as coarse as another, we may say its grain is one-fifth as coarse. In the Isle Royale section most of the work was done with a micrometer eye-piece, one of whose divisions was about equal to 1/30 mm. So I took three observations, for by adding them and pointing off two places the result is the average dimension in millimetres.

The grain of the rock may be regarded as the grain of characteristic and dominant constituent minerals. If it be studied with relation to the margin of an igneous rock it is important that the mineral should be one which formed after the fluid rock magma came to rest. The last formed constituent is generally that which conforms more closely to the laws of cooling, for (1) heat given out by chemical rearrangement is less, and (2) even its own latent heat of crystallization is taken up largely by pre-existing minerals and thus disturbs the simple cooling effect less; (3) the abundance of granules already present tends to prevent undercooling and brings on crystallization promptly, as fast as the temperature drops so that it is possible; (4) initial irregularities in temperature are more likely to have been smoothed out. My most important and interesting results have been obtained on the augite which is the last formed essential ingredient of many of the traps—those that run about 48% SiO_2 and 10% CaO, such as are very common in the Keweenaw series. It is the cement or mesostasis.

DETAILS of the work of the Transvaal mines for the first half of the current year are as under:

Stamps at work	10,055
Tube-mills at work	263
Tonnage crushed	12,847,652
Total yield	$92,625,600
Yield per ton	$7.08
Costs per ton	$4.56
Profits per ton	$2.52
Total working profit	$30,948,000

About 63% of the gold recovered by Rand mines is caught on the plates.

*Excerpt from the Annual Report of the Board of Geological and Biological Society of Michigan.

†Rosival (Verh. Wien Geol. Reichs-Anst., XXXII, 1898, p. 143) has demonstrated that volumes are proportional to linear measurements of mineral grains in section, as A. N. Winchell has called to my attention.

Possibilities of the Mother Lode in Depth

By W. H. Storms

Obviously every mine must depend for its success upon the conditions, geological, physical, and economic, obtaining within itself. While no two mines are alike, though similar, yet, by comparison of various mines much can be learned that is of interest, and in this way deductions from the observed facts can more safely be made.

If there were but one or two mines developed throughout the length of the Mother Lode, it would scarcely be safe to assume that these were indicative of the possibilities of the other undeveloped mines on the Lode, as the examples might be unfortunately chosen; for at several places on the Lode large sums of money have been spent in a fruitless and, I may say, in some instances, hopeless search for profitable ore. While it is not given to anyone, no matter how experienced, to see far into

the ground, yet observing geologists and mining engineers have learned by experience that on the Mother Lode there are points where the hope of developing a profitable mine is slender, to say the least, while in other places the conditions are such as to invite exploration with a reasonable probability of success in the developing of a valuable mine. In this the ore deposits of the Mother Lode are peculiar. The generally recognized limitations of the extent of the Mother Lode are from the vicinity of the old village of Bridgeport, in Mariposa county, in a northwest direction to near the northern boundary of Eldorado county, a distance of about 120 miles.

If, in traveling the length of this great Lode, it is found that every mine that has been largely profitable exhibits a noticeable set of conditions, and it is also observed that every unprofitable property is environed by another set of conditions opposed to and unlike the first, it must be concluded, whether willingly or not, that in undeveloped ground where the conditions which have been recognized as unfortunate are present, the proposal to undertake the development of this piece of ground would naturally be looked upon as extremely risky, or at any rate, as involving a risk greater than might be anticipated in a locality where the physical conditions were of that type known to be constantly associated with those mines which have been profitable.

Since certain physical conditions are known to be the accompaniment of valuable mines, the pertinent question is, what are these desirable conditions? Briefly, every profitable ore-shoot outcropping on the Mother Lode is situated either on a smooth unbroken hill, or on a nearly level tract of land, not cut by transverse ravines. In considering this phenomenon it is necessary to distinguish between ore-shoot and mine, for a mine may have several ore-shoots. It has been noted by myself and others that on the Mother Lode no ore-shoot, *at the surface*, crosses a gulch or depression, though an ore-shoot outcropping on a hill may, in its downward trend along the plane of the fissure in which it occurs, pass *in depth* beneath a neighboring ravine. The only explanation I have to offer for this phenomenon is that gulches, ravines, and depressions at the surface are usually the physical expression of geological disturbances beneath the surface. The primary cause may have been a fault or a fold, or it may be due to the fact that the rocks have been somewhat softened by crushing as a result of compressive stress.

Thus far, throughout the length of the Mother Lode, no very profitable mine has been developed in a locality where the surface is cut into a series of short ridges by ravines crossing the strike of the Lode. It is needless to mention the mines on the Mother Lode that are characterized by the favorable indications referred to, as every largely profitable property, beginning with the Princeton in Mariposa county, and as far north as the Union mine in El-

KEYSTONE MINE, AMADOR.

dorado county, without exception, is situated on a hill or on a flat, uncut by gulches or transverse depressions; or, if such occur, the ore-shoots lie between them. Careful investigation fails to find a profitable mine in a locality where the Lode passes through a series of short broken hills. Ore-shoots may, and do, occur in these localities, but they are short and generally do not justify the extensive work and equipment necessary to their development and exploration.

For years an effort has been made to determine, if possible, whether there is any uniformity or system in the distribution of ore-shoots in the great fissures of the Lode, but I have been unable thus far to discover any regularity whatever in the occurrence of bodies of workable ore. However, it may be said that in most of the mines the profitable ore was first found some distance below the surface, though there are several noticeable exceptions. Generally the zone of profitable ore was entered at 100 to 600 ft. below the surface; and in one instance—that of the main orebody of the Central Eureka mine, near Sutter Creek—the shaft was sunk in the fissure to a depth of 1000 ft. before workable ore was found. At the Union mine in Eldorado county the first pay-shoot occurred at the surface, though there were several shoots down to the 1700-ft. level. At the Plymouth Consolidated mines, in Amador county, the first ore-shoot outcropped at the sur-

face, but within 100 ft. it became poor again, the shaft passing through an impoverished zone to a depth of about 600 ft., where rich ore was found that continued to a depth of 1600 ft., the shoot producing, it is reported, $10,000,000. The depth of the shaft is 1700 ft., the lowest level being at 1600 ft. A disastrous fire in the lower levels about 1889 caused the suspension of all operations in these mines for many years. This famous property is now being reopened by Bewick, Moreing & Co. of London.

At the Gover mine of the Fremont Consolidated company ore occurred at the surface and extended to the present lowest level, 1650 ft. (1280 vertical). Sinking is in progress in the inclined shaft. The Fremont Consolidated has produced in excess of $5,000,000. The property has had a varied career, having been repeatedly closed in its earlier history, never having been properly equipped before coming under the present management.

The Bunker Hill property, near Amador City, has also had an interesting career. For years it was opened and closed by one company after another, none of which did well, assessments being far more conspicuous than dividends, until about eight years ago, when the present manager took control and drove a cross-cut into the hanging wall and there found a vein not previously known to exist. Fortunately, he cut the vein in good ore, and the Bunker Hill mine soon thereafter became one of the important producers, and one of the most profitable on the Mother Lode, and still continues to be. The mine is about 2000 ft. deep, with every indication of continuing to very much greater depth.

The Keystone mine at Amador City was among the first quartz mines worked in California. It was first known as the Ministers mine, being owned by a number of clergymen, but they were unable to make it pay. It passed from one to another with varying fortune, until it came into the ownership of James McDonald, who worked it successfully for many years, the mine producing, according to what is considered competent authority, upward of $17,000,000. The greater portion of this large sum came from the veins in the black clay-slates. The shaft reached a depth of 1575 ft. (1200 ft. vertical), and all who know this famous old property agree that it should be explored to greater depth. Sinking is now in progress.

The Lincoln mine at Sutter Creek has a record of $2,500,000, paid from the surface to a depth of 350 ft., but at that level the vein was intersected by a fault, beneath which the vein has apparently not been rediscovered, although extensive workings have been opened to a depth of 2000 ft. The fault in the Lincoln mine is the most extensive that has thus far been discovered on the Mother Lode.

The Wildman-Mahoney mine adjoins the Lincoln on the south. In this ground the vein splits into two branches, one of which passes into the Lincoln ground. On the Mahoney, and on the north end of the Wildman, the ore came to the surface, where it was worked in large open-cuts. This zone extended to a depth of 300 to 400 ft. Between this and the lowest level, at 1400 ft. (1200 ft. vertical), were found several shoots or masses of ore, some of them of large size, though for most part low grade. In the south end of the 1400-ft. level, it is stated, on what I believe to be good authority, that there is a mass of low-grade ore 170 ft. in width, though its other dimensions are unknown. This property is said to have produced $3,500,000, and if properly equipped to operate on a large scale would no doubt prove to be valuable at greater depth.

The Eureka Consolidated mine at Sutter Creek has been the richest mine on the Mother Lode, according to report. It was discovered in 1850, and soon thereafter came into the possession of Alvinza Hayward, who undertook its development, but who for some time met with disappointment, as the ore within 200 ft. of the surface was unprofitable (at that time). However, he persevered, and at about 200 ft. in depth the ore improved and he was soon working the most profitable mine in the state. The ore continued to a depth of about 1750 ft., the single shoot producing $20,000,000. The deepest workings in this property are at 2200 ft., this being at the bottom of a 200-ft. winze sunk from the 2000-ft. level. The hanging wall of this vein is massive greenstone (tuff); the foot-wall is clay-slate. The ore-shoot was 500 to 600 ft. long at the 1100-ft. level. It is reported that the ore down to 500 ft. did not mill over $10 per ton, though much of that below the 500-ft. level averaged $30 per ton and over.

The Central Eureka mine adjoins the last mentioned property on the south. In its early history it was known as the Summit mine. Near the north end of the mine was found a small shoot of ore which in its downward trend pitched into the adjoining Badger claim of the Eureka Consolidated company. It did not go to great depth, according to report. (See Tenth Report, State Mineralogist of California, p. 104). This ore was low-grade at the surface, but at 165 ft. was worth $25 per ton. The vein became so small in depth that it was finally abandoned. After an idleness of many years, the property was reopened by an incorporated company known as the Central Eureka Gold Mining Co., about 1894. A shaft was started several hundred feet south of the workings above referred to, and this shaft was sunk in the fissure to a depth of 1000 ft. or more, before any workable ore was found. At about the depth mentioned, three short and narrow shoots of ore were cut, but at the 1200-ft. level these shoots were found to have become longer, the ends overlapping, and from that level downward, to below 2400 ft., they constituted a large and profitable body of ore, from which substantial dividends were paid for several years. The end-lines of this property, as originally located, were convergent in the direction of dip, thus limiting the area and extent of operations, but the company has recently acquired additional territory adjacent to the original holdings and has resumed operation on a large scale.

Joining the Central on the south is the South Eureka, now one of the noted mines of the Mother Lode—noted for the reason that after years of an unprofitable existence, and the levy of 58 consecutive assessments, a fortunate discovery was made of a valuable body of ore. This discovery was made in a cross-cut driven west on the 2700-ft. level and at a distance of about 200 ft. west of the shaft in order to secure filling for the stopes. Development work was at once undertaken and has been successfully continued until the present, level after level being opened through cross-cuts driven from higher levels, these being started in the vicinity of the shaft. The extent of this shoot of ore has not yet been fully determined. It may go to the surface, though should it be found to do so it will prove the anomaly of the Mother Lode. One important fact in this connection points a lesson. During the term of management of the late J. F. Parks, he caused a cross-cut to be driven west from the main workings at the 500-ft. level. This cross-cut passed through a fissure in the clay-slate which was characteristic of the Mother Lode, but which *at that point* contained no ore. No lateral development was undertaken. The lesson to be learned from this circumstance is that ore-shoots are not without limitations, either as to length, height, or depth. In Mother Lode mines, as elsewhere, it is quite possible to drive levels above and beneath ore and to sink or raise beyond their horizontal limits, thus surrounding the shoot in the plane of the vein without disclosing the presence of profitable ore. A manager who cross-cuts and finds a fissure which at the place of intersection shows no ore, but which fissure is otherwise of promising appearance, is fully justified in driving, sinking, and raising in the fissure in search of a shoot of ore. Indeed, in my opinion, it is a serious mistake to fail to do so. Both the South Eureka and the Bunker Hill mines are unusual in that their ore-shoots are being developed from great depth upward—the South Eureka from 2850 ft., the Bunker Hill from about 1900 ft. Ordinarily the development of a mine proceeds from the surface downward.

The Oneida mine is between the South Eureka and the Kennedy mines and has recently been acquired by the former company. The Oneida was extensively worked in early days, having been discovered in 1851. J. Ross Browne reported ('Mineral Resources of the United States West of the Rocky Mountains, 1868,' pp. 74-75) that the ore-shoot was 300 ft. long at the surface, and 400 ft. long at a depth of 400 ft., and that the average yield was $17.50 per ton. The mine has seen several periods of prosperity and of idleness, and although not at present in operation, it is highly probable that the Oneida mine will still yield a large amount of gold, as the South Eureka company will undoubtedly drive its levels southward into the Oneida ground, and I anticipate with satisfactory results, for the reason that there are two or more veins of very promising appearance on which little or no development has been done. In this property, as in the others mentioned, the ore-shoots were not continuous in depth, but succeeded each other, to the lowest level, about 2200 ft. from the surface.

The Kennedy mine is one of the most noted gold mines of the world, not because of its richness, but from the simple fact that its management has been sufficiently progressive to sink the shafts through barren or unprofitable zones, after leaving those of largely profitable ore at higher levels, until these shafts have reached a depth greater than has been attained in any other gold mine in America. The present lowest level is 3450 ft. vertically below the collar of the main shaft, which is about 150 to 200 ft. lower than the outcrop of the vein on the hilltop. The main shaft has a present depth of 3654 ft. The result of this enterprise on the part of the Kennedy company, which, as indicated above, has with the other mines of the Mother Lode seen its dark days, has been to demonstrate not only that the fissures of this great lode persist to great depth, but that ore as profitable as ever was found in the mine at higher levels, has been developed in the lowest workings, at depths ranging from 3000 to 3450 ft. vertically below the surface (equivalent to about 4500 ft. on the dip of the vein). As previously stated, the Kennedy mine has had its vicissitudes. In its early history, during the sixties, the work was confined to that portion of the vein within 700 ft. of the surface. A quartz outcrop extends along the summit of the hill, marking the course of the vein, but this outcropping quartz is poor in gold and may still be seen in place. Somewhat deeper, however, good ore was found, and the early miners exploited the vein to a depth ranging from 300 to 700 ft., the former depth being near the North inclined shaft, the other near the South shaft. At these depths, and along a line connecting them, the quartz disappeared, only a fissure filled with gouge remaining. This fissure was strong, and continued in its course, both longitudinally and in depth. At 950 ft. in the South shaft, quartz again appeared in the fissures and continued for many hundreds of feet, forming a very valuable shoot of ore. Near the North shaft the quartz did not reappear in the vein until a depth of 1400 ft. had been reached, but from that level it continued downward for several hundred feet. There were two distinct ore-shoots in this portion of the mine in which there was a marked dissimilarity, though both were largely profitable. In the vicinity of the 2000-ft. level the condition of the mine was far from satisfactory. There was always some ore, but much of it was too low in value to meet the cost of mining and milling it. However, on the 2100-ft. level a vein was found which was a great surprise, as it came from the westward, from the foot-wall greenstone, in which direction nothing was expected. This vein proved to be profitable, and was perhaps the salvation of the mine, as it gave the company the much-needed courage as well as the means to continue the exploration of the great vein at still greater depth. Each year the workings were advanced to increasingly greater depth, the zone of impoverishment being at length passed, when it was found that below 2500 ft. the ore was again quite as good as that on any level above. The fact that the monthly output of the Kennedy mine with 100 stamps is nearly $100,000, all ore coming from below 2500 ft. vertical depth, is far more significant than any other argument that can be advanced in favor of deep mining on the Mother Lode of California.

The Argonaut mine joins the Kennedy on the south and is similar to it geologically and otherwise. The upper part of the main vein was not profitable in this mine above 400 ft. from the surface, but from that level downward for 1000 ft. or more the mine paid handsomely; but like its neighbor, the Kennedy, it had its zones of low-grade ore and through these the workings had to be driven, in depth as well as horizontally. At present the Argonaut is working a splendid body of ore in the vicinity of the 3300-ft. level (inclined depth), being the next deepest mine to the Kennedy on the Mother Lode.

The Gwin mine, in Calaveras county, is one of the most interesting of the Mother Lode properties, having produced several millions of dollars. The statement is made in the sixth report of the State Mineralogist of California, page 32, that the value of the ore in the early history of the Gwin mine was $8 per ton in free gold, besides which there was about 2% sulphides worth $100 per ton. The first ore-shoot discovered in the mine outcropped at the surface, and was worked to a depth of about 1500 ft. The second shoot was discovered while driving north on the 1200-ft. level, and proved to be a more important ore-body than the first. It seems, from what can be learned of the early history of the mine, that the management was, if not incompetent, at least improvident, and after a

KENNEDY MINE.

number of years of successful operation the mine was closed and remained idle for a long time, being reopened in 1892, when a vertical shaft was sunk to reach the vein below the old workings. For several years this enterprise was successful after reaching the vein, but in time, like the others, a zone of ore too low in grade to be workable, was entered, and the struggle for existence began which ended in the mine being closed indefinitely, notwithstanding a decided improvement in the value of the ore in the lowest level, at 2650 ft. vertically below the surface. It is my belief that the Gwin mine, with deeper development, will again become a valuable mine.

One of the most famous mines of California in the early days, and remembered still for its large output, was the Princeton, in Mariposa county. In many respects the Princeton resembles the Plymouth Consolidated mine, the Gwin, and also the vein in the South Eureka which has brought fame to that property within recent years. The Princeton vein occurs in a ridge of clay-slate, striking northwest. On the highest part of the ridge the vein outcropped for several hundred feet, but the ore was of only moderate grade, too low to afford a profit in those early days. At a depth of 100 to 150 ft., however, the ore was found to be much improved, and from that level to a depth of 600 ft. the Princeton output, according to official report, was over $4,000,000. The work was not carried far below the zone of profitable ore at that time, but the levels were extended some distance beyond it. The mine was closed and remained idle for many years, but was reopened in 1900 and fully equipped with hoisting and milling machinery. Since that time the output of the

Princeton mine has been swelled by a sum in excess of $1,370,000, making a total output considerably above $5,000,000. The operations of the past ten years have shown the presence of much good ore, which has occurred here and there throughout the mine, but the average grade has been disappointing, so much so that the mine was closed, though, as it appears, not by unanimous consent of all interested. The Princeton vein possesses to a marked degree many of the peculiarities of Mother Lode mines. It occupies a fissure of great persistence, both of horizontal and vertical extent; there are occasional branches into the walls, a feature quite common in these mines; it has its zones of rich ore and those that are poor; a gouge is commonly present on one wall or the other, and there are many minutiae of its appearance which stamp it as a fissure of the Mother Lode series. That which appeals to me most strongly is the unbroken continuity of the vein on the lowest (1600-ft.) level. Here the vein is 6 to 8 ft. wide for a distance of 1500 ft., an unmistakable evidence of the strength and probable continuity of the vein. The depth reached in the lowest workings, 1600 ft., is almost shallow as compared with the workings of several of the most successful mines of Amador county. This is only 1250 ft. vertically below the surface at the bottom of the main shaft, which was stopped at 1660 ft. Comparing this with the Kennedy's lowest working level at 3450 ft. vertically, it is seen that the Princeton is scarcely more than one-third as deep as the former.

In reviewing the facts here presented, I think the following conclusions may safely be deduced:

1. All of the profitable mines of the Mother Lode of California have zones of good ore, and zones that were too low in grade to be workable, and that these zones are not uniformly distributed.

2. There is no great difference in the elevation of the collars of the shafts of the mines mentioned, all occurring at from 1100 to 1600 ft. above sea-level, with the exception of the Princeton, which is over 2250 ft. above the sea, or from 650 to 1000 ft. higher than the other great mines of the Mother Lode.

3. The upper zone of rich ore has been found to occur at any level between the surface and 600 ft. (in one instance, at the Central Eureka, at 1000 ft.), but there seems to have been established no definite depth at which rich ore has been replaced by that which is poor, nor at what level poor ore may be expected to be replaced by that which is rich. In fact, it has been demonstrated that good ore occurs at all depths between the surface and a vertical depth of at least 3450 ft., as proved in the Kennedy mine.

4. Proper geologic conditions seem to be more important than all other considerations, and where these are present there is every reason to anticipate the recurrence of rich ore in the fissure to a depth as great as it lies within human possibility and mechanical means to reach.

5. A mine having once been profitable may be expected to become so again in depth (provided the vein be not lost by faulting as at the Lincoln mine), as instanced by the development of nearly every important mine on the Lode.

Iron Mining in Chile

The budget of Chile provides for an expenditure of ₱100,000, to be used in continuing the work of mapping out the iron deposits of the Republic, some work having already been done in the province of Coquimbo in 1911. In Coquimbo there are five groups of iron deposits, situated to the north of La Serena, known as Maitencillo, El Trigo, El Romeral, Las Escobas, and Los Hornos. These five groups are estimated to contain 200,000,000 tons of iron ore. Iron deposits are also found in Atacama, and in the department of Vallenar and Freirina. A conservative estimate of the ore contained in these is 30,000,000 tons. Investigations are also being made of the iron resources of Antofagasta, which are known to be considerable.—*Pan-American Union.*

Gold Mining in the Philippines

The Luzon Gold Co. is engaged in placer-mining operations in the hitherto almost unexplored region lying along the Umiral and Angelo rivers partly in each of the three provinces of Tayabas, Nueva Ecija, and Rizal, according to the *Philippines Free Press.* The Angelo river is a branch of the Umiral, which empties into the Pacific ocean at Dingalan bay, about eighty miles to the north of the port of Mauban. The ground on the Umiral river below the mouth of the Oyongan is controlled by Australian people, who were interested in the project by R. W. and C. D. Squires, of Manila, and who are constructing a dredge. The ground has been prospected and the average value has been estimated at 35c. per yard. The returns of the Colorado Mining Co., operating a 20-stamp mill at Aroroy, Masbate, are said to have been satisfactory during the past eight months.

The most important project in Paracale at the present time is the Gumaus dredge, the construction of which was begun some months ago on the Gumaus river under the direction of H. Patterson, representing the New York Engineering Co. The dredge will be in operation soon. The Philippine Exploration Co., owning this property, expects to handle 90,000 cu. yd. of earth per month with the new dredge, and the output of bullion should be above ₱50,000 per month.

The old Stanley dredge, which has been idle for two years, has been taken over by a new local syndicate known as the Maximall Gold Dredging Co. The hull has been thoroughly overhauled and found to be in fair condition, and the company expects to begin operations in October with F. W. Pearson as dredgemaster.

The Australian syndicate, which is operating the old Paracale dredge on the Paracale river, has two dredges under construction, both of which will be operated in the Paracale river basin. The first should be completed by the end of the present year and the other a few months later. The combined capacity of the two dredges, it is claimed, will be 100,000 cu. yd. per month. The old Risdon dredge on the Maliguit river under the supervision of John A. Bruce, is still producing regularly about ₱11,000 per month. Judge Frank B. Ingersoll and A. J. McDonald are planning to place a 5½-cu. ft. dredge of the close-connected type on the Maliguit river in addition to the old one now operating. Several of the Benguet properties, including the Headwaters with its 10-stamp mill, are operating steadily. It is stated that a hydraulic plant will be put on some claims in Surigas by the Surigas Gold Mining Company.

Syria, besides being rich in land, is also reputed to be rich in minerals. Gold, silver, iron, lead, and almost all the important metals are found; also coal, bitumen, and petroleum, but there are no expert mineralogists in this country to investigate them. To extract these metals it is necessary to obtain a license from the Government, for which a special tax is paid, according to the nature of the metal looked for. This tax varies from $243 to $973, in proportion to the area of land to be excavated, and for every 10,000 square metres an extra tax of 10 piasters (35c.) is taken. Where metals are found, 5 to 20% of the total goes to the Government treasury. A native company was formed this year to search for minerals and purchase lands supposed to contain them. A German engineer was employed, lands were bought at Ajloun, a town 50 miles south of Damascus, and a concession was obtained for the extraction of metals, as well as phosphates, which are abundant in that district. An English company has likewise been established, with a large capital, to prospect for petroleum in the Arak. It is expected to start operations soon. It is said that at Muzeireeb, at the end of the French railway, there is a petroleum well which was discovered through the smell of the oil in the spring there.—*Daily Consular Trade Reports.*

Iron in Mill Pulp

By A. McA. Johnston

*At one time ordinary cyanide practice in the mills of the Rand included concentrating to a rich product which was cyanided separately and which yielded, after many days' treatment, a fair proportion of its gold to the extractor boxes and incidentally added a considerable quantity of ferro and sulpho-cyanide to the solutions. The practice has of late years been superseded by treatment of this product with the sand and the presence of iron in cyanide solutions has thus not been so noticeable. Incidental, however, with the introduction of coarse screening and the beneficial effects of the tube-mill circuit (Dowling, 'Rand Metallurgical Practice,' pp. 123-129), a state has arisen, which, although present previously, has been emphasized by the existence of this circuit. A quantity of iron is present in the circuit, and remains there, it may be, for a very long period.

Iron is obtained in the crushed product from several sources. These may be tabulated as follows:

Ore.

(*a*) Metallic iron in the ore itself.

In a deep deep-level ore, iron has been found in the metallic state amounting to 0.013% of the ore.

Mine.

(*b*) Iron from wearing of the drills—either fine or in chip form.

(*c*) Iron from broken drills.

(*d*) Iron from bolts, nails, or pieces of scrap introduced underground. Hammer-heads are also a not unknown product in the ore sent to the mill.

Mill.

(*e*) Iron from wear of steel bins, chutes, and feeders.

(*f*) Iron from wear of mortar-box liners.

(*g*) Iron from wear of shoes and dies.

This has been stated to be about half a pound of iron per ton of ore crushed (Dowling, 'Rand Metallurgical Practice,' p. 132).

(*h*) Iron from screens used in mill.

(*i*) Iron from keys, etc., accidentally dropped in mortar-box.

Tube-mill.

(*j*) Iron from wear of feeders and of end liners.

(*k*) Iron from iron or steel liners, rails, or pegs used in the tube-mill.

(*l*) Iron from nails and scrap accidentally dropped into the circuit.

The iron from these various sources may be classed into two kinds, namely, that in a very fine state of division, due to its formation by abrasion, and that in coarser or pellet-like form, due to chipping, breakage, or accidental inclusion in the pulp. In mills where fine crushing is still in vogue, the percentage, per ton of pulp, of iron in a fine state will, naturally, exceed that found in mills where coarse crushing has been adopted, while again the removal of the larger pieces of iron from the motar-boxes, along with the die sand, owing to their inability to escape therefrom in the pulp, will in the former case lower the amount of this class of metallic iron in the tube-mill circuit.

The specific gravity of the iron, when compared with that of the ore, renders it more liable to remain in the tube-mill circuit. It may continue there for some time, till at last, through some fortuitous circumstance, the finer portion is carried to the cyanide plant with the pulp, while the coarser particles continue their weary round till abrasion has rendered them in a fit state to follow. This iron in the tube-mill circuit affects the working in various ways. These may be summarized as follows:

(*a*) The coarser particles are liable to scour the plates and cause loss of mercury. The mercury may later on be recovered from the launders, pumps, or traps, or it may be lost by flouring and consequent escape into the cyanide plant.

(*b*) In conjunction with the pyrite, the finest particles are likely to lie on the plates and so cover the amalgam that amalgamation will be interfered with and more frequent dressing of the plates necessitated.

(*c*) Again, owing to the heavy nature of these particles, it may be advisable to supplement the flow of the water over the plates or increase the grade of fall in the plates so as to diminish the tendency to interfere with amalgamation.

(*d*) The metallic iron is very apt to rob the plates of mercury by cohesion. This can be easily verified by visual inspection of the larger pieces, while microscopic examination of even the finest particles shows occasional specks of mercury.

(*e*) Owing to its retention in the tube-mill circuit, the iron causes additional expense in tube-mill work, due to its weight and the necessary addition of water to increase the flow.

(*f*) As a considerable quantity of this iron is in pellet form, its inclusion in the tube-mill product means less efficiency in the crushing process, for the pebbles, instead of crushing the sand, expend energy in flattening the iron. An examination of the product will show justification for this claim.

The fine iron which has overflowed into the cyanide pulp will, when the cyanide solution is pumped on the charge, be in one or other of the three states: metallic iron, ferrous oxide, or ferric oxide; the two latter being partly present in combination with water as hydrates. Iron in rusting forms an external covering of ferric oxide, with, underneath, a layer of ferrous oxide in contact with the metallic iron. Oxidation continues until the metallic iron has been converted into ferrous oxide and this eventually into ferric oxide. It is well known that ferric hydrate or ferric oxide does not form ferrocyanide with cyanide, and generally speaking, this covering over the iron protects it from the action of cyanide. The rubbing of the particles of sand on this, however, may break the protective coat so that the cyanide eventually reaches part, at least, of the ferrous oxide and metallic iron. Though the action of cyanide on iron vats or extractor boxes is so small as to be negligible from a practical standpoint, we must remember that the iron entering the plant with the pulp is in a fine state of division and therefore the more liable, not only to react with the cyanide, but to be changed into ferrous hydrate or ferrous sulphate, which are easily converted into ferrocyanide.

Thus the fine iron entering the cyanide plant may form, in contact with the cyanide solution, sodium ferrocyanide as follows:

$$6NaCN + Fe + 2H_2O + O = Na_4Fe(CN)_6 + 2NaOH + H_2O$$

$$6NaCN + FeO H_2 = Na_4Fe(CN)_6 + 2NaOH$$

and $$6NaCN + FeSO_4 = Na_4Fe(CN)_6 + Na_2SO_4.$$

The sodium ferrocyanide thus formed acts prejudicially on the solution of the gold, since it is a reducer and depletes the solution of oxygen (MacFarren, 'Cyanide Practice,' p. 43).

In addition to this effect of fine iron and its derivatives on cyanide, it is to be remembered that ferrous sulphide is produced when grinding pyrite between iron surfaces, $FeS_2 + Fe = 2FeS$, which latter is detrimental to gold-bearing cyanide solutions (Caldecott, 'Rand Metallurgical Practice,' p. 383). The same reaction would naturally take place in the tube-mill, when the sand and the metallic iron are being crushed by the pebbles.

These influences may appear of little importance in ordinary work and may be overlooked, but if it is remembered that in a solution entering the strong extractor boxes there has been used 326 lb. of sodium cyanide to hold in combination 0.02% $Na_4Fe(CN)_6$ in 1000 tons, the advantage of removing as much iron as possible from contact with cyanide solution, when it is in such a state that it will be attacked, is evident.

*Excerpt from a paper submitted to the Chem. Met. & Min. Soc. of S. A., on August 17, 1912.

To eliminate this iron from the tube-mill circuit a magnetic separator was installed under the direction of A. C. Holtby, assistant mechanical engineer to the Consolidated Gold Fields. After running a few days a representative sample, or as near such as could be obtained, owing to the nature of the material, was taken, and the following tests conducted thereon. It was found that a considerable quantity of non-magnetic material had been caught, owing probably to mechanical adherence in the wet state to the magnetic portions.

Microscopic Test.—A microscopic examination showed the finer portion of the sample to contain its gold in minute nuggety form, mostly adhering to comparatively large pieces of quartz. A considerable amount of pyrite was present in the finest part, though this portion contained little, if any, amalgam or mercury.

Assay Value of 14.50 Dwt. Per Ton

Grading Test Aperture.	Per cent.	Cumulative, %	Assay V, dwt.
+ 0.276	0.47	0.47	trace
+ 0.122	7.10	7.57	27.4
+ 0.103	2.87	10.44	20.0
+ 0.063	5.77	16.21	18.6
+ 0.033	12.90	29.11	37.2
+ 0.020	15.40	44.51	14.4
+ 0.015	11.17	55.68	12.6
+ 0.010	26.03	81.71	20.0
+ 0.016	13.76	95.47	44.4
− 0.006	4.53	100.00	136.0
	100.00	Calculated	29.12

This grading test shows that the + 0.010-in. aperture, amounting to 81.71% in weight, contains 41.1% of the gold, and the −0.006-in. aperture material, 4.53% by weight, contains 21.1% of the gold.

Magnetic Test.—A portion of the sample was separated by means of a magnet into magnetic and non-magnetic parts.

	Per cent.	Assay Value, dwt.	Total Gold in Sample, %.
Magnetic	73.5	1.6	8.3
Non-magnetic	26.5	48.8	91.7
	100.0	Calculated 14.1	100.0

It will be seen from this test that were it possible to entirely separate the magnetic from the non-magnetic, 91.7% of the gold would be retained in the latter.

Cyaniding Tests, both before and after roasting, gave very low extraction—from 2 to 4% of the gold. In these tests a very considerable amount of sodium ferrocyanide was formed. An analysis of another sample somewhat similar to the above showed:

	Per cent.
Iron (metallic)	87.4
Ferrous oxide	3.7
Ferric oxide	1.2
Pyrite	2.5
Silica	4.8
Moisture (at 100°C.)	0.2
	99.8

After the magnetic separator had been working about three months, a large sample, amounting to about a ton in weight, was taken for experimental purposes. This was piled in a heap on a flat clean surface where it was exposed to the action of the atmosphere. The weather was dry and cold during the three months of the test. The pile was turned over daily, while each alternate day it was thoroughly wetted, and once a week the water added contained 10 lb. of commercial salt. During the earlier part of the treatment considerable heat was evolved, due to the oxidation of the iron and the pyrite. Some temperature readings about 6 to 10 in. below the surface indicated from 160 to 170°F. At the end of four weeks a sample was taken from the lot and analyzed after being quickly dried on a hot plate.

A. Grading. Per cent.

+ 0.006 in	1.07 (chiefly metallic iron)
− 0.006 in	98.93
	100.00

Analysis.	Per cent.
Silica	9.14
Alumina	trace
Lime	trace
Magnesia	trace
Iron (metallic)	1.59
Ferrous oxide	9.96
Ferric oxide	73.24
Pyrite	3.06
Moisture (at 100°C.)	1.29
	98.28

From this it will be seen that the bulk of the iron present as metallic iron has been converted into iron oxide. A portion of the sample was amalgamated by being shaken in a bottle with mercury for 12 hours.

	Dwt. per ton.
Assay value of original	6.1
Assay value of residue	3.8
Extraction by amalgamation	2.3
	= 37.7%

The treatment of continued exposure to the atmosphere and with occasional wetting with water plus one spraying with a solution of 0.01% sulphuric acid, was continued for four more weeks. The analysis and amalgamation tests on this are given in B. After a further four-weeks treatment with spraying and turning over, the pile was again sampled and analyzed. The results are given in C.

Grading.	B, %.	C, %.
+ 0.006 in	2.70	0.94
− 0.006 in	97.30	99.06
	100.00	100.00
Analysis.		
Silica	11.13	10.51
Alumina	trace	trace
Lime	trace	trace
Magnesia	trace	trace
Iron (metallic)	3.04	1.04
Ferrous oxide	8.06	8.11
Ferric oxide	71.82	75.23
Pyrite	3.00	3.30
Moisture (at 100°C.)	1.60	1.00
	98.65	99.19

The larger percentage of + 0.006-in. pieces of metallic iron in B is due to the inclusion of one or two large particles. It is to be noted that all the sulphur has been calculated as pyrite. Portions would of course be present as sulphate and also as ferrous sulphide. The main object of the analysis was to obtain a general idea of the degree of oxidation of the iron.

C. A portion of this sample—that is, after 12-weeks exposure—was taken and amalgamated in a bottle for 12 hours with occasional shaking.

	Dwt. per ton.
Assay value of original	6.1
Assay value of residue	3.9
Extraction by amalgamation	= 36.0%

The residue from amalgamation was then cyanided (without previous drying) in a large bottle with occasional agitation. Time of treatment 36 hours, plus 24 hours for water washing.

	Dwt. per ton.
Assay value of washed residue	1.7
Extraction by cyaniding	2.2
Total extraction by amalgamation and cyaniding	4.4
	= 72.1%

The cyanide solution, 3 parts of solution to 1 of ore by weight, showed:

Originally,	0.165% KCN,
	0.065% NaOH.
After 36 hours treatment,	0.093% KCN,
	0.014% $K_4Fe(CN)_6$,
	0.009% KCNS.

The general conclusion to be drawn is that it is advantageous from a working, amalgamating, and cyaniding point of view to remove the metallic iron from the tailing. It can easily be oxidized by wetting and exposure to the atmosphere, but care should be taken that it be turned over and disintegrated daily, or at least each alternate day, so as to avoid the formation of lumps, until the greater part of it has been converted into the oxide. Generally speaking, this means until there is practically no more heat generated. Without this, the mass will form into hard cakes or pieces difficult to break up and slow to oxidize. Even with daily handling, little nodules form, the interior of which may consist of metallic iron and

ADDITION TO NIKKO ELECTROLYTIC REFINERY.

ferrous oxide, and may remain thus for some considerable time. The presence of silica, of course, helps materially in rendering the mass more porous and hence the more easily oxidized. When large pieces of iron in the form of bolts, nuts, or nails are present, the process would necessarily require a more lengthened period than is shown above.

It will be noticed that salt was used to assist in the oxidation process. It is a moot point whether this is necessary with this class of material. Personally, I should expect almost as quick results without its use. It is to be noted in conclusion that during the initial stages of the running of this separator, nearly a ton of magnetic iron, with silica and pyrite mechanically removed, was taken from the circuit daily. This has gradually decreased until after over six months running the daily yield of magnetic iron from a mill crushing 2500 tons per day is about 400 to 600 lb., or one pound per 5 tons of ore.

Summary.—The main points to be noted may be summarized thus:

(*a*) Iron is chiefly obtained in the tailing from the crushing plant, and is mostly present as small pieces, smaller than a pea, or as fine powder.

(*b*) Iron in this stage interferes with amalgamation and with the re-crushing in the tube-mills, and also consumes cyanide in the leaching vats.

(*c*) When removed from the pulp, this product can be easily oxidized by exposure to the atmosphere, wetting, and turning over.

(*d*) Failing any better means of disposal, this oxidized product will, if fed into the circuit, yield an average percentage of its gold to amalgamation and cyanidation.

OUTPUT of coal in New South Wales last year was 8,691,604 tons, compared with 9,147,025 tons for 1908.

Electrolytic Copper Refining at the Nikko Copper Works

By TETSUTARO HASEGAWA

The electrolytic refinery at Nikko was built in 1905 to refine the copper from the Ashio mine of the Furukawa Mining Co., and absorbed the older Honjyo plant at Tokyo. It is owned by the Furukawa company and serves to refine the blister copper produced at the various mines of that company. The growing demand in Japan for copper wire and other merchant forms of the refined metal has afforded a steady market, and the trade-mark of this plant is now well known throughout the Orient. The first plant was built upon the series system, and a brief description of it appeared in the *Mining and Scientific Press* of October 14, 1911.

To meet the demand for increased output, an addition to the refinery has recently been constructed, of reinforced

INTERIOR OF ELECTROLYTIC REFINERY.

concrete, after the Kahn system. This is shown in the accompanying illustrations, and contains 108 vats in 12 groups of 9 vats each. In this case the arrangement patented by Walker is used. The vats are made of wood and lined with 8-lb. sheet lead. A group of 9 vats is 9 ft. by 30 ft., and 4 ft. deep. The anodes used are 2 ft. 3 in. wide, 3 ft. long, and 1¾ in. thick, while the cathode strips are 2 ft. 4 in. wide, 3 ft. long, and 1/32 in. thick. A single vat will hold 18 anodes and 19 cathodes, spaced 4 in. centres.

At present the anodes are left in the vats about 21 days and the cathodes 7 days. The current density used is 20 amperes per square foot. The solution enters at the top of the vat and escapes at the bottom, the rate of flow being 100 cu. ft. per hour. The best results are obtained where the electrolyte is warmed to 40 or 50°C. The general arrangement of the plant can be seen in the illustration. The racks for the anodes are in the immediate foreground, just behind them are the tanks in which the anodes are washed, and to the rear of these are the racks for the cathodes. Behind these are the electrolyte vats, with the crane, of Whiting make, above them. The reservoir for electrolyte is seen to the right, in the prolongation of the line of the crane into the lower portion of the building, and the regenerators are seen in front. The annual output is expected to be 9,000,000 lb. of refined copper. The power-house is the small brick building, 54 by 36 ft., seen to the right in the illustration. Here a 450-hp. motor-generator set furnishes the current of 5000 amperes at 60 volts which is transmitted to the refinery.

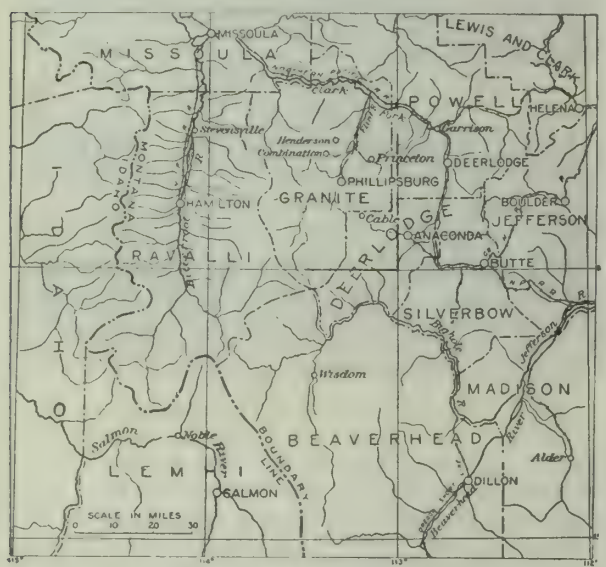
PIG IRON imported into France during the first half of this year reached 1,291,777 tons, against 976,627 and 536,896 tons, respectively, in the same periods in 1911 and 1910.

History of the Granite Mountain Mines

By C. P. Bowie

The properties of the Granite Bi-Metallic Consolidated Mining Co. are situated in the Flint Creek mining district in Granite county, Montana, about four miles east of the town of Philipsburg. The collar of the Granite, or Ruby, shaft is within a few hundred feet of the top of Granite mountain, a prominent peak in a range which rises to a height of 8000 ft. above sea-level. No more inspiring view can be imagined than that from the dump of this shaft. One stands at an elevation of more than 3000 ft. immediately above the beautiful Flint Creek valley; in the summer-time a carpet of waving grain, in the winter snugly tucked beneath a blanket of snow. On the east is a rugged range of mighty mountains stretching hundreds of miles to the south, studded with lofty snow-capped peaks standing in bold relief against the sky.

The story goes that late in the fall of 1872 a man named Holland was hunting in the vicinity of this peak. He



PART OF MONTANA.

was pursuing a wounded moose which crossed a ledge of rock, where the Granite shaft stands today, and dislodged a loose fragment. The rock rolled down the mountainside and broke against a boulder in the path of the hunter. Being by nature a prospector, Mr. Holland stopped to examine the rock, and upon discovering that it contained quartz, promptly forgot his quarry and turned his attention to the ledge from which the fragment came. He found that there was a short outcrop, about two feet wide, of barren-looking quartz between walls of compact granite. Later that year he located a claim on the outcrop and sank a shaft about 15 ft. deep, but the assay returns were so discouraging that the location was allowed to lapse, and it was not until two years later, in company with three others, that he re-located and definitely commenced development.

At this time C. D. McClure was president of the Hope Mining Co., which was operating extensively about one mile north of Philipsburg. After much persuasion on the part of the locators, he was induced to take a bond on the prospect for $40,000. Mr. McClure spent a considerable sum in development, and finally decided to see if he could not interest outside capital. Accordingly, he prepared to make an extended trip East. He left in charge of the mine a man by the name of Hogan, with instructions to continue the work as long as silver "remained up." This Irishman, although perhaps not overburdened with 'book learning,' had ideas of his own, and soon after Mr. McClure's departure devised the system of giving each miner, as he entered the shaft, three candles and five sticks of powder. A day's work was supposed to have been completed when the candles were consumed and the powder placed in a hole of the proper depth and made ready for shooting. But the wall rock was very hard and the vein none too soft, so that it soon became the rule that about three of the sticks of powder went into a convenient cache behind the lagging in one of the drifts.

Butte at this time had risen to the dignity of a daily paper. One morning this paper came into the hands of Hogan, and to his consternation recorded silver as $1.14⅝ per ounce. The issue of the week previous had said $1.14½ per ounce. Not being versed in the art of fractions, it became a serious question whether it was going up or down. Nothing abashed, Hogan went to the carpenter's chest and secured a brace, a ½-in. bit and a ⅝-in. bit. Then he went out to the stull pile and sat down. He bored a hole with the ⅝-in. bit and found that the ½-in. bit would enter with room to spare. The day was saved; it was still going up. He replaced the tools in the carpenter's kit and went underground, pondering on what might have been the consequences if the half-inch bit had been too large. That same day some wag of a miner set his blast in the cache behind the lagging. When the shots were fired, at the close of the shift, there was a terrific explosion which almost wrecked this portion of the mine, but which broke through a 'horse' of granite and exposed a ribbon of high-grade ore. By the time Mr. McClure returned from the East the wreckage had been cleared away, and the damage done was reported to him as having been caused by a 'slide.' The ribbon of ore was followed and, in 1883, 1435 tons of ore broken from it was worked through a local custom mill and netted the company $273,898.

The future of the mine from this time on was assured. The construction of a 20-stamp, dry-crushing mill, just below the collar of the shaft, was begun at once, but was later increased to 80 stamps. On grading for the retort-house, the top of another ore-shoot was found which proved to be the richest and most extensive in the mine. For a considerable period no attempt was made to work anything but the high-grade ores. On the 600-ft. level an 11-ft. face of ore carrying 150 oz. of silver per ton was left untouched for a number of months, the mill being busy on richer material.

In 1882 the Bi-Metallic Mining Co., composed of men who had been instrumental in the purchase and development of the Granite company, was organized. A 3-compartment shaft was commenced about 1000 ft. from the west workings of the Granite, and was sunk to a depth of 200 ft. before cross-cutting. The vein was there; driving soon disclosed ore. The mine proved later to have a large part of the same vein which was exploited through the Granite workings, although the ore was hardly so rich. A 100-stamp chlorination mill was built at a place known as Bi-Metallic, on Douglas creek, 1½ miles south of Philipsburg, and was connected to the mine by a wire-rope tramway four miles in length.

The ten years from 1883 to 1893 were very prosperous for both companies. During this period the Granite mine produced $20,000,000 in silver, of which more than $11,000,000 was paid in dividends, notwithstanding the fact that the company constructed, at great expense, a second mill of 100 stamps at Rumsey, in Fred Burr canyon, 1½ miles southeast of the mine. This mill was connected to the mine by a wire-rope tramway, and a branch of the Northern Pacific railroad was extended to it for a distance of 7.7 miles from Philipsburg. The production of the Bi-Metallic mine for this decade was about

$6,000,000, and $2,000,000 was paid in dividends. When the crash came in 1893 both mines were closed.

The towns of Philipsburg and Granite naturally enjoyed their full measure of prosperity during these years. The town of Granite, which today is practically deserted, boasted some 3000 inhabitants and was in many ways unique. It was built around the two mines. The streets were mostly roads graded into the mountain, the upper side often was 50 ft. higher than the lower, and, as the tenderfoot from St. Louis wrote home, "the longest of them extended only a block or two and ran up a tree." There was Magnolia avenue, close to the mines and mill, on which were the homes of the chief officials; Sunnyside, the abode of the next in rank; Finn Town, Bell avenue, and Denigol where the masses lived, and Whiskey Hill, the business centre. On Whiskey Hill every door was a saloon in which gambling devices innumerable could be found. Business was good everywhere. Contractors, merchants, and tradesmen grew rich as if by magic; fortunes, too, were won and lost at the roulette wheel, the faro bank, and monte game; and each night the lights of the underworld blazed unabashed.

BI-METALLIC MINE AND TOWN OF GRANITE.

DUMP OF THE GRANITE MINE.

The mines remained closed until 1898, when the two companies were consolidated under the name of the Granite Bi-Metallic Consolidated Mining Co., capitalized at 1,000,000 shares. Because the ore reserves in the Bi-Metallic mine were larger than those in the Granite mine, 200,000 shares of the Bi-Metallic company were transferred for 600,000 shares of the new company; 400,000 shares of the Granite stock being traded share for share. Extensive improvements were at once begun. A drainage adit 8850 ft. long was driven from the canyon of Douglas creek, meeting the Bi-Metallic shaft at a depth of 1000 ft. and the Granite shaft at 1450 ft., thereby greatly reducing the pumping cost. A subsidiary company called the Montana Water, Electric Power & Mining Co., was organized, and under its supervision a reservoir several square miles in extent was constructed on Georgetown flats, about twelve miles south of Philipsburg, and a hydro-electric plant was constructed in Flint creek canyon immediately to the north of the reservoir, which supplied the mine and mill with 1100 hp. The mills at the Granite mine and at Rumsey were completely abandoned. As far as possible the machinery from them was used in constructing the Bi-Metallic mill to treat tailing and high-grade ore. For low-grade ore a 300-ton concentrator was built at Granite, immediately below the collar of the Bi-Metallic shaft. The concentrate from this plant was sent to the Bi-Metallic mill by tramway and thence by rail to a smelter at Helena.

With these arrangements the mines were operated spasmodically until August 1905, when, because of the low price of silver and decreasing grade of the ore, they were closed. During this period they produced about $1,000,000 per year. Subsequently they have been partly reopened from time to time above the drainage adit and worked under leases. At the present time a cyanide plant is being constructed in the Bi-Metallic mill to work over the mill tailing, of which there is some 300,000 tons impounded in Douglas gulch. The production of these two mines laid the foundations of many large fortunes of the Middle West. It aggregated over $32,000,000, and nearly $15,000,000 was paid in dividends. Of this amount, the Granite mine produced approximately three-quarters, and its dividends were about $13,000,000.

The strike of the vein was almost due east and west, and the dip from 8°N. to 8°S. It varied in width from 2 to 150 ft., but the pay-streak was usually confined to a ribbon of ore not over 22 ft. at the widest. The walls were almost everywhere well defined, the vein being separated from both by a clay gouge. The highest-grade ores were sulphides and were found at a depth of never less than 200 ft. from the surface. The country rock is a medium-grained granite, composed chiefly of quartz, feldspar, mica, and hornblende, and cut at many places by small dikes of aplite. As a rule, the walls in the vicinity of the vein are very hard, but in some places the ferromagnesian minerals have locally been altered to green silicates. Large angular blocks broken from the walls form horses in the vein in many places, and, almost without exception, have been found to be completely barren. The Granite (or Ruby) shaft is 1500 ft. deep, and the Bi-Metallic (or Blaine) shaft 1800 ft. deep. The vein has been followed and stoped 2600 ft. below the surface, and there are altogether more than 20 miles of drifts and cross-cuts.

As is indicated by the large percentage of gross output which was paid in dividends, the management of both mines was efficient from the outset. Specialists of broad training were employed in every department. Some of the foremost men in the profession today were at one time or another connected with the work of one or both of these mines. There is, however, one criticism to be made of the management of the properties, one which, unfortunately, applies to the management of many great mines which have passed into history. Too much money was paid in dividends and too little held in reserve for prospecting new orebodies and providing means for profitably handling low-grade ores. The great wealth which the mines produced has been turned into other channels. While there are undoubtedly extensive bodies of low-grade ore still remaining in these mines, and perhaps some of high grade, yet without an initial expenditure of large sums of money, which the stockholders are loth to advance, they cannot be mined and worked at a profit. In the business of mining, or in any other business, it is a short-sighted policy which plans only for today and takes no thought of tomorrow.

Fire Assay Charges

By D. C. Livingston

In the fire assay for gold and silver in ores and metallurgical products, the ores fall into three divisions, of which the first two are most common. These are (1) siliceous ores; (2) sulphide ores, with galena and pyrite; and (3) basic ores with hematite and limestone, having a neutral, reducing, and oxidizing action, respectively.

Many books and articles have been published on assaying, and charges given for almost any ore; but when an ore is brought in for assay it is sometimes difficult to tell its composition, especially if ground fine. The object of this article is to give a few fluxes by which practically any ore or metallurgical product can be assayed, and good results obtained.

There are three methods which are generally used in fire assaying for gold and silver in ore: (1) the crucible assay, in which an excess of litharge is used over that required to give lead for the button, and in which either an oxidizer or reducer is added according to the character of the ore; (2) the crucible assay in which only sufficient litharge is used to give the required size of lead button, iron nails being added to the charge in the case of sulphide ores; and (3) the scorification assay. The main difference between the first two methods is that with the first the litharge acts principally as a flux, and in the second it acts as the carrier of lead for the button. Also, in the first method, the atmosphere in the crucible, during fusion, is mainly oxidizing; and in the second it is reducing. Each of these methods has its particular use.

For ores of the first division the first method is the usual one. Experiments show that the best results are obtained where a slag is used which is a mono-silicate of PbO and Na_2O. For a pure siliceous ore, the following charge will give this slag, which is calculated to contain enough PbO to give a lead button of 25 gm., as well as enough to combine with the silica in the proportion of a mono-silicate:

Ore	½ A. T.
Litharge	82 gm.
Sodium bicarbonate	39 "

Reducing agent for 25-gm. button.

This charge is somewhat large on account of the amount of soda, and equally good results can be obtained from the following charge, which has the advantage that a 15-gm. crucible can be used for ½ A. T. instead of a 20-gm. crucible, which is necessary for the above:

Ore	½ A. T.
Litharge	75.0 gm.
Sodium bicarbonate	12.5 "
Potassium bicarbonate	12.5 "
Flour	2.0 "

Borax glass and soda cover.

In practice it saves time to prepare the fluxes beforehand. This flux contains the following percentages by weight:

	Per cent.
Litharge	73.5
Sodium bicarbonate	12.25
Potassium bicarbonate	12.25
Flour	2.0
	100.00

The fusion should be conducted quickly, at a fairly high temperature, the muffle being hot when the charges are placed in it. A quick hot fusion is one of the main essentials in excess litharge charges, and the time ought not to exceed 30 minutes.

For sulphide ores any one of the three methods can be used, depending upon the character of the ore and whether the assay is for a hand sample or control. By No. 1 method practically any ore, and the majority of metallurgical products, can be assayed. It is especially suitable for ores high in copper, arsenic, and antimony, because, owing to its oxidizing nature, the greater part of these elements is oxidized and slagged. The principal objection to the method is that with sulphide ores a preliminary assay is necessary in order to determine the right amount of the oxidizer to add, which is usually nitre. Another objection to the method is that the flux is more expensive than that used in the iron-nail assay. No. 2 method is unsuitable for the above classes of ore owing to the reducing condition in the crucible, these constituents will be reduced to the metallic state, and will be brought down with the lead into the button. It is of course possible to scorify this button, but the results will invariably be low, particularly in silver, as well as requiring more time for the extra operation. For sulphide ores consisting principally of pyrite and galena, the iron-nail method will give good results, and has the advantage of saving a preliminary assay.

The scorification assay can be used on almost any ore, but should, in most cases, be considered as the last resort for ores that cannot be assayed by any other means. This is true, particularly, in the case of gold ores, on account of the small sample that can be taken for assay. A greater length of time is also required for the operation than for the excess-litharge assay.

In using method No. 1 for sulphide ores, a less siliceous slag is generally employed than for quartz ores, and more litharge is used. One of the best charges for nearly all kinds of sulphide ores and mattes is the following:

Ore: For pyrite or galena ores, or where not very large quantities of Cu, As, Sb, etc., are present	½ A. T.
Ore: For ores containing over 3 or 4% copper, or much As, Sb, etc.; or where the ore has such a high reducing power that more than 20 gm. of nitre will be needed for ½ A. T. (It may be necessary to reduce this amount still more with ores running over 35% copper.)	¼ A. T.
Litharge	100 gm.
Sodium bicarbonate	7 "
Potassium bicarbonate	7 "
Silica	4 "
Borax glass	5 "

Nitre to suit, and borax-glass cover.

The percentage of the reagents in the flux will be as follows:

	Per cent.
Litharge	81.3
Sodium bicarbonate	5.7
Potassium bicarbonate	5.7
Silica	3.2
Borax glass	4.1
	100.0

The charge for ½ A.T. will be 123 gm., but this amount can be reduced somewhat for ¼ A.T. For high-grade galena ores, it is better to reduce the litharge, as the lead button is liable to be brittle, due to the presence of litharge. The fusion should be done quickly, the charges being placed in a muffle already at cherry-red heat, and finished at a somewhat higher temperature than that necessary for siliceous ores. There is little danger of the crucibles boiling over even with as much as 18 gm. of nitre, in a 20-gm. crucible. Providing the fusion is properly carried out at a sufficiently high temperature, practically any sulphide ore can be assayed with this charge by varying the amount of ore taken according to its character and impurities contained. With the above charge the oxidizing power of nitre can usually be taken at between 4.2 and 4.5. It is essential that the same flux be used in the preliminary assay, and if possible the same amount of ore as that required for the final assay, as the condition will then be similar, and there is very little time saved by taking 1/10 A.T., as is often

recommended. If the preliminary assay shows that some reducing agent is necessary in order to obtain a 25-gm. button, flux No. 1 can be added in the right proportion, or approximately about 4 gm. of flux for 1 gm. of lead required, and flux No. 2 can be reduced accordingly. As a general rule, it is safer to have too large than too small a button.

On sulphide ores there are numerous charges given for the iron-nail method, the following being a good one:

Ore	½ A. T.
Litharge (according to amount of lead in the ore)	18 to 30 gm.
Sodium bicarbonate	15 "
Potassium carbonate	15 "
Borax glass	10 "
Silica	4 "
Flour	3 "

Nails, 2 to 6, and a cover of soda and borax glass, or salt.

The flour is not necessary in a heavy pyrite ore, but does no harm, and if the flux is prepared ahead, it should be added, because it will be needed with ores deficient in sulphur. In the fusion with this charge it is best to have the temperature of the muffle low at the start, raised gradually, and finished at a high temperature, in order to insure perfect fusion and a good pour. Providing only pyrite or galena ores, or ores with only small quantities of copper, etc., are to be assayed, this method is quite reliable, but it is useless to expect good results on ores containing large amounts of such interfering elements, for the reasons already given.

In the scorification assay of sulphide ores, the usual charge in a 3½-in. scorifier would be as follows: ore, 1/10 assay ton; test lead, 50 to 80 gm., the latter used with a high percentage of copper, or arsenical ores; cover of silica and borax glass. The method of conducting the assay has often been described. It is a good reliable method, especially for high-grade silver ores, but is not generally as satisfactory as the crucible, for the reasons previously given.

For basic ores—hematite, limestone, etc.—the following charge will give satisfactory results, as a rule:

Ore	½ A. T.
Litharge	60 gm.
Sodium bicarbonate	15 "
Borax	10 "
Silica	5 "

and flour according to the oxidizing power of the ore, which depends upon the amount of ferric iron that it contains. The percentages of the reagents in this flux are as follows:

	%
Litharge	66.7
Sodium bicarbonate	16.7
Borax glass	11.1
Silica	5.5
	100.00

There are very few ores which could not be assayed by either flux No. 1, 2, or 3 without any change excepting the amount of ore taken. I have tried flux No. 2 on numerous checked smelter samples of sulphide ores and mattes, with good results. Where there was any variation it was almost always the assay with flux No. 2, which was the higher, and this was particularly the case where the smelter assay had been made by scorification.

L. Vogelstein & Co. gives the following figures of German consumption of foreign copper for the months January to August 1912.

	Tons.
Imports of copper	142,464
Exports of copper	6,057
Consumption	136,407

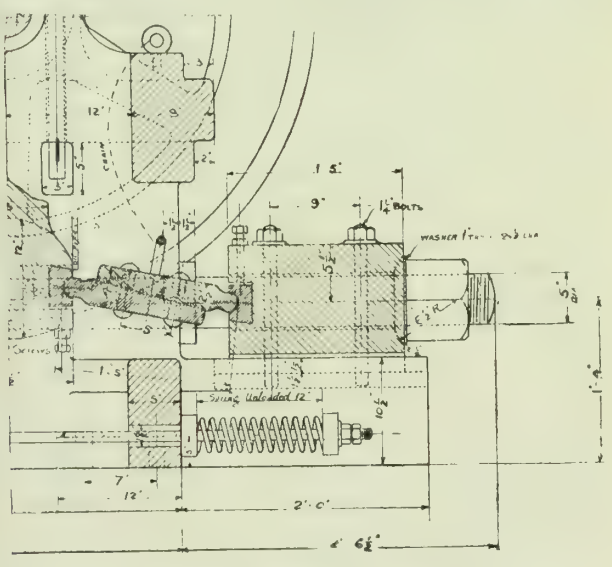
as compared with consumption during the same period in 1911 of 119,943 tons. Of this quantity 124,642 tons was imported from the United States.

Rock-Crushers at Kalgoorlie

By M. W. von Bernewitz

The relative merits of jaw and gyratory types of crushers have often been discussed in technical papers, so I shall only refer to the general practice of crushing ore, and the cost of this work at the large mines of Western Australia.

At one time it was customary to have crushers on top of the mill storage-bins; but now the practice is to have the crusher-house entirely separate from the mill. The broken ore is conveyed from the crusher to the mill-bins by an 18 or 20-in. belt-conveyor of either rubber or balata construction. Perched on the top of a mill, a crusher is a nuisance, as it shakes the whole building, repairs are difficult, and the distribution of ore is not easy. Crushers with the Bigelow patent toggle, in which



BIGELOW SHEARING TOGGLE.

10 steel rivets, with a total shearing strain of 360 tons, are sheared off in case of an unbreakable substance getting between the jaws, are extensively used. This shearing is somewhat like the break-pin arrangement in the Gates breaker. Adjustment of the No. 7½ Gates, type K, is made at the top instead of at the step. The crushing head and spindle are suspended from this point, relieving the bottom of much weight. The spiders are set parallel to the flow of ore from the grizzleys, the ore thus fills the gyratory breaker all round the crushing head, tending to high capacity and efficiency. Motor-driven crushers are generally satisfactory, and circuit-breakers or fuses rarely blow out, although the feed is so irregular. The No. 5 and 7½ Gates take 30 and 65 hp., respectively, when full of ore; and the 30 by 12-in. jaw crushers take 30 hp. each.

Stage crushing is considered preferable at the large mines, including the Boulder, Horse-Shoe, Ivanhoe, and Perseverance. It is rather too much to expect any single breaker to crush 700 tons per day, considering the sizes in use and the number of hours at work. Some mines crush ore during the whole 24 hours; others during two shifts; and others again during day shift only. There was at one time an idea that motors would not do for driving crushers, as the sudden rush of ore into an empty machine caused a high flow of current which would open the circuit-breaker or other safeguard; but in practice this proves not to give trouble. The crushers at the Associated Northern, Ivanhoe, and Kalgurli are driven by steam-engines. The former is driven from a counter-shaft, by belt from a clutch pulley on the main mill shafting. The Ivanhoe drives a countershaft by a small engine, the counter carrying rope pulley from which three ropes drive

a No. 7½ crusher, and two ropes each drive the two No. 5 Gates below—rather an unusual arrangement. The Associated, Boulder, Hainault, Horse-Shoe, Ivanhoe, Kalgurli, Lake View, and South Kalgurli crushers are fed directly from skips, the ore of course first passing over grizzleys. The Associated Northern, one section of the Boulder plant, and Oroya Links crushers are fed from cars, while the Perseverance and one section of the Oroya Links are fed from a bin into which the skips are dumped.

I have seen the break-pin arrangement work properly on the No. 5 Gates, but the larger size is not provided with it. The Horse-Shoe had one crusher broken by an iron bar, while the Associated had two spiders broken, one hopelessly and the other cracked. A 2-in. band was shrunk around the cracked spider, while ½-in. boiler plate was studded on the arms, with good results. Recently a spalling hammer got jammed between the head and concaves, but the circuit-breaker, which is set at 135 amperes, flew out, and no damage was done. The table following gives details of the breakers at work at Kalgoorlie:

DETAILS OF CRUSHING PLANTS AT KALGOORLIE.

Name.	Jaw.	Gyratory.	Type.	Size.	*Tons crushed per day.	How driven.	Cost per ton, cents.
Associated	..	1	Gates	K. 7½	360	80-hp. motor	10
Associated Northern	..	1	"	No. 5	70 to 120	engine	10
			"	No. 5			
†Boulder	..	6	Hadfields	R. & S., 7½ and 5	600	motors	8
Hainault	3	..	Fraser & Chalmers	20 by 10 in.			
				16 by 9½ in.	230	"	10
Horse-Shoe	..	3	Gates	5 and 7½	800	"	..
Ivanhoe	..	3	"	7½ and 5	650	engine	6
Kalgurli	3	..	Fraser & Chalmers	30 by 12 in.			
				15 by 19 in.	360	"	8
Lake View	2	..	Bigelow	30 by 12 in.	600	motors	..
Perseverance	1	2	Hadfield & Gates	30 by 18 in.			
				No. 3	700	"	11
Oroya Links	2	..	Bigelow	30 by 12 in.	360	"	10
South Kalgurli	1	..	"	30 by 12 in.	330	"	9

*Deduct 20% for fine.

†The Boulder also has 3 H-type Gates breakers for crushing ore to about 1-in. size for the Griffin mills.

In these costs the transport of broken ore to mill-bins is included; this item is about 4c. per ton.

It will be seen that there are 12 jaw and 16 gyratory crushers at work at the mines mentioned, and, so far as can be gathered, each type is giving satisfaction. When once supplied with new wearing parts, each machine works for a considerable time without any repairs. The life of jaws, mantles, and concaves varies considerably with the class of ore broken and the composition of the steel. Jaws last up to 180 days; while the No. 5 Gates liners will crush 100,000 tons. The No. 7½ Gates liners will run fully 270 days. Of the ore raised from the mines, about 20% is fine enough to pass the grizzleys. The hardest sulphide ore contains 65 to 75% silica. Manganese steel liners are quite satisfactory; but not cast iron, chilled for about ½-in. depth, as I saw one set replaced not long ago.

It is not necessary to fill in behind the jaws with metal, the bolts being sufficient to hold them in place; but of course a new mantle or set of concaves is run with zinc, as usual. Concaves are now supplied in two pieces, so that the bottom half, on which the bulk of the crushing falls, may be thrown out and another fitted in. In doing this, it is necessary to remove the top sections, to make the job easier. The wheel eccentric is generally changed at this time, although if poor metal is used for it, it will not last many weeks. One lasted 18 months in a No. 5 Gates and 9 months in a No. 7½. Plenty of good oil is essential for the gyratory, at the spider, where the spindle is suspended, as well as for the eccentric and bearings, and grease for the gear. The oil for the eccentric should be renewed every week, using some 5 gal. The bearings of the jaw crusher are lubricated with any good grease, squeezed in by the Stauffer system. The Perseverance casts the spiders and steel heads for the No. 3 Gates with good results.

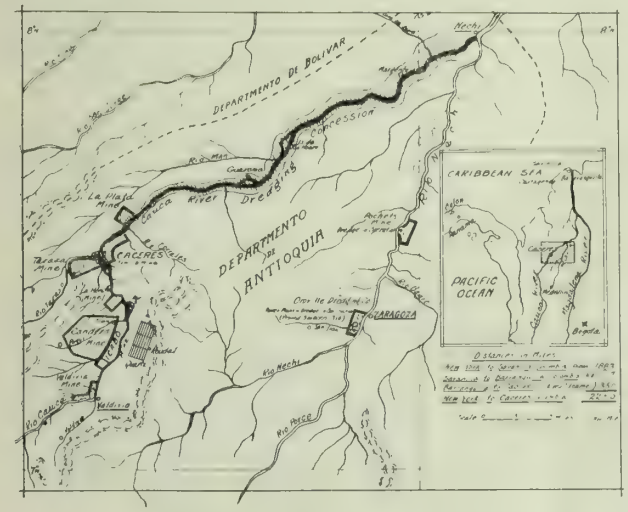
Transport of ore from crushers to mills is closely connected with crushing; in fact, costs generally embrace breaking and storage. At the Associated the crusher feeds on to the 18-in. inclined belt by a peculiarly-shaped chute, really a compound bend, whence it is elevated to a horizontal belt, which discharges the ore into either of two storage-bins holding 500 tons each. The Associated Northern distributing belt discharges into three separate bins. The crusher here stands on top of the mill-bins. The ore from the Edwards' crushing plant of the Boulder is taken by a 20-in. belt-conveyor to the mill, meeting the ore from the main shaft crusher, when part goes to the ball-mill bin and part to a trommel, the coarse from this being crushed in three H Gates crushers, set at about 1-in. opening; then all the fine ore from the trommel and the small breakers goes by belt to the Griffin mill-bin. The Horse-Shoe has two crushing stations, and from the storage-bins the ore is conveyed by rubber belts to the stamp-mill. The Ivanhoe conveyor is fed by Challenge feeders, and by an automatic tripper the ore is discharged into the stamp-mill bins. From the Kalgurli storage bin at the main shaft the ore is carried in ½-ton skips by a Bleichert tramway to the ball-mill bins. The Lake View broken ore is conveyed to the stamp-mill by long inclined belts; that from the Star mine being transported in cars drawn by a small locomotive to the Lake View, where it is dumped down a chute, hoisted, and conveyed to the stamp-mill. The jaw-crusher at the Perseverence is fed from a bin at the mouth of the main shaft, which is filled by the skips in the shaft and cars from No. 6 shaft, worked by a ropeway. The crusher discharges upon a belt which feeds two No. 3 Gates, the ore dropping in a 1000-ton capacity bin, from which a belt elevates it to the ball-mill bins. The Oroya Links ore comes from the Oroya mine by Bleichert aerial tram, and from the Eclipse mine in cars, holding three tons each, drawn by horses. All the broken ore is dumped into the stamp-mill bins by a tripper.

On the whole, the crushing plants on the 'Golden Mile' are worked cheaply, and give a minimum of trouble. Crushers get rough work to do, and they need constant attention, not necessarily repairs. The engineer's staff should examine them thoroughly the first thing every morning.

THE quantity of nickel exported from New Caledonia during June was 4873 tons, making the total exports of that metal from the first of the year 23,842 tons. The exports of chromite for June amounted to 1721 tons, the total exported since January 1 being 25,991 tons.

Dredging in Colombia

Holders of Oroville Dredging shares will be particularly interested in a report by Silas H. Wright, American consular agent in Colombia, South America. The report in part is as follows: The mining industry of the Department of Antioquia continues to attract outside capital, and particularly American capital, although the actual gold production for the past year or more has been less than for previous years, due to various causes. Antioquia until recently produced on an average some $4,000,000 annually, but now it is not more than $3,000,000; even this is a considerable amount under the circumstances. The fact is that small operations such as the native miner carried on so long at a profit are being rapidly exhausted, and today more capital is required to operate and equip mines than previously. This capital must come from the outside—as it is coming now almost daily—because it is not to be had in this country, and because the mines here contain the gold in profitable amount. This industry will naturally become a leading, if not the chief, industry of



DREDGING FIELDS OF COLOMBIA.

Antioquia, but foreign capital, energy, and modern appliances are necessary. Better transportation facilities have also reduced costs.

American and English interests are now largely represented throughout the Department of Antioquia, both in mineral exploration and in the equipment and operation of mines. Englishmen usually appear to prefer quartz mining, while Americans mostly take to placer mining. This past year various undertakings by American companies on both the Cauca and the Nechi rivers in the extreme northern portion of the department, principally in drilling (with Keystone and other drills) for dredging operations, have met with marked success. The Oroville Dredging Co., of California, is about to place a modern dredge on the Nechi river near Zaragoza, and two other large American companies expect to place dredges on the Cauca river in the near future. This region is perhaps the richest and largest placer region in the department, especially suitable for such enterprises on a large scale, having both extensive area and high values. Being also on navigable rivers with cheap transportation, it bids fair to become the dredging ground for Colombia.

On the Porce river also, in the upper portion of Antioquia, not far from the city of Medellin, several American enterprises are operating hydraulic elevators with good results. There are numerous similar enterprises under American management throughout the department, and from indications more are coming rapidly.

While there are foundries in Medellin where certain classes of castings and machinery may be obtained, and where repairs may also be made up to a certain point, there are no representative American machinery houses here for furnishing mining or any other class of machinery. Nearly all machinery for these mines, especially those operated by Americans, comes direct from the United States.

The most important property under development is that of the Pato mines, financed through the Oroville Dredging Co., which has expended a large sum on its dredge, powerplant, and the largest cement dam in Colombia. It is expected that the plant will be ready to operate in October.

Goldfield Consolidated Report

During August the total production of the Goldfield Consolidated Mines Co., according to the report of J. F. Thorn, general superintendent, was 32,538 tons, containing $465,289.07, or an average of $14.30 per ton, of which 30,330 tons was milled with an average extraction of 89.31%, and 2208 tons of an average value of $15.26 per ton was shipped; the net recovery from all ore being $12.88 per ton. The total net realization was $223,580.71, or $6.87 per ton. During the month 4319 ft. of development work was performed. The total cost of mining, development, transportation, milling, office, and general expense was $6.14 per ton, distributed as follows:

Mining (including stoping and development)	$3.30
Transportation	0.11
Milling	1.86
Marketing	0.05
General expense	0.28
Bullion tax	0.03
Marketing ore shipped	0.53
Total cost of operation	$6.16
Miscellaneous earnings	0.02
Net cost per ton	$6.14

In the Combination mine 136BX, the new stope from the second level, 200 ft. northeast of the shaft, produced 577 tons of $22.60 ore. The 217 drift on the 200-ft. level south in the Jumbo No. 2 cut a small vein which produced 50 tons of $74 ore. Not enough work has been done to determine the extent of this orebody in length or depth. The stopes being carried through the old Sheets-Ish and Begole lease workings in the Mohawk produced 1801 tons of ore averaging $19.25 per ton. The stope in the old Hayes-Monette lease workings above the 250-ft. level produced 454 tons of ore averaging $24 per ton. The 202 stope being carried through the old Francis-Mohawk workings produced 531 tons of ore averaging $20 per ton. The 348 stope being worked through the Loftus-Davis lease workings above the 450-ft. level produced 291 tons of $71.60 ore. The 490-I stope, which was cut out of the 438X drift between the 600 and 450-ft. levels, produced 1856 tons of ore averaging $84 per ton. In the Clermont the 571 drift on the downward extension of the 510 orebody, between the 900 and 750-ft. levels, produced 100 tons of ore averaging $40 per ton. On the 1300-ft. level of the Grizzly Bear a sill is being cut in the 802 orebody and has produced 140 tons of average $22 ore, which was shipped to the smelter. The Grizzly Bear shaft has been completed to the 1400-ft. level and a sump cut, and the drift on this level advanced 30 ft. from the shaft.

Upon the entry of goods and the payment of customs duties thereon in Colombia, the collector of the custom-house through which the goods are imported shall fix a period, not to exceed 15 days, within which the goods must be removed from the customs warehouse by the importer or his agent. In case the goods are not removed within the time set, the following storage charges will be collected: For each of the first 30 days, 2c. per package, not exceeding in weight 75 kg. (kg. = 2.2046 lb.); for each of the following 90 days, 5c. per package; and thereafter 10c. per day per package until a year from the date of the importation of the goods.

New York Meeting of the Institute

The adjourned annual business meeting of the American Institute of Mining Engineers was held at the headquarters of the Institute, 29 West 39th street, New York, on Monday, October 7, at 10 a.m. The following members were in attendance: H. F. Bain, W. deL. Benedict, John Birkinbine, D. W. Brunton, J. A. Church, F. W. Cottrell, J. S. Cox, James Douglas, H. W. DuBois, E. L. Dufoureq, A. S. Dwight, Anton Eilers, J. R. Finlay, L. C. Graton, H. G. Granger, H. M. Howe, L. D. Huntoon, Hennen Jennings, Sidney J. Jennings, E. R. Jones, J. N. Judson, Charles Kirchhoff, A. R. Ledoux, Waldemar Lindgren, Charles McCrery, P. N. Moore, E. E. Olcott, E. W. Parker, E. G. Spilsbury, G. C. Stone, Bradley Stoughton, Joseph Struthers, and Kirby Thomas. About 1400 proxies had been received from members unable to be present, but these were not used. Differences of opinion existing in the membership were reconciled by previous conferences and the greatest harmony marked the proceedings. The resolutions passed by the meetings of members held at San Francisco and Los Angeles, as given in the *Mining and Scientific Press* of September 28, were read. The report of the Committee of Five was accepted, the committee thanked for its efforts, and discharged. All the pending amendments to the constitution of the Institute, as proposed in the circular of October 1911, were voted down. Amendments to the constitution and by-laws were proposed by C. R. Corning, providing for a class of Junior members; separate investment of the funds received from life memberships; stricter treatment of members in arrears for dues; secretaries of the Board of Directors and Council to be elected by the bodies served; yearly budgets to be prepared in advance and no expenditures to be made except as authorized by the directors, who shall hold monthly meetings for the consideration of the business of the Institute; change of name of the president and vice-president of the Council to chairman and vice-chairman, respectively; the creation of the office of secretary emeritus; increase of dues not more than $5 per year, if necessary, until the land debt is extinguished, when they shall automatically revert to $10 per year; nominations for officers of the Institute to be announced not later than November, thus permitting effective opposition; the appointment of a business manager for the Institute by the Board of Directors; the use of letter ballots; the development of local sections; creation of topical divisions; specification of the terms upon which affiliations with other societies may be entered upon; and many minor changes intended to clarify the business conduct of the Institute. A committee of the Directors and Council, of which J. W. Richards was chairman, in conference considered some of these changes unnecessary, but was in substantial agreement with the greater number. Messrs. Richards, Rand, and Kirchhoff introduced an amendment providing that the secretary shall be elected by the Council, with the approval of the Board of Directors, and creating the office of secretary emeritus, as provided in the amendment by C. R. Corning. All these amendments were ordered printed and sent to the members for discussion at the meeting to be held at Cleveland, October 28, 29, 30, and 31. The business meeting was then adjourned to New York on November 12, when the wording of the amendments will be perfected so that final action can be taken at the annual business meeting in February 1913.

The 103rd meeting of the Institute, for the reading and discussion of professional papers, will be held in Cleveland, Ohio, beginning Monday evening, October 28, 1912. The Institute headquarters will be established at the recently completed Statler hotel, where a bureau of information in charge of C. B. Murray, secretary of the local committee, will be maintained. The early sessions will be held in one of the rooms of this hotel, and the concluding session in the Electricity building of the Case School of Applied Science. The arrangements for the meeting, apart from the technical sessions, are in the hands of the local committee, D. T. Croxton, chairman, and C. B. Murray, secretary, Perry-Payne building, Cleveland, to whom all inquiries concerning local matters, except those referring to papers and discussions for the technical sessions, should be addressed. The control of the papers and discussion will be exercised by the president and secretary of the Council as usual. No special reduction of railroad fares for attendance at this meeting is practicable, and members will make their own arrangements in this respect.

Details of the technical sessions of the meeting, and visits to points of engineering and scenic interest, will be given in the program of the local committee. Members wishing to visit during the week any individual plant or work in Cleveland or vicinity will be assisted to do so by means of suitable introductions and guidance upon notice given by them in advance to C. B. Murray. The following provisional program has been arranged, subject to possible but not probable change by the local committee:

Monday, Oct. 28—Afternoon: Registration at headquarters, Statler hotel. 8:15 p.m.: Informal social meeting at headquarters.

Tuesday, Oct. 29—At Statler hotel: 10 a.m., technical session; 2 p.m., technical session; evening, informal smoker and popular addresses.

Wednesday, Oct. 30—10 a.m., technical session at Statler hotel. Afternoon: Trip. 7:30 p.m.: Subscription banquet, members and guests, including ladies.

Thursday, Oct. 31—10 a.m.: technical session at Case School of Applied Science. Afternoon: Trip. Evening: Unassigned.

The meeting is primarily one of the Iron and Steel Division of the Institute, and 18 papers dealing with iron, steel, and related topics will be presented. Sixteen papers on general topics and ten papers presented at the Eighth International Congress of Applied Chemistry will be submitted. Most of these papers will be read by title, but a large number will be presented by their authors.

Publicity and the Press

In accordance with the Act of Congress, August 24, 1912, referred to editorially in our issue of September 21, we take pleasure in publishing the following:

Statement of the ownership and management of the *Mining and Scientific Press*, published weekly at San Francisco, California.

Name of	P. O. Address.
Editor—H. Foster Bain.	San Francisco, Cal.
Managing Editor—H. Foster Bain.	"
Business Manager—L. A. Greene.	"
Publisher—Dewey Publishing Co.	"

Owners of 1% or more of stock.

T. A. Rickard,	London, England.
Edgar Rickard,	"
Lewis T. Wright,	"
H. Foster Bain,	San Francisco, Cal.
F. W. Bradley,	"
H. F. Dexter,	"
L. A. Greene,	"
John J. Young,	"
J. Parke Channing,	New York, N. Y.
J. F. Kemp,	"
L. S. Austin,	Salt Lake City, Utah.
Philip Argall,	Denver, Colorado.

Known bondholders, mortgagees, and other security holders, holding 1 per cent or more of total amount of bonds, mortgages, or other securities: NONE.

L. A. Greene.
Business Manager.

Sworn to and subscribed before me this fourth day of October, 1912.

Henry B. Lister.
Notary Public.

Coalfields of Wind River Region

The coalfields of the Wind River region, in Fremont and Natrona counties, Wyoming, are discussed in detail in Bulletin 471-G of the U. S. Geological Survey. The primary purpose of the investigation was to obtain data for the classification of the public land and to collect information relating to the amount and character of the coal in order to fix a price at which such land should be offered for sale. The Wind River coalfields comprise an area of about 2500 square miles and include the geographic centre of Wyoming. This region has been known to contain coal of commercial value since some of the earlier explorers examined coal beds along Popo Agie river. Only small mines were opened, however, because the sparse settlement afforded very little local market and there was no commercial market which could be reached until 1906, when the Wyoming & Northwestern railroad was completed from Casper to Lander.

The coal, which is a low-grade bituminous coal, when reduced to a coarse powder is black, but when crushed to a very fine state is dark brown. It burns with a short red flame, ignites readily, and produces ash not inclined to clinker. When burned in a stove the coal does not fuse and shows no tendency to coke. The Wind River coal is best adapted for domestic fuel, but it has been employed satisfactorily under stationary boilers, in lime-kilns, and in similar places where forced draft is not required. Owing to the rapidity with which it disintegrates, the coal must be shipped in box cars and can be held in storage only a short time after it is mined. This results in mining only in winter, when fuel is needed for immediate use, and when mining is more difficult and expensive than in summer. The market for coal in the Wind River region is limited to a few towns along the railroad and to widely separated ranches in the area. Consequently the product of the large mines must be shipped to places reached by railroad outside of the region. In these markets, however, the coal is brought into competition with that from other fields in Wyoming and in Iowa, where mining conditions are generally more favorable or where a better grade of coal is obtained.

Copper Producers' Association Report

The Copper Producers' Association statement, October 8, shows an increase during the preceding month in accumulation in this country of 16,364,213 lb. The details are as follows:

	Pounds.
Stock of marketable copper of all kinds on hand at all points in the United States, Sept. 1, 1912	46,701,374
Production of marketable copper in the United States from all domestic and foreign sources during September	140,089,819
Deliveries for consumption, September	63,460,810
Deliveries for export, September	60,264,796
Stock of marketable copper of all kinds on hand at all points in the United States, October 1	63,065,587

The changes in surplus since October 1, 1911, have been as follows, in pounds.

	Increase.	Decrease.
October, 1911	.....	5,897,214
November	.....	23,212,454
December	.....	22,330,493
January, 1912	.....	22,173,252
February	.....	3,301,944
March	.....	572,431
April	2,927,829	.....
May	.....	15,450,386
June	.....	5,280,639
July	5,945,416	.....
August	.....	3,579,046
September	16,364,213	.....

Gold Placers Near the Yukon

The town of Eagle, on the Yukon, 30 miles above the eastern boundary of the region, and Circle, on the Yukon 30 miles below its western boundary, are the nearest settlements to the gold placers in the basin between Woodchopper and Fourth of July creeks, Alaska, on the Upper Yukon. The northern part of this region is readily accessible from the Yukon, but in the parts that are remote from the river the means of communication are still very primitive. Trails and winter sled roads lead up most of the principal creeks.

Mining was probably done in the region as early as 1898, but the most important developments have been made during the last six or seven years. The total gold production of the region is less than $150,000, the greater part of which has come from Mineral gulch, a tributary of Woodchopper creek, and from Fourth of July creek. Last year about 30 men were engaged in placer mining on the creeks in this region.

Auriferous gravels are distributed over a considerable area along Woodchopper creek, but no rich or extensive deposits have been found. The relative accessibility of the placers to the Yukon is favorable to cheap mining, but only a small amount of water is available for sluicing. With one exception, all the operations have been of a primitive type. A steam-shovel on Fourth of July creek and a few steam hoists are the only machines employed. These deposits are described in Bulletin 520-G of the U. S. Geological Survey.

Alleged Chemical Effects of Pressure on Mineral Metamorphism

Giorgio Spezia, in the *Atti acad. sci Torino*, 46, 682-98, criticizes Van Hise's views on the influence of pressure on the dehydration, deoxidation, and silicization of minerals in the zone of 'anamorphism' (U. S. Geol. Surv. Monographs, Vol. 47). As dehydration under pressure is conceivable only if the hydrated mineral is surrounded by an anhydrous mineral with minute pores into which the water squeezed out can penetrate, samples of rock alum, alabaster, and limonite surrounded with well dried quartz powder were subjected for eight months to a pressure of 8000 atmospheres at 15 to 24°. After this treatment the limonite still gave off much water when heated in a tube and when powdered had the yellow color of iron hydroxide, while analysis showed that the alum and alabaster had lost practically no water. The great influence of temperature, on the other hand, is shown by the fact that these two minerals can be completely dehydrated at 100°C. and that the alabaster is dehydrated in water in an autoclave at 150°C., and limonite at 330°C. Goethite, containing 10.16% H_2O, lost no water after 26 days under 9500 atmospheres at 15°C. with quartz powder, while after 7 days with water at 320 to 330°C. it contained only 0.13% H_2O. Similarly, deoxidation under pressure is conceivable only if another mineral with a greater affinity for O is present, yet no chemical reaction took place when CuO mixed with Mg filings or with K was subjected to 9500 atmospheres pressure at room temperature for 30 days, although the sum of the molecular volumes of CuO and Mg (or K) is greater than that of Cu and MgO (or K_2O). Van Hise's division of minerals, based on pressure, is untenable. To test his statement that at very great depths calcite (d. 2.72) should change into aragonite (d. 2.92), powdered Iceland spar and aragonite, separated by a disc of lead, were placed in the same apparatus and subjected to a pressure of 7000 atmospheres for 6 months at room temperature. The resulting cylinders were then powdered and treated by the Meigen method; on heating with $Co(NO_3)_2$ the calcite remained perfectly white and the aragonite assumed the characteristic violet color.

Discussion

Readers of the MINING AND SCIENTIFIC PRESS are invited to use this department for the discussion of technical and other matters pertaining to mining and metallurgy. The Editor welcomes the expression of views contrary to his own, believing that careful criticism is more valuable than casual compliment. Insertion of any contribution is determined by its probable interest to the readers of this journal.

Effect of Copper on Steel

The Editor:

Sir—The item in your New York correspondence in the issue of August 24 relating to the discovery that the unusually good wearing qualities of certain rails on the New York, New Haven & Hartford railroad was presumably due to the fact that the steel used contained 1¼% copper, is interesting in the light of some recorded experiments with the use of copper as an alloy of iron made about 1910 under the direction of C. F. Burgess at the University of Wisconsin laboratories. Mr. Burgess, collaborating with James Ashton under the auspices of the Carnegie Institute of Washington, conducted an illuminating series of tests of the alloys of nickel and copper with electrolytic iron. Regarding the copper-iron alloy the report says:

"Our results and comparisons would indicate that the copper-iron alloys are also worthy of consideration and might be comparable to the nickel steels in use, even if the strength should not reach such high values as those of the nickel. A 1½% copper alloy is of promise, since the smaller percentage required and the lessened cost per pound of copper as compared with nickel would result in a lessened cost of construction, even if there is some increase in tonnage required because of the slightly decreased strength per equal weight."

Other investigators have made interesting tests of alloys of copper and steel. Notable among these is Pierre Breuil, who in 1907 made an effort to see if there was a beneficial effect due to the addition of copper to steel suggested by the favorable influence of copper on steels for railway axles, which was noted on some of the French railroads. Breuil mentions the 4% copper alloy with mild steel as worthy of further study, and generally confirms the claim that certain copper-steel alloys are of commercial advantage.

Your correspondent has effectively made the most of the incident from the copper-market angle, but there remains the consideration that the acceptance of the beneficial effects of small amounts of copper in iron and steel will be a relief to some of the owners of iron mines in which copper is found as a minor impurity, and to the producers of pyrite cinder and other iron by-products in which the presence of copper in small amounts is sometimes unavoidable.

KIRBY THOMAS.

New York, September 5.

The Measure of Precision

The Editor:

Sir—Being a subscriber to the *Mining and Scientific Press*, I have read your editorial entitled 'The Measure of Precision,' published in the issue of June 22. In this you make certain statements concerning my paper, 'Illogical Precision in Mine Reports,' which has been read before the Institution of Mining and Metallurgy. I do not mind how severe a criticism is, provided it be reasonable and to the point; but I do take exception to the hasty remarks in your article on a portion of the subject which you have palpably misunderstood.

In the article you have copied the following sentences from my paper: "Lode-widths are usually measured to the nearest inch, so that it is mathematically incorrect to calculate the average width to anything less than a whole inch." "The writer has not been able to find this principle definitely stated as a law in a mathematical text-book, but it would appear only a matter of common sense that, in determining the mean of a number of quantities, the result should be expressed to the same degree of accuracy as that observed in measuring the several quantities." Then follows your intemperate tirade, enlarging on a totally different principle to that expressed in the above sentences.

You have put yourself to much trouble in quoting authorities who prove that by making several determinations of the same measurement, the mean of these can be expressed to an accuracy which is greater than that observed in making the several determinations. Unfortunately, this axiom has no bearing on my paper, as it deals with *multiple* determinations of the *same* measurement; whereas the principle stated in my paper relates to calculating the average of *individual* determinations of *different* measurements, all of which are observed with admitted approximation to accuracy. I hope you will acknowledge the difference.

In my paper it is stated that I do not know of any mathematical text-book which treats of this phase of averaging measurements, and I repeat that statement here; nor have you had the satisfaction of finding any such book for me. But you have indeed given to the world a most interesting piece of news by stating that Laplace's 'Philosophical Essay on Probabilities' was published in 1744. This happens to be five years previous to the birth of the author. For your information I will add that Laplace was born at Beaumont-en-Auge on March 28, 1749, and the publication of his 'Philosophical Essay on Probabilities' was commenced in 1812, although it is known that he gave a course of lectures on the subject some years previously. Writing "nonsensical flapdoodle" —to use your own proud phrase—would seem to be a contagious complaint.

F. PERCY ROLFE.

Langlaagte, Transvaal, August 12.

[We are glad to accord Mr. Rolfe the space he requests, since he feels he has been misrepresented. But the distinction sought between multiple determinations of a single measurement and the average of individual determinations of different measurements is no more illuminating and serviceable than that between tweedledum and tweedledee. The average value of a variable quantity is as definite an entity as the exact value of any other quantity; the length of a line, for example. The laws governing the exact determination of either have been well understood by mathematicians for many years, and it would be well if they were more generally understood by engineers of the present day. Mr. Rolfe naturally does "not know of any mathematical text-book which treats of this phase of averaging measurements," just as he does not know of any astronomical text-book which treats of the possibility of the moon being composed of green cheese. In other words, the distinction sought is no distinction at all, as is evident from a moment's logical thought.

The date given for Laplace's work, though erroneous, is not misleading, being merely intended to indicate that so long ago as the middle of the eighteenth century the logic of probability was well developed. By that time more than a dozen authors, among them Huygens, the Bernouillis, and De Moivre, had contributed to the discussion of the topic which Laplace later so admirably summarized. Laplace's 'Mémoire sur la Probabilité des causes par les Évènemens' is confused, in the only reference work at hand at the time of writing, with his 'Théorie Analytique des Probabilités,' 1744 being a misprint for 1774, the date of the former work.—EDITOR.]

SHIPMENTS of coal from New South Wales last year amounted to 5,024,080 tons, valued at $12,947,968, as against 4,690,433 tons, valued at $11,951,498, for 1910. There was 2,498,304 tons, valued at $6,587,735, of coal shipped to over-sea ports, an increase of 286,368 tons and $747,614 in value over the preceding year. Exports to Australasian ports were 2,525,776 tons, valued at $6,360,233, an increase of 47,279 tons and $248,856 in value over 1910.

Special Correspondence

BLACK HILLS, SOUTH DAKOTA

HOMESTAKE PROSPEROUS.—WORK OF THE WASP NO 2.—COLUMBUS CONSOLIDATED.

A local paper is authority for the statement that the month of August was a record breaker for the production at the Homestake. During that month 21 bars of bullion were produced, an amount in excess of the usual production. This is stated to be due to higher grades of ore mined on the lower levels. For a year or so it has been quite generally known that some of the richest ore ever found in the Black Hills was being taken from the workings on the deep levels in the Ellison. During August more of this class of ore was milled than usual. It has been the custom of the company for years to maintain the average value by treating each month a small amount of high-grade ore. During the past month the work on the construction of the new recreation hall and club building for Homestake employees, the gift of the company to its men, has been pushed. Foundation work is well in hand, and the structure will probably be enclosed before cold weather sets in.

During the quarter ended September 30, L. P. Jenkins, assayer in charge of the U. S. assay office at Deadwood,

NORTH HOMESTAKE MILL.

reports bullion purchases to have been $1,988,814. This is the largest quarter of the year, and very nearly equals the largest quarter's business ever done by the office. Milling operations have been suspended at the Black Hills Standard property and will not be resumed before spring. The mill building was in such a poor state of repair, after ten years' disuse, that it was decided not to attempt to repair it at this time. In the meanwhile work is being carried forward at the mine, and by the time the mill is in operation again the mine will be in still better shape. The Victoria mill is operating steadily, handling over 100 tons of ore per day. It is hoped to increase the tonnage to 200 per day with the present equipment, which will be in excess of the rated capacity of the plant at the time it was built. O. N. Brown, Cyanide, South Dakota, is manager.

The Wasp No. 2 company is paying 2c. per share per month dividends. Steam-shovel stripping is being pushed, as it is planned to shut the shovel down during the winter months. At the present time 35,000 tons of ore is stripped, practically four months' supply, from that portion of the property where the shovel is used for stripping. On the south side, where hand labor is used in stripping, there is a smaller quantity uncovered, and it will probably be necessary to continue stripping through the winter on this part of the property. The Bismarck mill, adjoining the Wasp No. 2, is being rapidly completed, and should be in operation within two months, according to F. B. Hitchings, the general manager. The superstructure is completed, and the tanks set up. About all that remains to be done is to install some of the machinery and make final adjustments. Orders have been placed for all of the needed equipment, and it will be erected as rapidly as received. A consolidation of the Deadwood Homestake, owned by C. E. McHugh, the Montezuma and Whizzers, owned by Carpenter and Gillmore, and the Garfield, owned by Clara D. Coe and associates, is announced. The properties adjoin the Homestake on the east and northeast. It is proposed to sink a shaft 1000 ft., close to the Homestake boundary, in anticipation of cutting some of the Homestake orebodies.

The Homestake company is acquiring the Columbus Consolidated as fast as the necessary legal papers can be signed and delivered. The purchase involves taxes, liens, and judgments amounting to about $30,000, and a payment to bondholders of 5% for the bonds outstanding. This purchase, with the Hidden Fortune, which was taken over recently, gives the company an additional 1000 acres of ground, making a total of close to 4000 acres along the strike of the orebodies, held by the company. The last two purchases were made at exceptionally low figures, and were possible through internal troubles, resulting in litigation and suspension of operations by the original companies.

WASHINGTON, D. C.

LEASING OF WYOMING COAL LANDS.—CONTROL BY BUREAU OF MINES.—AMOUNT OF ROYALTY.

Leasing of 2480 acres of public coal land in Wyoming to the Owl Creek Coal Co. marks an important development in the policy of the Federal Government in regard to the public lands, and the leasing system is likely to develop extensively. Van H. Manning, assistant to J. A. Holmes, director of the Bureau of Mines, has gone to Wyoming to complete the negotiations between the company and the Government. The Bureau of Mines will have control of the methods of mining and the safety precautions taken to safeguard the men and prevent wasteful mining, according to the terms of the lease, as approved by W. L. Fisher, Secretary of the Department of the Interior.

The lease, which is signed by Samuel Adams, as acting secretary of the Interior Department, and Rufus J. Ireland, president of the Owl Creek Coal Co., provides that the company has the right to mine coal from 2480 acres of land at Lander, Wyoming, for a period of thirty years. The lease proper is for ten years, the company to have preferential right of removal for successive periods of five years each up to a total of thirty years on terms to be fixed by the Secretary of Interior at or before the beginning of each five-year period.

The company agrees that it will pay at the beginning of the lease and on July 1 of each succeeding year, $2480, or $1 for each acre in the lease, which is to be credited upon the royalties due under the lease. The company agrees to pay on the production of all coal mined a royalty on each ton of 6½c. for the first five years and 8c. per ton for the next five years. The royalty thereafter is to be fixed by the Secretary of the Interior at the beginning of each five-year period. The company further agrees that it will operate its mines with "reasonable diligence, skill, and care, in compliance with any and all rules and regulations now or hereafter promulgated by the Secretary of the Interior for the purpose of safeguarding the health and lives of the miners and employees and of preventing the unnecessary waste of coal."

Still further the company agrees that all mining operations shall be subject to the examination, inspection, supervision, and direction of the Bureau of Mines. The company must not assign the lease or any interest in the premises; it shall not permit traffic in intoxicating liquors on the property; and at the end of the lease the property must be surrendered in good condition. All débris from the mine free from coal shall be deposited separate from waste containing coal, and no such waste shall be deposited in the bed or margin of any stream. The Secretary of the Interior has the right to forfeit the lease for any violation. The lease closes with the following clause: "No member or delegate to Congress, or resident commissioner, after his election or appointment or either, before or after he has qualified and during his continuance in office, and no officer, agent, or

employee of the Government, shall be admitted to any share or part of this contract or agreement, or to any benefit to arise therefrom."

LONDON

EL ORO OUTPUT.—INTEREST IN RAND MINES.—NEW MODDERFONTEIN REPORT.

During his visit to Mexico in December last, R. T. Bayliss sent home some unpleasant news concerning the probable future of the El Oro gold mine. He announced that the stopes in the upper portion of the San Rafael vein could not maintain the current output of ore for more than three years. In order that a regular output might be maintained for a sufficiently long time until the deeper levels are explored and developed on a large scale, he recommended a reduction in the rate of extraction of the ore. The results of this policy are shown in the report for the year ended June 30, 1912. The net realized profit was £182,149, as compared with £216,430 during the previous twelve months, and the dividends totaled £143,437 as compared wih £172,125. The amount of ore treated was 302,698 tons as compared with 360,294 tons. In addition, 84,459 tons of accumulated sand tailing was re-ground in the tube-mills and sent to the cyanide plant. It was decided to start the re-treatment of this tailing in order to maintain the tonnage passing through the tube-mills and vats. There still remains 378,279 tons of this material. The assay-value of the ore treated was $6.36 gold and $1.30 silver, and of the tailing re-treated $2.68 gold and $0.88 silver. The bullion realized £454,582 and the mining expenditure was £299,222. A profit of £23,868 was made on the railway; London expenses and directors' fees were £5006, and £25,000 was written off the value of plant. It is estimated that the ore reserve on June 30 was 301,934 tons, averaging $7.46 gold and 3 oz. silver per ton, as compared with 484,139 tons a year ago. A. F. Main, the manager, gives details of the exploration and development work done during the year. Unexpected discoveries of ore have been made in the upper portion of the south end of the mine, and the results obtained by the further development of the Branch vein on the 1150 and 1300-ft. levels are sufficiently encouraging. On the 1450 and 1600-ft. levels not enough work has been done to justify any expression of opinion. The mill is now regularly treating 20,000 tons of ore and 15,000 tons of tailing per month.

For some years the speculative interest in mines on the Rand has been decidedly restricted, for the new developments have been in connection with either old mines in depth or old outcrop mines that have hitherto been unprofitable. The great expansion of the work in the far east Rand has not been taken quite seriously. The deposits here are flat and of comparatively low grade. There has been no opportunity for enrichment by surface weathering such as characterizes the deposits on the central Rand where discoveries were first made thirty years ago. It is noteworthy, therefore, that the speculative interest in Rand doings is being awakened once more by the good results shown by many of these mines in the far east Rand. In the early days, a quarter of a century ago, C. J. Alford urged the desirability of exploring for gold in this district. Outcrops of coal had been found there, and the deposits have since then been continuously worked, providing an invaluable source of fuel for the gold mines. But at that time Mr. Alford's views were scouted by capitalists, and knowing that the evening of his life is being spent in conditions far removed from affluence, it is opportune to remark that his case affords another example of a conscientious and well informed technical man not receiving his full deserts in this world. At the present time there is much discussion on the Rand as to the continuity of the various deposits, and the actual geology of the district between the big bend of the outcrop southward at Boksburg and the Heidelberg deposits, 15 miles south, has formed the subject of many a battle royal among geologists, not to say also the pseudo-geologists. The Van Ryn may be called the pioneer gold mine of the far east Rand. For years the low grade and irregular content of the surface deposits there caused trouble to the capitalists, and the income was not equal to the expenditure. As already mentioned, the flat outcrop had not the common surface enrichment which usually provides the capital and experience in a new goldfield. Later G. A. and H. S. Denny, as consulting engineers to Albu Brothers, effected many improvements in development, mining, and surface treatment, and the Van Ryn has since become a valuable property. As regards other mines in this district, I need not recapitulate here what I have written from time to time during the past three or four years about the Brakpan. The development of this mine has been in the hands of W. L. Honnold, one of the few Americans left in South Africa. This mine is in close proximity to the overlying coal deposits, and coal is at present being hoisted from points on the dip of the auriferous conglomerate not far away horizontally from the Brakpan workings. I have also mentioned the Kleinfontein and Benomi mines on the outcrop, in connection with metallurgical discussions due to E. J. Way's refusal in the first case to progress with the times in tube-mill practice, and in the second case to his decision to erect a treatment plant on a large scale employing a system not fully proved. I have also mentioned the attempt to consolidate the Benoni and Apex. The most important advances at the present time that have led to an increased interest in the far east Rand are in connection with the four Modderfonteins, namely, the New Modderfontein, the Modderfontein B, the Modderfontein Deep, and the Government Gold Mining Areas (Modderfontein). The two first-named belong to the Central Mining group, the third to the Goerz group, and the management of the fourth, under government control, is with the Barnatos. The results at the New Modder and Modder B are already profitable, and at the former the increase in the output, profits, and ore reserve is most noticeable. The results of the last years operations are in the following paragraph. At the Modder Deep and the Government Gold Mining Areas the work is at present confined to shaft-sinking. At the first-named the vertical shaft cut the deposit at 2990 ft., where the lode is 10 ft. thick, averaging 8.8 dwt. The two shafts sunk by the Government Gold Mining Areas have not happened to strike good quality ore; at the first the lode was 2½ ft. thick, averaging 7 dwt., and at the second 20 in., assaying 4.7 dwt. There is no special reason for discouragement, for the auriferous deposits on the Rand vary in width and content to an extent not generally admitted or recognized by people unacquainted by actual experience. The total area covered by these flat lodes covers quite ten square miles, so that the potential value of the deposits is of the greatest importance.

To give an idea of the actual results achieved in this district, I cannot do better than reproduce the figures contained in the yearly report of the New Modderfontein for the year ended June 30 last. During the year 657,806 tons was raised and, after the rejection of 11% waste, 585,900 tons was sent to the mill. The extraction by amalgamation was 184,081 oz., and by cyanide 56,901 oz., making a total yield of 240,982 oz. There are 180 stamps and 7 tube-mills. The assay-value of the mill-feed was 35s. 5d., and of the final residue, 9d.; the yield was therefore 34s. 8d. per ton, or 97¾% of the estimated content. The income from the sale of gold was £1,011,020, and the expenditure was £546,960, leaving a profit of £464,059, or 15s. 10d. per ton. The amount of ore treated was 47,500 tons greater than during the previous year, and the yield per ton was 5s. 1d. greater. On the other hand, a scarcity of native labor during the last few months of the financial year caused the average cost per ton to increase from 17s. 4d. to 18s. 8d. By concentrating operations over a more limited area, it has been possible since the close of the year to obtain better results with the limited labor force

at disposal. The reserve on June 30 stood at 3,900,000 tons, averaging 8.1 dwt. gold, as compared with 3,341,830 tons, averaging 7.6 dwt. the year before. The revenue account for the year under review shows that £17,781 was spent on capital account on undermining rights, and £41,469 on new plant and shaft-sinking, while £43,152 was paid as government tax. The dividends absorbed £350,000, being at the rate of 25%. Since the formation of the company the yield of gold has been worth £4,915,642, and the dividends have totaled £1,247,500.

NEW YORK

GRANBY REPORT.—PHELPS-DODGE ACTIVITIES.—INCREASED DIVIDEND SPECULATION.

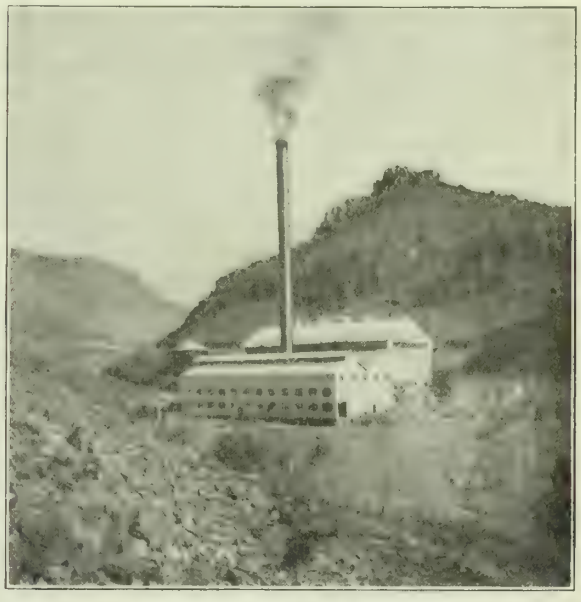
The annual meeting of the Granby Consolidated was held on the first of October. The number of directors on the board was reduced from 15 to 13 by the retirement of A. L. White and Arthur Curtiss James, the latter having resigned some months ago. W. H. Nichols was elected president of the company, succeeding George Martin Luther. The report of the year's operations shows that during the eight months when the property was operated 13,231,000 lb. of copper was produced, at an averaged cost of 11.1c. and a net profit of $583,378; which, however, was not carried forward, as $600,000 was written off for depreciation,

GRANBY SMELTER, GRAND FORKS, B. C.

resulting in a deficit of $17,184. The developed ore is now estimated at 6,463,433 tons, as compared with 6,720,294 tons a year ago. At the present time Granby is producing at the rate of about 20,000,000 lb. per year and, at the present copper price of 17¾c., can earn about $100,000 per month. The most important matter taken up at the meeting, but not definitely decided, is the question of the financing of the Hidden Creek mine. The Hidden Creek is now considered of more importance than the older property at Phoenix, but it has so far been developed out of the earnings of the Granby. If this method is continued it will be necessary to withhold dividends; while, on the other hand, the public would undoubtedly be glad to take a convertible bond issue, which would provide ample funds to develop some five million tons of ore containing 2.3% copper, nearly twice as much in copper content as the average of the Granby ores. The new plant is expected to be in operation by the end of 1913, a good deal of preliminary work having already been accomplished in the building of a wharf and grading both for wagon-roads and the railroad. J. P. Graves estimates that at Hidden Creek copper can be produced at not more than 8½c. per pound.

The Moctezuma mine of the Phelps-Dodge company at Nacozari has resumed shipments, and the first load of concentrate delivered for a month arrived at Douglas this week. The Phelps-Dodge production for the month will show a marked decrease owing to the interruption of shipments, though the mill at Nacozari lost no time, but accumulated a stock of concentrate that can now be forwarded. The Consolidated Arizona Smelting Co. is expecting to blow in its new 150-ton smelter at Humboldt, Arizona, by November 1. Consolidated Arizona had a long market career and has been the medium of some spectacular market turns, but as a mining venture it has not been a startling success. Yavapai county, in Arizona, is to the investor or share-buyer in the East one of the best known mining districts in the United States, but it unfortunately does not muster any large number of successful ventures. The final decree of dissolution has been entered concerning the Chemung Copper Co., and a distribution of assets in final liquidation is all that remains to be done. The cash balance in the treasury amounts to $1,231,072, which will give the stockholders about $6.16 per share.

Our own group of copper magnates, while the most important in the industry, is not the only syndicate of some pretensions as factors in the metal market. A copper syndicate has been operating in Russia since 1907, and now controls over two-thirds of the Russian output. Some justification for the claims of the copper people as to the



COPPER QUEEN POWER-HOUSE.

vastly increased consumption of the metal is found in a study of the Russian copper industry. Since 1907, production in Russia has increased from 14,300 tons to 25,000 tons in 1911. Consumption, however, has also made great strides, increasing from 23,100 tons in 1906 to 30,700 tons in 1911. Russia's mineral resources are largely undeveloped and a great deal of English capital is being invested in the development of Russian mines.

The speculation regarding increased dividends to be paid by the Guggenheim companies is partly set at rest by the semi-official announcement that no move of this kind will be made until next April, when it is expected that Ray and Chino will arrange for initial disbursements, and Utah double its present dividend rate. Nevada Consolidated's fiscal year closes with the calendar year, and a distribution of the present cash surplus in the Nevada Consolidated treasury in the form of an extra dividend is anticipated. Market speculative interest in copper is centred in Amalgamated, and now that Anaconda's distribution has been raised, market followers will be deeply disappointed if Amalgamated is not placed on a 6% basis. The 'Street' is firm in the belief that Amalgamated is to be sold at par before the present movement is over, and thereafter the dissolution of Amalgamated will be looked upon as an important possibility.

Mason Valley is acquiring an increased market following since the smelter capacity has been increased by the blowing in of the new 900-ton furnace. The old furnace is to be enlarged to 35 ft. in length, when it is expected that 2000 tons of ore can be handled daily by the two. The smelter management is able to get a fluxing mixture from the

various ores handled, and has put 917 tons of ore through the old furnace in one day. The Phelps-Dodge output for September was 11,757,372 lb., as compared with 15,152,558 lb. in August, the decrease being due to the interruption of shipments from Nacozari. The Pittsburg & Mt. Shasta Gold Mining & Milling Co., a property which is nearly completely owned in and around Pittsburg, is holding a special meeting this week for the purpose of voting on an increase in capital stock from $1,000,000 to $1,500,000.

South Pass, Wyoming, made its first bid for publicity many years ago, when 'Mark Twain' described his journey through the pass by stage coach. Of the mountains encircling South Pass, Clemens wrote: "These sultans of the fastnesses were turbaned with tumbled volumes of cloud, which shredded away from time to time and drifted off fringed and torn, trailing their continents of shadow after them; and catching presently on an intercepting peak, wrapped it about and brooded there, then shredded away again and left the purple peak as they had left the purple domes, downy and white with new laid snow." The South Pass country and the Wind River mountains have always been known as one of the most fascinating parts of the Rocky Mountains, and the prospector has lingered there for many years in the hope of finding something worth while. South Pass mining properties have been offered to the public for more than forty years, but results have never justified any great degree of enthusiasm as to the district's mineralization, however much in accord one might be with the humorist's splendid description of its snowy heights. The telegraphic despatches of the day carry news of a discovery in the Hidden Hand mine, near South Pass, of $60,000 ore, and of a freight train of seven wagons carrying 25,000 lb. of ore averaging $2000 per ton. To quote another line from 'Mark Twain,' "I am not given to exaggeration, when I say a thing, I mean it." Seriously, though, the Eastern markets would welcome the advent of a new precious metal district, with something in the way of mineralization that would justify inspection and development. It is useless to attempt to conceal the desperate plight of the New York mining market. With almost no public following, traders are reduced to that condition technically known as a wholly professional market; perhaps better described as a case of 'dog eat dog.' If South Pass or Terra del Fuego could enlist some public interest, either would be impartially and wholeheartedly welcomed in New York.

BOSTON

DETAILS OF THE DOW FAILURE.—DOW'S CAREER.—CLEANING UP BOSTON.

The district attorney has started an investigation of the failure of Stephen R. Dow & Co., and it is quite probable that the matter will result in a bill of indictment against the young broker who has played fast and loose with the funds of his companies. Dow has had a sensational career, having started out but a few years ago as stock clerk in a brokerage house. He is just 40 years old and is one of the 'nerviest' stock plungers Boston has ever had, not forgetting Thomas W. Lawson and Jesse Livermore. Dow entered the copper-mining field in connection with the enterprises of Harry F. Fay, president of Old Colony and late president of Mayflower. He first attracted notice as president of the Franklin Copper Co., which he has brought to a producing stage. He then formed North Lake, Indiana, and Algomah, in the Lake Superior district; Corbin, in the Corbin district of Montana; and the Arizona Mines Co., of Arizona. While he was bringing all these issues forth on the Exchange and Curb, and making them in almost every instance leaders in trading activity, he was identified with Adventure, Elm River (now known as Contact Copper), Mayflower, and the Union Copper Mine & Land Co. as director. Dow was in the height of his prosperity in the early part of 1910, when he boomed Indiana and North Lake, both of them at the time drill-core prospects, up to $44.75 and $25.67½ per share respectively.

Although it is not believed that Dow succeeded in distributing much of the stock of these companies, and was, in fact, afterward embarrassed more than helped by keeping up their quotations, he attracted attention throughout the country as a bold and resourceful operator. He did not hesitate at times to express his contempt for the slow-going methods of other copper manipulators, who, on the news of a discovery made at their properties, would fail to move the stock up a few points. Dow was in the habit of saying that it did not take much of a development item at one of his properties to send the stock up five or ten points. Yet with his reckless adventures into the stock market he was regarded as a very thorough man in the handling of his mining properties. He insisted upon full reports and the news of development being promptly despatched to the home office. Inquirers after conditions at any of his mines were said to have always found him ready to give them any desired details. After the Indiana and North Lake boom, Dow received a severe blow by the St. Mary's Mineral Land Co. distributing Franklin stock to the land company stockholders in payment for land the company had sold to Franklin. As this stock amounted to 32,000 shares and found its way, to a large extent, into the market, it forced the price of Franklin down from above $20 to $10 per share. As Dow & Co. was a large holder in Franklin, this crippled the firm.

In the middle of 1910 Dow had another serious financial problem put up to him when Algomah was floated. It cost him $150,000 to make peace with some of the original owners of the land. His undoing seems to have dated from August of last year, when it became necessary for a group of Boston banking houses to advance him about $100,000 to tide over his firm, at the same time securing the consent of twenty banks holding Dow collateral to refrain from any sudden liquidation of these securities. In the past year most of these old loans have been liquidated. It is possible that the Dow failure may yet reach approximately half a million dollars, involving principally the Franklin, Indiana, North Lake, and Algomah companies, and a few of the members of the Stock Exchange. It was thought, immediately following the failure, that Mr. Dow had left town, as he could not be found, but this did not prove to be the case. He is standing his ground, holding that he acted within his rights in borrowing from the companies which his house represented as fiscal agents. These companies are said to have borrowed from him in turn. Mr. Dow received a salary of $5000 per year from each of five companies—Franklin, Indiana, North Lake, Algomah, and Corbin—and his firm occupied an entire floor of the new Stock Exchange building of Hornblower & Weeks. Franklin and Indiana have already called assessments to make up the shortage created by Dow's cleaning out their treasuries. Franklin's call is for $2 and Indiana's for $1 per share. Algomah is expected to take similar action later. Corbin does not sustain any losses, as the company was itself a borrower. The South Lake company directors have felt it necessary to make a statement explaining that their company did not suffer by the Dow failure, as it has not made any loans to Mr. Dow or anybody else. It is claimed that the by-laws of the copper companies admitted of the loans being made to Dow without requiring sanction on the part of the board of directors. There is a technical question as to the guilt of Mr. Dow from a legal standpoint, but the extent of their losses and the flagrant character of the case is causing many stockholders to clamor for criminal proceedings. The district attorney, who recently contested the nomination for governor of Massachusetts, but was unsuccessful, has been charged with playing politics in the great activity his office has shown against the Boston Elevated Co. and the heads of the American Woolen Co. But he says now that he is going to probe the Dow failure to the bottom, and has also intimated that the Stock Exchange will be investigated and ventilated also. It is certain that Boston has not had a more deplorable failure in financial circles in the past ten years.

General Mining News

ALASKA

FAIRBANKS

The output of the Koyukuk district should reach $230,000 this season. About 350 men are in the country, and all are doing fairly well.

NOME

The *Nome Weekly Nugget* states that over 100,000 people have traveled between Nome and Seattle since the first gold discovery. The total number of claims staked and filed in the Nome office is 56,600, but the deputy recorder says that about 15,000 of such instruments filed were not locations. Claims recorded in the Teller district total 8000, Kougarok about the same number, and the Council district probably 12,000. The shipments of gold for this year from Nome are practically the same as last year, and the general tonnage of supplies exceeds last year, to date being 18,865 tons.

The Kimball dredge, on Shovel creek, has worked into rich ground. There is more activity right through the Council district this season than last. The steamer *Mackinaw* left Teller with $60,000 of tin ore, shipped by the York Dredging Co. The dredge was built during last summer and then recovered tin worth $48,000. This is shipped to Liverpool, England. Tin from Buck creek is worth $575 per ton. The American Goldfields Development Co. has taken an option on 3500 acres of ground on Cripple river, and is now prospecting the area by drilling. It is stated that four or five new dredges will be built in the Keewalik and surrounding districts next season, one dredge being on its way up from Seattle. The Keewalik Mining Co. has four nozzles working on Johnny Bull hill, two being 3½-in. size. The clean-up is expected to be at least $25,000. The Candle Creek Mining Co.'s dredge is working well. Seventy-five tons of graphite ore will be shipped out from C. E. Christofferson's mine, near Teller. A large tonnage is said to be exposed. The Lange mill of six stamps will be built at Bluff this fall or next spring. Near Nome the New Era Mining Co. has a 4-stamp mill at work, and recently cleaned up 91 oz. of gold, which exceeded expectations. An adit has been started 75 ft. from the mill, and is in 50 ft.; it should cut the vein at 200 or 300 ft. at a depth of 400 ft. The claim of C. Goodmanson has a vein 6 ft. wide assaying $22.50 per ton. The *Nome Weekly Nugget* is issuing a third edition of its Mining and Dredging issue.

VALDEZ

The inhabitants of Seward have been worried of late by possible danger from Lowell creek, which threatened to overflow the town. There have been unusual quantities of water flowing through the channel. Game is reported to be very scarce in the hills this season, this being attributed to the eruption of Mt. Katmai, which distributed a large quantity of ash over the Kenai peninsula.

ARIZONA

COCHISE COUNTY

The Shattuck- Arizona will increase its employees by over 100, but skilled men are hard to get. It is intended to start shipping ore to one of the Douglas smelters. The Junction shaft of the Calumet & Arizona is 1800 ft. deep, and it has been decided to concrete it from the surface down to 1500 ft. Concrete will be mixed at the surface and run down into the forms through pipes.

GILA COUNTY

(Special Correspondence.)—In September the Miami Copper Co. mined and milled 90,000 tons of ore, producing concentrate which will yield about 2,790,000 lb. of fine copper. The mill recovery was about 70%. Three 8-ft. Hardinge pebble-mills are on the road, and they will replace the Chilean mills in the second unit, making four of the six units to be thus equipped. Exploration and development of the northeast part of the property by two churn-drills continues, and the ground below the 570-ft. level is being explored by diamond-drilling, four holes having been put down to date. At No. 4, or main shaft, foundations are being laid for the new change-house, the new machine-shop is being equipped, and the new mine and engineering office is being finished inside. The construction of the Miami-Inspiration hospital is well under way. About 1000 men are employed.

The main east shaft at the Inspiration Consolidated mines was 305 ft. deep on October 1, and the main west shaft 435 ft. deep, and sinking continues steadily. Development work at the Inspiration mine is confined almost entirely to opening up the first haulage-level, and 3800 ft. was done in September, compared with 4900 ft. for August. The decrease was due to the fact that much of the September work consisted in widening to working size and timbering the drifts previously driven. There was an increase in the amount of work done, there being now 240 men working underground. At the Live Oak mine, driving from No. 2 shaft on the 570-ft. level continues, No. 1 shaft is being sunk, and the sulphide adit is being widened for electric haulage. McArthur Brothers are using a steam-shovel and employing about 250 men in grading for the railroads. At South Live Oak, churn-drill hole No. 4 has been started about 1000 ft. westerly from hole No. 3 in silicified, copper-stained schist, and is now down over 50 ft. Fisk & Snell, lessees of the Black Warrior mine, are employing 20 men on the 100, 250, and 300-ft. levels in cleaning out and repairing the workings, and getting ready for mining. E. M. White, manager for the Warrior Copper Co., has just returned to Globe from a business trip to Eastern cities. John Gibson, who is leasing on the Black Oxide vein at the Superior & Boston mine, corresponding to the Buckeye vein of the adjoining Buckeye mine of the Old Dominion company, has shipped to the Old Dominion smelter three cars of ore from stopes above the adit level, and is loading a fourth. The ore is estimated to average 7% copper. Frank Gill is employing two men in developing the Iron Mass & Pittsburg group of 18 claims, two miles north of Globe, adjoining the German Copper, Irene, and Old Dominion properties. A prospect shaft is being started on a vein on a limestone-diabase contact, having favorable indications of copper ore.

Globe, October 3.

GREENLEE COUNTY

The continued high price of copper and general mining activity throughout the country has given small mining companies in the Morenci district a new lease of life. The New York & Arizona Gold & Copper Co. has leased part of its holdings to Morenci men, who are working two shifts of miners breaking rich ore. The company expects to receive enough royalty to finance the purchase of a Nissen stamp-mill. The Home Copper Co. nearby is expected to start work soon. Several other properties are also about to resume operations.

PINAL COUNTY

Officials of the Ray Consolidated have been sampling the old Reymert mine, situated between Florence and Superior. The lodes in the upper workings carry lead and silver, while below the 400-ft. level rich copper ore was found 16 years ago by the old company.

CALIFORNIA

KERN COUNTY

(Special Correspondence.)—The Gold Peak mine in Caliente canyon, with a 10-stamp mill and complete cyanide plant, has been bonded by Coulin brothers of Los Angeles and Bartlesville, Oklahoma. The mill is working full time. The Cowboy and Cowboy Annex claims have also been bonded by the same people, and the ore is being treated at the Gold Peak mill. S. G. Musser reports finding ore at the Krames Consolidated group, and rich ore is being shipped from the Musser lease. F. Krames is shipping

high-grade ore from the Manwell claim to the Amelia mill, which is being overhauled before handling the custom ore of the district, north of Paris. This district is more active at present than for several years, and numbers of prospectors are coming in from all parts. It extends from Gold Peak canyon to Piute mountains, a distance of 9 miles, and is 4 miles wide. Silver veins are large, and occur in the lime dike, which can be traced for 7 miles. Veins carrying gold are smaller but richer, and occur in pockets, similar to the Randsburg district.

Loraine, September 30.

Shasta County

(Special Correspondence.)—With three furnaces in commission, the Mammoth Copper company is treating about 1275 tons of ore per day. About three-fourths of this is sulphide, and the rest fluxing material. The Mammoth ores average about 3% copper and $1.50 to $2 per ton in gold and silver. The zinc content is said to average 3 to 5%. The bag-house collects about 25 tons of fume per day, consisting largely of zinc oxide and sulphate. The Mountain Copper Co., Ltd., shipped 12,000 tons of ore to the Martinez smelter in September. Development is progressing

SUNSHINE MINE, HIGH GRADE DISTRICT.

at the Iron Mountain and Hornet mines, and the monthly pay-roll averages around $25,000. It is reported that the ore reserves at the Iron Mountain are exceptionally satisfactory. This is the oldest copper mine on the Shasta belt, and has produced large quantities of high-grade ore. In the Pittsburg district, about 1½ miles north of Heroult, the Shasta-Belmont Mining Co. is developing a promising vein in the Graham property. Development consists of two adits and a 50-ft. shaft. The main adit is in 350 ft. At point of intersection the vein is 26 ft. wide. Assays average 4 to 5% copper, and $3 to $8 in gold and silver per ton. W. E. Casson is president and manager. It is planned to make the first test of the new copper-treatment plant at Heroult about October 19. The method is devised to smelt ores without generating noxious fume. Electricity is employed. The Clear Creek dredge, ten miles below Redding, is operating steadily. An excellent monthly profit is being earned, according to reports. The dredge is of the close-connected elevator type, equipped with 5-cu. ft. buckets. Oroville people, said to be representing Oroville Dredging, Ltd., are prospecting in the Clear Creek district with a Keystone drill. The ground has been worked in past years by ordinary placer methods.

Redding, October 7.

Sierra County

(Special Correspondence.) The 40-stamp mill has been started at the Alaska mine, near Pike City. The vein has been developed to a depth of 550 ft. and ranges from 2 to 30 ft. wide. The ore is low grade and free milling, and is crushed in rock-breakers and passed to the stamps, arranged in eight batteries. From the amalgamating plates the pulp flows to eight Wilfley tables, from which tailing passes to settling-tanks, before being allowed to run to the restraining dam. Mine equipment includes two air-compressors, 25 machine-drills, and pumps having a rated capacity of 2500 gal. per minute. The Alaska is operated by the Sierra-Alaska Gold Mining Co. Charles Scribner, of the Scribner Publishing Co. of New York, and Gen. W. S. Schuyler, are prominent stockholders. George St. John is president and manager. Negotiations are pending for the transfer of the Squires gold quartz claim to San Francisco capitalists. The claim lies near Forest.

Downieville, October 5.

Work has been stopped at the Poker Flat mine on account of shortage of water. The shaft is down 550 ft. Gravel which returns a trifle over $2 per load is being taken out at Deadwood. The owners of the gravel claim in Clark's canyon, at the head of North Fork, are preparing for winter and have built a reservoir to wash the gravel. Several men will start work at the Australia quartz claim in Slug canyon. Machinery at the Keystone has been repaired. From the face of the adit the lode shows free gold and sulphides, and there are over 1200 ft. of backs.

COLORADO

Gilpin County

The main shaft at the Manchester group of claims, on North Beaver creek, near Rollinsville, is down 115 ft. On the 100-ft. level the vein is 3 ft. wide, carrying a high percentage of tungsten. A 25-ton mill has been erected on the property and contains a crusher, rolls, and No. 6 Wilfley concentrating and slime tables. From an 8-hr. run last week, 600 lb. of concentrate worth $125 was saved. Several more tables will be installed. H. and H. Eilman, leasing at the O. K. mine, on Central hill, have opened 6 ft. of ore at the 400-ft. level and are mining 200 tons per month. At the 100-ft. level of the Federal mine, in Russell district, the vein is about 3 ft. wide. A shipment of ore to the Iron City mill returned 1.56 oz. of gold, 59.65 oz. of silver, 3.35% copper, and 28.02% lead, and saved 90% of the metal content. Sixty-two tons of ore from the National adit, at Black Hawk, yielded one ton of concentrate worth $78.79 per ton, and 16 tons worth $15 per ton. This ore comes from a stope about 3500 ft. from the portal of the adit, and shows a width of four feet.

Development on the 100- and 200-ft. levels of the Buckley mine has opened a lode 36 in. wide, assaying 20 oz. of gold and 7 oz. of silver per ton. The shaft is down 630 ft., and the mine is equipped with plant to handle the present output. The Topeka is sending 65 tons per day to the mill at Black Hawk. The local pool working the Corydon mine has opened promising veins on the 200, 300, and 400-ft. levels.

Jefferson County

The North American Smelter & Mines Co., capitalized at $2,500,000, and owning a smelter at Golden and mines in the Clear Creek-Gilpin district, is in the hands of a court receiver. Interest on bonds had not been paid, and holders of bonds worth $500,000 had asked for the action. It is hoped to finance the company and resume operations. The smelter shut down last November.

Lake County (Leadville)

A large number of lessees in the district still have faith in Fryer hill, and after 33 years of strenuous work the famous hill continues to produce plenty of ore. Work is being done at the Chrysolite on the 210-ft. level; the Annie lessees are driving a raise to cut high-grade ore found in the upper level; shipments have been resumed from the Little Chief; the old McRae shaft is being unwatered; lessees at the Matchless are shipping from the 190-ft. level; and at the Duncan they are driving on the 200-ft. level. At the Brunswick, near the head of Big Evans gulch, work will be continued through the winter. Adits are being driven into the hill. This is a new district, and work will be watched with interest. The Sugar Loaf Consolidated is shipping 20 tons of ore per day.

Ouray County

The Wanakah company is making a profit of $10,000 per month, and is making improvements at the mine and mill. The Barstow is shipping a fair quantity of concentrate. The Butcher and Larsen lease, on the Jumbo, is looking well. A winze is 9 ft. below the drift, showing 12 in. of high-grade bismuth ore. Sundry work is being done at the Humboldt, Mineral Farm, Mono-Baltic, Congress, San Antonio, and Brooklyn properties.

During the past nine months of the current year, there has been shipped from Ouray mines a total of 13,588 tons of ore and concentrate, says the *Plaindealer*. The principal contributors to this total are the Wanakah with 4708 tons; Camp Bird, 4373 tons; Atlas, 1789 tons; Revenue, 699 tons; and Wedge, 555 tons. The power plants of the Revenue are at work repairing and erecting new lines having been done during this summer. Work is to be started at the Germania-Montfurst-Dykelot group of claims two miles east of Ouray in the Horseshoe.

Teller County (Cripple Creek)

According to local statistics, the September production of the Cripple Creek district totaled $1,146,034, with a tonnage of 72,230. The local low-grade mills contributed about 29,000 to the total tonnage. The figures given out by representatives of the various plants are as follows:

	Tons.	Av. Val.	Gr. Val.
Smelters	3,885	$15.00	$250,275
Golden Cycle	29,500	20.00	590,000
Portland, Victor	14,700	3.06	44,982
Portland, Colorado City	10,000	22.00	220,000
Stratton's Independence	10,945	2.96	32,397
Cavanaugh	1,500	2.00	3,000
Isabella	500	2.00	1,000
Gaylord	1,200	3.65	4,380
	72,230	$15.87	$1,146,034

The flow of water from the Roosevelt tunnel is 9750 gal. per minute. The total drop in the water-level at the Gold Coin shaft of the Granite company has been 178 ft. Owing to the presence of gas in the Chickenhawk shaft on Guyot hill, a blower has been erected to remove it. During September the McKinney mine shipped 33 cars of ore worth $35 per ton, while 12 cars came from lessees; the Granite production was 70 cars averaging $25 per ton; from the Vindicator 68 cars worth $68 per ton was mined from levels 14 and 15; and the Jerry Johnson sent out 17 cars, of which seven were from the chief lessee. In development at the 1600-ft. level of the Portland No. 2 shaft, one of the old orebodies has been opened. It is about 12 ft. wide, of fair grade. The mill is treating nearly 15,000 tons per month, one-third of which comes from the dumps.

A meeting of a number of those people heavily interested financially in the Roosevelt tunnel was held at Colorado Springs on October 4, and the question of another deep drainage bore was discussed. No definite estimates have been prepared; but it is stated that a tunnel 500 ft. lower than the Roosevelt would cost $500,000. The latter cost approximately $750,000. Another meeting will be held at an early date.

The *Colorado Springs Gazette*, in its 'Twenty Years Ago Today' column of October 4, said that at Cripple Creek the local mill was treating 50 tons per day, while 25 tons was being shipped. The stamp-mill was worked by G. M. Taylor, now manager of the Portland company's milling department. The shipments went out on burros. The present daily tonnage treated locally and shipped amounts to about 2400 tons.

IDAHO

Coeur d'Alene

Fire broke out on October 7, in the Kellogg adit of the Bunker Hill & Sullivan mine; and fire crews, relieving each other at frequent intervals, tried to extinguish the outbreak. F. A. Benz, the pumpman, remained at his post until the fire short-circuited the current which drives the pumps, and is now missing, though a rescue crew of four men, equipped with oxygen helmets, entered the workings on October 8. The fire broke out again late on the night of October 8 and was finally extinguished the next morning. The pumpman has not been found, and no hope of rescue is held out. About 600 men will be out of employment until repairs can be made.

MISSOURI

Jasper County

September was a month of record production, shipments, and prices for the Joplin district. Zinc ore prices averaged $55.14, $58.10, $60.62, and $61.10 per ton for each week respectively, the record price being $64.50 for 60% ore during the third week. Calamine ore also profited by the advance, and averaged $32 per ton for the month. The average weekly shipments were 6476 tons of blende, and 464 tons of calamine. Lead ore prices varied between $59.75 and $65.09 per ton, and 946 tons per week was shipped. The aggregate value of zinc and lead ores for the 39 weeks of 1912 is $12,510,021, compared with $9,719,480 for the same period in 1911. There has been a total of 194,895 short tons of blende produced during this period. Drills working at leases of the Gray land, southeast of Joplin, and on a lease between Thorns station and Carl Junction, have cut lead and zinc ore respectively.

MONTANA

Silverbow County

The September output of copper from the mines at Butte was 29,054,940 lb. The output from the various mines was as follows:

	Ore, tons.	Copper, lb.
Anaconda group	170,300	10,558,600
Boston & Montana group	108,920	7,079,800
Butte Coalition	37,260	2,645,460
North Butte	34,720	2,360,960
Butte & Boston	15,700	973,400
Alex-Scott	7,800	936,000
Trenton	15,110	921,000
Original	11,600	707,600
Washoe	9,210	561,810
Tuolumne	4,500	540,000

At the annual meeting of the Davis-Daly Copper Co., held last week, W. Bloom, of Boston, was elected a director to succeed F. A. Heinze. For the year ended June 30 the gross revenue was $113,333, while total expenses were $199,029, leaving a deficit of $85,696. About 50 tons of ore averaging 4% copper and 6 to 8 oz. of silver has been shipped daily. The August revenue was nearly $14,000. Extensive development has been the cause of much extra expenditure. The company was one of the first to recognize the miners' demand for increased wages, the present rate being $4 per shift. The company's fixed assets are given as $5,239,029; deferred, $1,217,910; and current, $214,244; making a total of $6,671,184, almost similar to those of last year. Capital stock is $6,000,000, current liabilities $20,573, making the total liabilities $6,020,513. The surplus account stands at $650,671.

NEVADA

Esmeralda County

(Special Correspondence.)—The estimated production of the Goldfield Consolidated company for September is $390,000 from 29,460 tons treated. Operating expenses were $190,000, leaving a net profit of $200,000. The tonnage milled is low on account of repairs; while ore shipped was also low on account of repairs at the Grizzly Bear shaft.

Goldfield, October 2.

The storage battery at the Consolidated enabled the company to keep on working a great deal of its machinery, when the electric power was shut off last week, due to the plant of the power company being struck by lightning. The shaft at the Goldfield Merger mine, which is 7 by 18 ft.

in the clear, is being sunk to 2000-ft. depth. The Jumbo Extension is treating 60 tons of ore daily. At a point east of the shaft, and near the Merger mine, the company is mining 5 ft. of ore worth $50 per ton.

The Pittsburg-Silver Peak company has declared a dividend of 2c. per share, which means the distribution of $55,800. The mill is treating over 15,000 tons of ore per month. R. S. Peterson, a miner, has started a suit against the company for $76,858.50 for injuries received when he and four others drilled into an old hole on June 15, 1911.

Humboldt County

The National Mines Co. employs 60 men, and the Charleston Hill Syndicate 25 men. The former is mining high-grade ore from the undisputed part of the property, while the latter is working along the fault line. This work shows that the quartz stringers are all cut off by the fault, or penetrate no farther than the hanging wall. The contention is that all development by the Syndicate verifies the theory of A. C. Lawson as to the Charleston Hill faulting and the general movement. Work has progressed favorably, and by October 10 the Syndicate anticipates that it will discover the fault portion of the high-grade vein as foreshadowed by Mr. Lawson. The Wheeler Leasing Co. employs 10 men. The Wheeler adit has cut a number of veins carrying gold and silver.

Mineral County

Another 50-ton mill is to be built at Rawhide, and a better feeling prevails in the district. The Nevada New Mines Co. has exposed two orebodies of $25 average in the 365-ft. cross-cut from the Grutt Balloon, and 30 tons of ore is being added to the dump daily. Ore worth $25 to $40 per ton is being extracted from the Grutt Hill, Hooligan Hill, Marigold, Regent, Morning Star, and others.

Storey County

The Yellow Jacket mill, at Gold Hill, is crushing an accumulation of Crown Point ore, which comes from the slopes on the 1400-ft. level. Shipments of ore have been sent to the smelters from the Gould & Curry and Comstock-Phoenix mines. The Mexican mill treated 422 tons averaging $42.45 per ton, with 94% extraction. This ore came from the 2300, 2400, and 2500-ft. levels of the mine. At the 2500-ft. level of the Ophir, the southwest drift is out 576 ft. The Butters filter, and precipitating boxes have been erected in the mill. The usual work was done at the Consolidated Virginia, Union Consolidated, Sierra Nevada, and others on the Comstock. At the C. & C. shaft the pumps worked practically full time, while the shaft was repaired and other work done. All equipment and material has been taken from 2000-ft. level of Ward shaft, and the No. 3 pump at the 2100-ft. station is being dismantled.

Four mills in Sixmile canyon have a total of 40 stamps working on ore from the Lady Bryan, Comstock-Phoenix, East Comstock, Chollar & Potosi, and Monte Cristo mines.

White Pine County

With the closing of the mill and smelter at McGill, the strike will affect nearly 4000 men, who were earning about $300,000 per month. From indications it would seem probable that the Nevada Consolidated will not reopen the mines this winter. The manager of the Giroux Consolidated asked that the pump-men be allowed to work, as the mine will fill with water; but the request was refused. Everything is quiet and the best of feeling exists between the operators and men. The stock of ore on hand at McGill will soon be exhausted, and the mill will have to be shut down, followed by the smelting plant. It is said that the Kimberly concentrating plant of the Giroux company is to be overhauled and its capacity increased from 500 to 1000 tons per day. The company would have then to supply 1000 tons per day for the Steptoe plant under the 5-year contract, and a similar quantity for the Kimberly mill. On the 1000 and 1200-ft. levels of the Alpha, a large quantity of high-grade copper ore is ready for stoping. The Railroad Valley company has purchased a standard drilling rig and will soon resume drilling work.

NEW MEXICO

Grant County

Five steam-shovels are working at Chino, ore coming from the Hearst-Carrasco and Chino sections. The fifth unit of the mill is about finished, and the September output should be about 4,000,000 lb. of copper.

TENNESSEE

Polk County

It is reported that the Tennessee Copper Co. will organize a new company with a capital of $25,000,000, divided into 500,000 shares of $50 each. The present capital is $5,000,000, with 200,000 shares of $25. The object of this is to provide funds for a new blast-furnace plant to treat the large quantity of iron sulphide ore developed. This will cost about $2,000,000. After extracting sulphur and copper, the slag will be sold to cement manufacturing people, as it contains no phosphorus. An annual profit of $1,000,000 is expected from the work.

UTAH

Beaver County

The Moscow Mining company, in the North Star district, is shipping 15 cars of ore per month. A lode 5 ft. wide has been opened at the 500-ft. level, but has a low content in lead, silver, and gold. The Moscow vein has been cut by the drift which was driven from the shaft on the 500-ft.

UTAH-APEX MINE.

level to connect with the north workings. The drift has been driven 50 ft. on the vein, which is of good width and metal content.

Juab County

The mines of the Tintic district shipped 208 carloads of ore for the week ended October 4. The Mammoth company has declared a dividend of 15c. per share, equal to $60,000, the first payment for nearly four years; and makes a total of $2,280,000. The new orebody opened at the 600, 700, and 800-ft. levels has helped largely to bring about larger production. Eighty tons of silver ore, valued at about $12,000, left No. 3 workings of the Iron Blossom last week. As much of this ore as possible will be saved for the new mill. Settlements for zinc ore from the May Day average $20 per ton. Notices have been posted in the district announcing an increase of 25c. per day for all underground workers, at most of the mines. The Tintic District Miners' Union has appointed a committee to confer with the mine-owners.

Salt Lake County

The firm of Kirk & Leavell started to open the old workings at the New York, Minnie, and other claims of the Utah-Apex company on February 1 of this year, and found the old stopes, drifts, and raises badly caved, and treacherous to work in. Their lease expired on September 30, and during that time they employed from 30 to 135 men, and mined ore worth $135,000, paying the company a good

royalty, and also doing fairly well for themselves and sublessees. The ore carries lead, silver, gold, and copper, with a small quantity of zinc occasionally, and averaged about $25 per ton.

It has been announced by D. C. Jackling that the Utah Copper and Nevada Consolidated companies will pursue a waiting policy and that, though the companies are perfectly willing to treat with their men as individuals, they will not recognize the Western Federation. At Bingham it is hoped that the Utah Copper will soon be in a position to resume work.

WASHINGTON

Ferry County

G. E. Thornton, who has been prospecting for 10 years in and about the California mine, 9 miles southeast of Republic, has inherited one-fifth of an estate valued at $125,000. The rearranged crushing department of the North Washington Power & Reduction Co.'s plant has doubled its capacity, making 125 to 160 tons handled per day. The ore now passes a Blake crusher to a set of 19-ton rolls, then to a revolving screen, from which the oversize goes through finishing rolls to storage bins. During the year ended May 31 the Republic Mines Corporation shipped 20,646 tons of ore valued at $382,118. Mining, treatment, freight, etc., cost $339,381, which left a surplus of $42,737. The extraction was 66.2 per cent.

Spokane, September 20.

The Superior copper mine, near Browns Lake, in the west Chewelah district, has been leased for three years. Over $25,000 has been spent in development of a lode 9 ft. wide, carrying high-grade copper-silver ore.

Jefferson County

A company which intends to manufacture potash from kelp, a seaweed which grows prolifically along the Pacific coast, has located beds extending from Point Wilson to Middle Point, and also lying west of Smith island, in the Strait of Fuca.

CANADA

Cobalt

The Cobalt Lake company has sent out a trial sample of ore assaying about 25 oz. of silver and 25% nickel. Four claims at the Gillies Limit have been sold for $5000. They are situated close to the Waldman; and there is a large calcite lode from A99 to the upper claim of the group. A 3-in. vein of high-grade ore was cut on the 150-ft. level of the Crown Reserve last week, in a crosscut, a distance of 800 ft. from the shaft. On October 1 the largest shipment of bullion that ever left Cobalt in one day was sent to Montreal, to be transshipped to England. There were 143 bars of bullion, weighing 159,400 oz., worth $102,100, which came from the Nipissing, O'Brien, and Crown Reserve mines.

Porcupine

At the Pearl Lake mine an orebody 18 ft. wide has been cut on the 400-ft. level, 224 ft. from the shaft at the south. It consists of veins of quartz up to 36 in. wide, in heavily mineralized schist, showing free gold. Assays return $30 per ton. Driving is being pushed east and west and the shaft is being sunk to 600-ft. depth. A 20-stamp mill will be erected as soon as possible. Treatment at the Vipond mill is said to be good, with an extraction of 90%, at a cost of about 60c. per ton. At a meeting of the miners' union held last week, the general feeling seemed to be in favor of asking for the wage scale adopted for Porcupine in August 1911, and amended in October of that year. This wage is about 50c. per day higher than the present scale. The Board of Conciliation met at Toronto, and upon its decision depends whether there will be trouble between the men and mine-owners.

Yukon

Construction of roads in the territory, under appropriations made at the recent session of the Yukon Council, is progressing so well that most of the work is about completed. The winter road to Glacier creek will be built before snow falls, and will follow up the Swede Creek valley, thus avoiding the high and dangerous Glacier ridge road in winter.

MEXICO

Jalisco

The Amparo mine, in the Etzatlan district of this state, is producing bullion worth ₱140,000 per month. Last year operations were interfered with by interruptions to the power service of the Chapala Hydro-Electric & Irrigation Co., but these have been few and short during the present rainy season. In November 1911 the shrinkage system of stoping was started, and by August of the current year there were 54,000 tons of broken ore in the stopes. The mill is now treating 260 tons per day. A 200-hp. Ingersoll-Rand compressor has been erected at No. 2 shaft, which is down 1120 ft. About nine cars of ore per month are being sent to smelters from El Favor mine, of the Makeever interests, in the Hostotipaquillo district. Development is mainly being done at the Mololoa mine belonging to the same people. The Espada Mines Co. is treating 100 tons per day at the Virginia & Mexico mill. So far this year concentrate and bullion worth ₱100,000 has been produced. The Miravalles Mining Co. has been organized to work the famous *antiguas* known as the Huicicila mines at Tepic, five hours from Composteba. They were taken over in July by W. R. Ramsdell, well known in this state, and are being opened under the direction of W. J. McCormick, formerly at the Casados and El Favor mines.

Mexico

(Special Correspondence.)—Water troubles have been overcome at the mine of the San Vidal y Anexas Co. at El Oro. While work on this was being done, a cross-cut was put in the hanging wall country to look for the vein which is opened in the shaft at a higher level. At a distance of 13 ft. west, a sulphide vein was cut, dipping northwest and approximately parallel with the San Carlos vein. It is about 33 ft. wide, and was cut a few feet below its apex. Samples from a well mineralized stringer on the foot-wall of the vein assayed 10 to 55 oz. of silver per ton. Shaft sinking is in progress.

El Oro, September 15.

Sonora

(Special Correspondence.)—El Tigre was attacked by 350 rebels, under the leadership of Inez Salazar, on September 13. The camp was defended by 20 federal soldiers and 50 citizens. Reinforcements of 360 federals were despatched to the trouble, but failed to arrive. At 11 o'clock on September 14, the defenders retired and allowed the rebels to take possession, having exhausted all ammunition after 30 hours' fighting and no relief in sight. On September 16 the rebels left El Tigre, taking 21 bars of bullion worth $25,000, which has since been recovered. Loss of merchandise, and one burned building, cost the company $15,000. Railroad and wagon traffic has been resumed, and most of the rebels have left the district, which is occupied by federals. During September the plants were shut down for three days. On September 28, bullion valued at $60,000 was received at Douglas, Arizona, and on September 30 bullion worth $25,000 will be shipped from the mine. The accumulated production of ore and concentrate will be shipped as fast as possible.

Kansas City, Missouri, September 30.

Sonora

As soon as the present unsettled conditions are over, a stamp-mill or concentrator of some type will be erected at the Golden Cross mine, in the Magdalena district. This property has ore carrying gold and silver, and is owned by the Dolores Mining & Development Co. of Oakland, California. The Major Domo claim, five miles from Cananea, will have its shaft sunk to 200-ft. depth, and the 100-ft. level driven in two directions. The Gordo mine, next to the Golden Cross, owned by Cananea men, is showing high-grade ore in one of the adits.

Personal

Professional men are invited to send news of their engagements and travels. Such news is interesting to friends.

E. H. BENJAMIN has gone East.

C. R. KEYES is in San Francisco.

PEREGRINE O. WILSON has gone to Mexico.

GELASIO CAETANI has returned from Arizona.

A. M. CHAMBERLIN has gone to Juneau, Alaska.

EDMUND JUESSEN has returned to San Francisco.

D. H. DUNN was in San Francisco during the week.

D. M. FOLSOM was in San Francisco last Thursday.

ARTHUR A. FRANCIS has gone to Spain for a brief stay.

R. S. BOTSFORD is now at Bogoslovsk, in the province of Perm, Russia.

ALBERT WHITE, of San Francisco, has gone to Auckland, New Zealand.

LIONEL LINDSAY has returned from a trip to the Southwestern states.

H. HENDRICKSON is now with the Cia. Minera de Penoles, Ojuela, Durango.

BRAXTON BIGELOW has returned to Goldfield, Nevada, from Treadwell, Alaska.

A. J. FISHER, of San Francisco, has gone to the Black Oak mine, Soulsbyville, California.

B. N. LEHMAN has returned to Salt Lake City from a visit to the Yankee Consolidated mine.

E. F. BURCHARD is returning from Juneau and expects to reach San Francisco on October 22.

MARSHALL S. WALKER has accepted a position in the United States Assay Office, New York.

A. G. CHARLETON has left London for the Continent, expecting to return from Sicily about November 8.

FOREST B. CALDWELL, superintendent of the Candelaria Consolidated Mexican Mining Co., is in San Francisco.

FRANCIS P. BRAY, general manager for the West African Trust, Ltd., has left the Gold Coast on his annual holiday.

A. ADIASSEWICH has returned from the Caucasus and has left London for a five months trip to the United States.

F. H. MORLEY will sail at the end of October for an extended holiday trip in Egypt, Greece, and southern France.

RUSH T. SILL and HARLEY A. SILL have opened offices at Los Angeles as consulting mining and metallurgical engineers.

WILLIAM T. CARDWELL has left Cananea, Sonora, Mexico, where he has been with the Puertecitas mine, and is now at Miami, Arizona.

H. FOSTER BAIN was in New York, Washington, and Pittsburg during the week, and has gone to Chicago, expecting to return to Cleveland on October 27.

TADASHIRO INOUYE, professor of mining in Tokyo Imperial University, was in San Francisco during the week and has gone to the dredging fields and the hydraulic workings in Trinity county.

FREDERICK G. CLAPP spent a part of September and October in Ontario and Quebec in connection with a general investigation of the oil and gasfields of Canada which the Bureau of Associated Geological Engineers is making for the Canadian Department of Mines.

Obituary

HENRY E. PICKET died at Berkeley, California, September 27, at the age of 74. A native of Pennsylvania, he went to the Black Hills in the first gold rush, and later moved to Placerville, California, where he was engaged in mining for many years. The later years of his life were occupied in real estate ventures in Sacramento.

Market Reports

LOCAL METAL PRICES

San Francisco October 10.

Antimony	11—11½c	Quicksilver (flask)	41.50
Electrolytic Copper	18—18½c	Tin	52—53½c
Pig Lead	5.35—6.30c	Spelter	8½—8¾c

Zinc dust, 1400 lb. casks, per 100 lb., small lots $9.50—9.75; large $7.50—8.50

METAL PRICES

(By wire from New York.)

NEW YORK, October 10.—Copper quiet; buyers are holding off. Lead still firm. Spelter quiet. Average daily prices for the past week, in cents per pound, based on wholesale transactions, standard brands, are given below.

Date.	Electrolytic Copper.	Lead.	Spelter.	Silver, per oz.
Oct. 3	17.45	5.10	7.48	63⅞
" 4	17.45	5.10	7.48	64
" 5	17.45	5.10	7.48	64⅛
" 6	Sunday.	No market.		
" 7	17.40	5.10	7.48	64
" 8	17.35	5.10	7.48	64⅛
" 9	17.35	5.10	7.48	63⅞

LONDON QUOTATIONS

(By cable, through the courtesy of C. S. Burton & Co., New York.)

	October 10.
Camp Bird Ltd	$ 6⅜
El Oro	3⅜
Esperanza	9⅜
Oroville Dredging	1⅛
Santa Gertrudis	7⅛
Tomboy	6⅛

COPPER SHARES—BOSTON

(By courtesy of J. C. Wilson, Mills Building.)

	Closing prices, October 10.		Closing Prices October 10.
Adventure	$ 6¼	Mohawk	$ 67½
Allouez	45½	North Butte	38⅜
Calumet & Arizona	81⅜	Old Dominion	62½
Calumet & Hecla	592	Osceola	113
Centennial	22	Quincy	87
Copper Range	59	Shannon	15½
Daly West	3⅜	Superior & Boston	1⅜
Franklin	10⅛	Tamarack	46¼
Granby	64½	Trinity	5
Greene Cananea, ctf.	10⅜	Utah Con	13
Isle-Royale	35½	Victoria	3
La Salle	5⅜	Winona	5
Mass Copper	7	Wolverine	78

NEVADA STOCKS

(By courtesy of San Francisco Stock Exchange.)

San Francisco, October 10.

Atlanta	$ .19	Midway	$ .52
Belcher	.25	Montana-Tonopah	2.17
Belmont	9.85	Nevada Hills	1.62
B. & B.	.05	North Star	.41
Big Four	.46	Ophir	.45
Booth	.06	Pittsburg Silver Peak	.91
Combination Fraction	.11	Round Mountain	.37
Con. Virginia	.35	Savage	.10
Florence	.70	Tonopah Extension	2.60
Goldfield Con.	2.47	Tonopah Merger	1.10
Jim Butler	.73	Tonopah of Nevada	6.25
Jumbo Extension	.35	Union	.36
MacNamara	.23	Vernal	.11
Mexican	2.42	West End	1.70

MINING STOCK QUOTATIONS—NEW YORK

(By wire from C. S. Burton & Co., New York.)

	Closing Prices. October 10.		Closing Prices. October 10.
Amalgamated Copper	$ 90	Miami Copper	$ 29
A. S. & R. Co.	87⅜	Mines Co. of America	3
Braden Copper	6⅛	Nevada Con	22⅜
B. C. Copper Co.	4⅛	Nipissing	8⅜
Chino	43⅛	Ohio Copper	1⅜
First National	1⅛	Ray Con	21⅛
Giroux	4⅛	Tenn. Copper	44½
Goldfield Con.	2⅛	Tonopah Belmont	9⅛
Greene-Cananea	10½	Tonopah Ex.	2⅛
Hollinger	14½	Tonopah Mining	6½
Inspiration	20⅜	Trinity	6
Kerr Lake	2⅛	Tuolumne Copper	2⅞
La Rose	2½	Utah Copper	64⅛
Mason Valley	12⅜	West End	1⅛
McKinley-Darragh.	1⅛	Yukon Gold	3½

Recent Publications

Soil Erosion. Bull. 71, Bureau of Soils. Washington, D. C.

Mineralogy of Japan. By T. Wada. No. 4. 72 pp., ill. Tokyo, 1912.

The Woodsman's Handbook. Bull. 36, Forest Service. Washington, D. C.

Properties and Uses of Douglas Fir. Bull. 88, Forest Service. Washington, D. C.

Forest Trees of the Pacific Slope. Forest Service, Miscellaneous. Washington, D. C.

Boletin de la Sociedad Nacional de Mineria. 62 pp., maps, tables. Santiago, Chile, 1912.

Notes of Mineral Wastes. By C. L. Parsons. Bureau of Mines Bulletin 47. 44 pp. Washington, 1912.

Colorado Scientific Society Proceedings. 'The Electron Theory.' By H. A. Curtis. Denver, July 1912.

Boletin del Cuerpo de Ingenieros de Minas del Peru. No. 77. By Carlos P. Jiminez. 72 pp., index. Lima, 1912.

Examination and Classification of Rocks for Road Building. Bull. 37, Office of Public Roads. Washington, D. C.

Wind-Graved Mesas and Their Message. By C. R. Keyes. Reprint from *Popular Science Monthly*. 11 pp., ill. New York, September, 1912.

Manufacture of Coke in 1911. By E. W. Parker. Advance chapter from 'Mineral Resources of the United States, 1911.' 61 pp. Washington, 1912.

Production of Petroleum in 1911. By D. T. Day. Advance chapter from 'Mineral Resources of the United States, 1911.' 152 pp. Washington, 1912.

The Zinc Deposits of Northeastern Tennessee. By A. H. Purdue. State Geological Survey Bulletin 14. 69 pp., index, ill., maps. Nashville, 1912.

Bibliography of the Geology and Mineralogy of Tin. By F. L. and E. Hess. 408 pp., index. Published by the Smithsonian Institution, Washington, 1912.

Reports on the District of Patricia. Compiled and edited by W. G. Miller. Report of the Bureau of Mines of Ontario. 216 pp., ill., maps, index. Toronto, 1912.

The Absorption of Creosote by the Cell Walls of Wood. By C. H. Teesdale. U. S. Department of Agriculture circular No. 200. 7 pp., ill., tables. Washington, 1912.

Recent Discoveries of Carnivora in the Pleistocene of Rancho la Brea. By J. C. Merriam. University of California Publication. 8 pp., ill. Berkeley, September, 1912.

Resources of Tennessee. Bulletin of the State Geological Survey. 'The Valley and Mountain Iron Ores of East Tennessee,' by R. P. Jarves. 42 pp., ill. Nashville, September, 1912.

The Initiative, Referendum, and Recall. The Annals of the American Academy of Political and Social Science. Papers collected and edited by C. L. King. 352 pp., index. Philadelphia, 1912.

Constructive Theory of the Universal Plane Quartic by Synthetic Methods. By A. D. Biddle. University of California publication in Mathematics. 54 pp., diagrams. Berkeley, 1912.

Mine Waters. By A. C. Lane. Reprint of pages 774-779 of the 'Keweenaw Series of Michigan.' Annual report of the Board of Geological and Biological Survey for 1909. 15 pp. Lansing, 1911.

Preliminary Report on the Tertiary Paleontology of Western Washington. By C. E. Weaver. State Geological Survey Bulletin No. 15. 95 pp., ill., maps, index. Olympia, Washington, 1912.

Silver, Copper, Lead, and Zinc in the Central States in 1911. Mine Production. By B. S. Butler and J. P. Dunlop. Advance chapter from 'Mineral Resources of the United States, 1911.' 82 pp. Bibliography. Washington, 1912.

Developed Deposits of Fullers Earth in Arkansas. By H. D. Miser. Advance chapter from Bull. 530, 'Contributions to Economic Geology, 1911. Part I.' U. S. Geol. Surv. 16 pp. Map. Washington, 1912.

Temperature of Copper Mines. By A. C. Lane. Reprint of chapter VI of the 'Keweenaw Series of Michigan.' Annual report of the Board of Geological and Biological Survey for 1909. 17 pp. Lansing, 1911.

The Grain of the Igneous Rocks. By A. C. Lane. Reprint of chapter IV of the 'Keweenaw Series of Michigan.' Annual report of the Board of Geological and Biological Survey for 1909. 27 pp., tables. Lansing, 1911.

Coal Fields in Eastern Wyoming. By J. A. Davis, C. H. Wegemann, and D. E. Winchester. Advance chapter from Bull. 471, 'Contributions to Economic Geology, 1910. Part II.' U. S. Geol. Surv. 95 pp. Tables, maps. Washington, 1912.

First National Mine-Safety Demonstration at Pittsburg, October 30, 1911. By H. M. Wilson and A. H. Fay. Also a chapter on the Explosion at the Experimental Mine, by G. S. Rice. Bureau of Mines Bulletin 44. 75 pp., ill. Washington, 1912.

Coal Fields of the Wind River Region, Fremont and Natoma Counties, Wyoming. By E. G. Woodruff and D. E. Winchester. Advance chapter from Bulletin 471, 'Contributions to Economic Geology, 1910.' 53 pp., maps. Washington, 1912.

Storage of Water for Irrigation Purposes. Part I. Earth-Fill Dams and Hydraulic-Fill Dams. 95 pp., 20 pl., 41 fig. Bull. 249. Part II. Timber Dams and Rock-Fill Dams. 64 pp., 8 pl., 38 fig. Bull. 249, U. S. Geol. Surv. Washington, D. C., 1912.

Production of Mineral Waters in 1911. By G. C. Matson. With, Concentration of Mineral Water in Relation to Therapeutic Activity. By R. B. Dole. Advance chapter from 'Mineral Resources of the United States, 1911.' 60 pp. Washington, 1912.

Chart of the Elements. Published by the Metallic Compositions Co. 43 pp., ill., tables. London, 1912. This publication consists of a large chart based on the periodic law of the elements according to Mendeleeff. Principal properties are given of each element in abstract together with explanations of the chart.

Records of the London and West County Chamber of Mines. 8 pp., tables. London, July 1912. Of late practically the only function of this institution has been to collect and publish statistical and reliable information relating to the mines of the west of England, which is not the purpose of a chamber of mines. Many useful subjects could be discussed, but proper meetings could not be arranged. The Chamber therefore is dissolving. There has been a quiet revival of interest in Cornish mining; and now is the time to move if anything is to be done toward the formation of a really useful chamber of mines.

The Ruby gold-placer district of Alaska, on the south side of the Yukon about 175 miles below the town of Tanana, is discussed in Bulletin 520-J of the U. S. Geological Survey by A. G. Maddren. Late in the summer of 1907 a report was circulated along the Yukon that prospects of placer gold had been discovered on Ruby creek, and the district has since received some attention from gold-seekers. The discovery was made at the mouth of the creek in some fine gravel at the level of the spring high-water mark of the Yukon, of which the creek is a tributary. During the summer of 1911 the report of new discoveries attracted a large number of persons to this district, but the actual discoveries of placer gold up to the time of the latest reports do not seem to indicate that this will be a new bonanza field, although many are of the opinion that they indicate more extensive deposits of gold-bearing gravels.

Concentrates

Most of these are in reply to questions received by mail. Our readers are invited to ask questions and give information dealing with the practice or mining, milling, and smelting.

SCALE in boilers one-sixteenth of an inch thick means a loss of 25% in efficiency.

ENERGY in coal that is being effectively utilized is probably not over 11 per cent.

ELECTRIC incandescent lamps were invented by T. A. Edison, 30 years ago, on September 4, 1882.

ZINC has been, and in general still is, considered about the worst impurity to be found in copper and lead ores, as it has always given trouble in their treatment.

BITUMINOUS coal amounting to 406,000,000 tons was produced in the United States last year, yet only $3,800,000 worth of nitrogen was recovered out of $160,000,000 worth that could be recovered.

ELECTRIC power is to be transmitted 80 miles to the city of Tokyo, in Japan. The scheme involves building a high-pressure power line, and 60,000 hp. will be developed from the rapids of the Kinu river.

SULPHURIC acid amounting to about 3,000,000 tons is produced yearly in the United States, of which nearly one-half is used in manufacturing fertilizers. Smelters discharge enough SO_2 into the air to make over 8,000,000 tons of this acid.

SCIENTIFIC control of combustion under boilers is increasing, but the losses of carbon which still pours from chimneys, defacing monuments, buildings, and landscape, are without valid reason. It is one of the evils of modern civilization.

NITROGEN amounting to 810,000,000 tons has been wasted in the United States since 1893 through the use of the old-fashioned beehive coking oven. By-product coke-ovens would have yielded from this coal 9,315,000 tons of ammonium sulphate, worth $60 per ton, which could have been used as a fertilizer instead of importing $15,000,000 worth of potash from Germany every year.

PENNSYLVANIA has yielded 2,270,798,737 short tons of anthracite and 2,396,491,260 tons of bituminous coal since 1814, the date of the earliest record of coal production in this country, according to a chart just issued by the United States Geological Survey. Illinois comes second with 844,012,353 tons of bituminous; West Virginia third with 649,448,201 tons; and Ohio fourth with 611,949,292 short tons. These four states have therefore produced 6,772,699,843 tons in 98 years; or more than three-quarters of the total output of the United States.

PLATINUM is usually found as small nuggets, scales, and rounded or irregular grains. The specific gravity of crude platinum varies from 14 to 19, and percentage of metal contained is 70 to 85%. The output from the United States is almost wholly from California and Oregon. Owing to its high melting point and resistance to acids, platinum is used for laboratory apparatus; in making kettles for concentration of sulphuric acid; in photography, dentistry, electric installations, jewelry, and electric lamps. Its use for jewelry is unfortunate, as other metals can be substituted. Tungsten is replacing platinum in incandescent lamps; and an alloy of nickel and chromium is used for triangles used in laboratories. Platinum salts are used in chemical analysis.

Commercial Paragraphs

The BRADEN COPPER CO., of South America, has just placed an order for four 8-ft. diameter Hardinge pebble-mills, all-steel trunnions with cut gears, for concentration grinding. These mills are similar in type to those furnished to the Miami and other copper companies of Arizona.

An arrangement has just been consummated whereby the Mexico Mine & Smelter Supply Co., will have the exclusive agency in Mexico and Central America for the OLIVER CONTINUOUS FILTER CO. N. Guthridge, Ltd., of Sydney and Melbourne are the Australian agents for the OLIVER CONTINUOUS FILTER COMPANY.

LEROY A. KLING, who has been connected for some time past with two well known crusher companies in Cedar Rapids, Iowa, has accepted a position with the WHEELING MOLD & FOUNDRY CO., of Wheeling, West Virginia, as sales manager of the road machinery department. This is the concern that has built considerable machinery for the Panama canal. It will eventually manufacture a complete line of road-building machinery, including a modern crusher, adjustable to crush to any size, pulverizers, rolls, screens, elevators, trucks, and graders.

J. W. STONEHOUSE, Victor, Colorado, is placing on the market enameled steel signal signs for mines. Their advantages are obvious, as they are not affected by moisture, are always legible, and much more durable than cloth signs. Among the mines equipped are the following: Copper Queen Con. Mining Co., Bisbee; Calumet-Arizona Mining Co., Warren; Shattuck-Arizona Copper Co., Bisbee; United Verde Copper Co., Jerome; Old Dominion Copper Co., Globe; The Arizona Copper Co., Ltd., Clifton; Arkansas & Arizona Copper Co., Jerome; Ray Con. Copper Co., Ray; Mascot Copper Co., Dos Cabezos; The Detroit Copper Mining Co., Morenci; Great Western Copper Co., Courtland; Commonwealth M. & M. Co., Pearce, in Arizona; and in Colorado, Stratton's Independence, Ltd., Victor; Vindicator Con. Gold Mining Co., Independence; Isabella Mines Co., Cripple Creek; The Ajax Gold Mining Co., Victor; The El Paso Con. Gold Mining Co., Victor; Gold Dollar mine, Victor; and Golden Cycle mine, Victor.

An evidence of the increasing attention being given to the most efficient methods of advertising and marketing engineering and technical products appears in the announcement of the formation of the firm of WIGHTMAN & RICHARDS, technical department of Jos. A. Richards & Staff, general advertising agents, Tribune building, New York City. Associated in business are Joseph A. Richards, Lucius I. Wightman, and Paul Morse Richards. Mr. Joseph A. Richards is the head of the agency having his name, founded by Joseph H. Richards in 1872, and since identified with some of the most conspicuous national successes in advertising salesmanship. Mr. Wightman is an engineer who has for many years specialized in the advertising and marketing of machinery and engineering products, and brings to the association several important technical accounts. Mr. Paul Morse Richards is a publisher, sales manager, and advertising man of wide experience, until recently with *Motor World*, and prior to that, advertising manager for *Power* and other technical journals. His extended experience will aid in the conduct of advertising, selling, and marketing campaigns. Wightman & Richards bring to the field served by the technical press that much needed combination of agency facilities with specialized technical and engineering skill. The scope of their services covers every proved method of legitimate sales increasing and business building, direction and preparation of advertising and advertising literature, mailing lists, sales campaigns, marketing plans, and the organizing and systematizing of advertising departments.

URUGUAY'S only producing gold mine in 1911 yielded bullion worth $68,321 from 20,489 long tons of ore treated, according to a consular report.

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EDITORIAL

FORMATION of a mine-owners association for Utah is proposed and is eliciting the support of prominent operators.

NEARLY 25,000 employees of the United States Steel Corporation are shareholders, their holdings aggregating 103,000 shares.

CONFERENCES on mine rescue and first-aid work were held in the Bureau of Mines building, Pittsburg, last month and agreement was reached on methods to be followed in this important work. The committees made a number of useful suggestions, both for coal mine and metal mine operations, some of which we shall publish later.

AUSTRALIANS rejoiced at the turning of the first sod in the construction of the Port Augusta-Kalgoorlie railroad on September 14. The road is to be 1060 miles in length and will link the eastern and western coasts of that commonwealth. A graceful compliment was the grouping of the flags of Great Britain, Australia, and the United States. Australian problems have many points in common with those which have developed here, and the exchange of citizens between the two countries, largely as a result of mining activities, has been helpful to both. It is gratifying to know that Australians reciprocate in full the friendly regard in which they are held by Americans.

DECISION of the Attorney-General of Colorado that the bequest establishing the Myron Stratton home has not lapsed, even though in the nine years which have elapsed since the death of W. S. Stratton the provisions of his will concerning the sale of his real and personal property and the establishing of the home have not been carried into effect is reassuring and commendable. Execution of the provisions of the will has been delayed by interminable litigation, the claims brought against the $6,000,000 estate aggregating over $23,000,000. Provision of a home for the aged poor is a worthy charity, and it is to be hoped that the trustees, Messrs. D. H. Rice, T. S. Dines, and William Lennox, may soon be able to carry it into effect.

PROPOSED changes in the constitution and by-laws of the American Institute of Mining Engineers are given at some length elsewhere in this issue, and we would urge their careful perusal by all the members. The proposed changes outline a constructive program for the enlargement of Institute activities upon a business-like basis. A committee is at work to devise the best plan for coördinating the work of the Board of Directors and the Council, and its proposals, together with other suggested changes, will be communicated to the membership in time to allow full discussion before final action at the annual meeting in February next. Among the most important changes it will be noted that the Board of Directors, who are legally responsible for the conduct of the Institute, will assume active supervision of its financial affairs, leaving the tech-

ical activities, as heretofore, in the hands of the Council. Each of these bodies is to have a secretary, and the business activities of the Institute are to be under the direct supervision of a business manager. Editing of the Institute publications is to be performed by an editor, under the control of a committee on publications. The success of such an arrangement is likely to depend upon the personnel of the committee, and a statement as to the results of the arrangement in force during the past year would be of service. We hope the proposed changes will be fully discussed by the members, and we offer the freedom of our 'Discussion' columns to the membership.

KAMLOOPS recently celebrated its centenary, and the event was signalized by a gathering of the Fraser river pioneers in gold mining. What is known of the early history of British Columbia has, through the courtesy of Sir Richard McBride, Minister of Mines, been gathered into a pamphlet, 'The Days of Old and Days of Gold.' Not the least interesting of the material are the quotations from 'Sawney's Letters' by James Anderson. This stanza indicates that life in the early days sometimes brought more of hardship than wealth.

"Dear Sawney.—Little did I think
That Eighteen Sixty-seven
Wad see me still in Cariboo,
A howkin' for a livin'.
The first twa years I spent oot here
Was nae sae ill ava,
But hoo I've lived since syne, my freen',
There's little need to blaw!
Like foot-ba' knockit back an' fore,
That's lang in reachin' goal,
Or feather blawn by ilka wind
That whistles 'tween each pole;
E'en sae my mining life has been
Fu' mony a weary day,
(Will that sun never rise for me,
That shines for makin' hay?)"

CONDITIONS in Mexico have temporarily improved. The Chihuahua *Enterprise* has resumed publication after a suspension of four months, due to the political situation, and the mining companies in northern Sonora are again at work. The El Tigre mine, which produced only one-third of its usual output during September, expects to make a normal profit this month, while other mining and smelting companies are in as steady operation as circumstances will permit. An engineer who has recently returned from Sonora is of the opinion that permanently settled conditions cannot be expected without the intervention of the United States authorities. Brigandage is alluring to the primitive element in all human character and, by a gradual transition from what was denominated patriotism at the outset, has now attained the freedom from disrepute which is the natural result of common public practice. The bands are swayed by local considerations rather than patriotic policy and the body politic has become so thoroughly disorganized that only vigorous measures can restore order. The present government could restore order by the adoption of the vigorous policy once practised in Mexico, but the world's public opinion will no longer countenance such methods. By educating the Mexican people to the necessary standards of self-government a lasting and better result will be obtained, but the process is necessarily slow and a degree of order is a prerequisite, just as a teacher must maintain order in a school-room if effective work in educating the pupils is to be performed. It is evident that no one desires to even appear to interfere with the liberty of the Mexican people to conduct their affairs in their own way; the conduct of other nations during the past year is irrefragible evidence of this. But liberty and license are different things; those who wish to enjoy liberty must refrain from license. It is gradually becoming evident that just as our freeing of Cuba from Spanish oppression has entailed our supervision of the Cuban form of government to prevent the recurrence of conditions no less deplorable, even though brought about by the Cuban people themselves, so the position taken by the United States to prevent the interference of European nations in Mexican affairs entails a corresponding obligation to prevent the maintenance in that republic of conditions which would reasonably require the interference of outside powers. We have been patient with Mexico, but there comes an end to all patience.

The Fruits of Violence

The attempted assassination of Mr. Theodore Roosevelt at Milwaukee on Monday failed of its object, and with characteristic vigor our virile ex-president continued his way to the convention hall and delivered his address as expected, though bleeding from a bullet wound in his chest. The motive for the deed has not been disclosed at the time of writing, but it is generally accepted that the violent abuse that is characteristic of comment upon men in public life is at least indirectly responsible for a deed so contrary to the whole spirit of our American institutions. Criticism of this phase of current politics is more merited because the practice has become so general, the men of Mr. Roosevelt's own party being as culpable as his opponents. Politicians and newspapers seem to find it difficult to believe in the intelligence of the American voter, and think by a flood of abuse of opponents to attract adherents to their own political propaganda. Yet political events of recent years have all gone to show that the general public in this country is reasonably well informed and can only be effectively reached by arguments which appeal to its intelligence. The use of billingsgate as a campaign argument is not new, for it is proportionately less used now than in former years, but it has become more prominent with the growing tendency to conduct political campaigns through the use of newspaper columns rather than from the stump. It is to be hoped that an aroused public sentiment may bring to an end, once and for all, the use of such methods. For the benefit of our subscribers in the lone places, let us add that, in our opinion, the attempt upon Mr. Roosevelt's life makes his election in November highly probable, where it was previously doubtful. There is an element of boyishness in American character, and a man who, with a bullet in his chest, delivered an address on the necessity of being a good soldier, is likely to thereby win votes that would be unaffected by logical arguments. The great strength of the Progressive party largely lies in its labor policy. Nearly two-thirds of the people of the United States are engaged in gainful occupations, and the constructive and intelligent scheme of labor legislation of the Progressive party, backed by a general belief that Mr. Roosevelt is the only candidate who is virile enough to be able to put his pre-election promises into effect, is likely to prove a powerful factor in the election. New York has more electoral votes than all the states west of the Rocky Mountains and will exert a corresponding influence in the election. Mr. Oscar Straus has been nominated by the Progressives for governor of that state, and the weakness of his opponents, together with his high personal repute, makes his election almost certain. Whether he will be able to carry the state for the national Progressive ticket is a question, the answer to which will largely determine the outcome of the election next month.

Ideals of Imperfection

The passing of the vanning-shovel assay for tin, chronicled in our London letter this week, is an unlamented departure. Another metallurgical ideal of imperfection has gone to take its rightful place in the limbo of oblivion, together with the fire-assay for copper and for lead. The persistence of outgrown structures and methods is a characteristic of the animate world. The rudimentary vestiges of his ancestral five toes sometimes interfere with the locomotion of the horse, and the vermiform appendix, the shrunken remnant of a once useful structure, is a constant menace to the health of men. Similarly, the crude methods devised to meet the conditions of pioneer work often persist to hamper progress in later development of industry. Correct judgment of the relativity of conditioning circumstances is one of the most valuable as well as one of the less common human attributes. Where the conditions are simple their relations are easily perceived. Anyone would merely estimate that a nearby town is two or three miles distant in deciding whether to walk or hire a carriage; or would measure it carefully before letting a contract for paving the road; or would measure the distance with extreme refinement of method if it is desired to use it as a base-line in carrying out a survey. It is not so generally recognized that the choice of method to best serve the desired end also involves a corresponding definiteness of the concept of what is required. In the first case, the one who makes the estimate probably will not stop to consider whether the estimated distance is to the edge of the town or to its centre, but in drawing contract specifications for the paving work it will be carefully provided that the pavement shall begin at a certain street corner and end at another specified one, while before beginning the base-line measurement much care and effort will be necessary to establish permanent monuments upon which the exact point of origin may be marked with the greatest precision. In chemical work similar relations are even less evident. It is not only the beginner in quantitative analysis who slights the work of solution, precipitation, and filtration in a vague hope of securing accurate results by careful measurement at the end, while it is only of recent years that the relation between the method and care employed in the taking of samples and the trustworthiness of the final analysis has been generally recognized.

In the complexity of modern life economy of effort, the conservation of mental energy, is a prime consideration. Curiously enough, it is found that primitive methods, generally devised to secure the desired result with a minimum of immediate effort, do not conduce to this end, because of their absence of definiteness. Exact classification and comparison is impossible when the things to be classified and compared are themselves devoid of exactness, and endless confusion is the result unless an appalling amount of mental energy can be devoted to the consideration of single items. The use of crude methods is, therefore, the reverse of expeditious, and effectually hampers the development of exact knowledge which is the prerequisite of useful progress. The vanning-shovel assay of tin obscured the fact that the recovery of that metal by the mechanical methods employed is so imperfect as to call for careful study and to offer wide scope for improvement. Similarly the fire assay for lead ores served to obscure the defects of crude metallurgical methods when it was first employed, though in this case its abandonment followed as a result of improvement in metallurgical methods, rather than as a means to that end. The first consideration in deciding whether present methods are adequate is to find out exactly where we stand and to clearly understand what it is we wish to do. Precise methods need not be employed for rough determinations, but the relation between the method employed and the results derived should be clearly understood. Present-day problems are problems of refinement of method. Products once wasted must be saved. In carrying out his own activities each must observe the rights of others. Right decisions depend upon exact knowledge; whether a smelter is a public nuisance or a public benefit is not a matter to be settled by public clamor, but by exact determination. Whether large corporations are necessary and useful factors in the conduct of business, or whether they are potent forces oppressing the public is not to be decided by the utterances of speakers or journals owned by large corporations or by revolutionary societies. Whether it is possible to secure larger compensation for labor and immunity from the perils of work without unduly burdening industry, whether prompter justice cannot be obtained without incurring danger of injustice, whether the right road of progress lies to this hand or that is not to be disclosed by vague discussion, loose methods of thought, inexact concepts, and crude methods of analysis. Ideals of imperfection lead only to stagnation, perfection of result is attained only through approximation to ideals of perfection.

Antimony Production

The smelting of antimony at Tacoma is proposed as a result of the development of the Black Eagle mine in the Vault Creek district of Alaska. Antimony production has so far been almost monopolized by the gold mines of France and the antimony mines in Hunan province in China. The supply of the metal is ample for the demand it enjoys, and the development of antimony deposits in this country must needs depend upon local favorable conditions. The sale of the metal is under the control of an international syndicate and the individual producer can scarcely find production of antimony an inviting field for his enterprise. Much of the present demand for antimony in the United States is met by the production of hard, or antimonial, lead by the principal lead smelting companies, and the yearly imports of antimony only amount to about 5000 tons. Deposits of antimony ores are known to exist in Nevada, Arkansas, and other states, but none of them are now being operated, and the small smelting plant near San Francisco has also ceased work. The production of metallic antimony, or antimony regulus, as it is known to the trade, involves the employment of a considerable amount of hand labor, and the lower wage scale prevailing in France and China is an advantage not easily to be overcome. The treatment of other than high-grade ores is somewhat expensive, and in China the crude ore is carefully hand sorted before subjecting it to metallurgical operations. In France the antimony is associated with gold and is obtained as a by-product of gold recovery. La Lucette is the most notable mine, producing about one-half of the antimony output of France and about one-quarter of the world's production, though the Chinese output has been increasing more rapidly than that of France. The uses of the metal are numerous, its alloys, which are used for bearing-metal and type-metal, are universally known, and a variety of other alloys are used in a lesser degree. The use of antimony oxide is growing, especially as a cheaper substitute for tin oxide in ceramics and the manufacture of enamels. It is also used in the manufacture of white paint, where a mixture of metallic salts is found to give better service than the unmixed lead salts. The lead supply of the world is apparently a limited one, and the possibility of its exhaustion is often discussed, but the known antimony supply is ample to meet all present needs for the metal, and probably future ones as well, so that the field offers no great attraction to producers.

An Electric Hoist With Automatic Control

By Frank C. Perkins

The accompanying illustration shows the construction involved in a new English method of operating electric hoisting engines at the Auchincruive colliery of William Baird & Co. At the Auchincruive pits the problem to be met involved the electrification of all the auxiliary machinery at three hoisting shafts and the complete electrical equipment of two new pits, situated 1¼ miles distant. This scheme provides for the generation of electric power by the use of exhaust steam in mixed-pressure turbo-alternators at the three steam hoisting shafts, and its transmission to the two outlying pits for operating electric hoists upon the 'Thury' or 'series' system was adopted. It is thus possible to use a high-tension alternating-current plant for generating and transmitting the power, while at the same time the advantages of the Thury system were fully utilized at the coal-hoisting plant at the Auchincruive pits.

With this system there is an entire absence of rheostatic control, the hoist motor used having similar characteristics to a steam hoisting engine and its simplicity of operation. In this mine power-plant there are two 600-kw. Dick-Kerr mixed-pressure impulse turbines, running at 3000 r.p.m. direct connected to two 625 kva., 3-phase, 50-cycle, 3000-volt alternators, the voltage of the machines being controlled by voltage regulators of the Thury type. It may be stated that the turbines take the exhaust steam, when available, from hoisting and auxiliary engines in use at No. 1, 2, and 3 pits, and operate in conjunction with Korting jet condensers. The circulating water is re-cooled by being pumped through spray nozzles distributed over a cooling pond.

The current is used for operating the main ventilating fan, for haulage, screening and washing, and pumping, and this part of the installation calls for no special comment. The sub-station at the new pits contains the hoisting plant, together with the fly-wheel set and switchboards. The incoming transmission cables are connected to a five-panel board, the incoming panel being fitted with, voltmeter, ammeter and oil switch, bus-bar switch, and recording wattmeters. The other panels are used for distribution only and are exact duplicates, except that no voltmeters or wattmeters are needed. It is of interest to note that the induction motor is provided with a Thury slip regulator, the object of which is to limit the current taken from the alternating-current power supply; this regulator controls a resistance in the rotor circuit, cutting it out automatically as the motor picks up its speed, until the full speed of 428 r.p.m. is obtained. If the load on the series generator becomes heavy, and the induction motor is in consequence overloaded, this slip regulator puts resistance into the rotor circuit, preventing a heavy rush of current from the power-house, and by allowing the set to slow down enables the fly-wheel to transmit its stored energy to the series generator when the demand caused by hoisting is heaviest.

There is in the sub-station a motor-generator fly-wheel set, consisting of a 250-hp., 2750-volt, 50-cycle, 3-phase induction motor direct coupled to a 10 ft. 6-in. fly-wheel, the rim of which weighs 4.7 tons. This is in turn coupled to a 450-kw., constant current, direct-current series generator, built and designed to give 450 amperes at a voltage varying from 0 to 1000, and suitable for running at a speed varying between 375 and 428 r.p.m. The current from this generator operates the two hoists, one at each end of the sub-station, and for this reason alone the system is worthy of the close attention of all interested in electric hoisting, as with the fly-wheel systems hitherto in use a fly-wheel set has usually been necessary for each individual hoist.

When the hoists work in rotation, it is found that one of the motors returns energy to the fly-wheel set during retardation, while the other motor takes current for acceleration, thus enabling the fly-wheel to run at a fairly constant speed. In case of failure of the current supply, the stored energy in the fly-wheel is capable of enabling the hoist to complete a trip. Each of the hoists is driven, through double-helical reduction gearing, made by the power-plant company and having a ratio of 8.4 to 1, by a 275-hp. constant-current series motor, absorbing 450 amperes at a voltage varying from 0 to 500.

It may be mentioned that the control levers rest in a vertical position corresponding to the neutral position of the brushes, and the movement of either lever moves the brushes in a corresponding direction, causing the motor to run either way, as the case may be. Supposing either lever be pushed forward and the motor run up to speed, then by merely pulling the same lever over past the central notch in the guide quadrant the motor is made to act as a generator, returning current to the system, and a powerful braking effect is applied to the drum, causing the hoist to stop in the required period of time. The drums are 10 ft. diameter and the usual mechanical brakes and safety devices are fitted. The speed of the motor is controlled by moving the brushes backward or forward from the neutral position, according to which direction of rotation is desired; if the brushes are kept in the neutral position, the motor remains at rest, even if the current is passing through it.

There are two methods of controlling these motors; one is purely mechanical, the brushes being moved backward or forward by a lever connected to them by a rod; the other is an electrical one, and in this case the hand lever is connected to a regulator operated by oil pressure, which in turn is connected to the brush gear. When the electrical control is in use the direct hand control cannot be used, as the oil pressure in the regulator, 100 lb. per square inch, is too powerful to allow of the brush-rocker being moved by hand; should, however, this oil pressure fail for any reason, the hand control is immediately available without the operator having to move from his usual position. It is pointed out that the usual foot-brake is used to a very limited extent, and in practice only during the last fraction of a second for the purpose of causing the drum to stop at the exact levels. The action of both levers is the same, only with the regulator control the lever simply moves a valve in the oil supply to the regulator in question, after which further movement of the brushes is automatic; therefore, the operator only has to control one lever and a foot-operated brake lever.

It may be of interest to note the difference in the action of the hand and automatic control, especially with an unbalanced load with hand control. Under these circumstances, if the cage is being lowered, the weight, of course, helps the motor, and after merely pushing the hand control lever half-way and releasing the foot brake, the drum picks up speed very quickly, and this lever has to be brought back into the reverse or braking position. With the automatic control in use the starting lever is simply pushed to the full speed position, irrespective of whether the load is balanced or unbalanced, or whether it is being raised or lowered. As soon as the drum is up to speed the regulator automatically keeps it at that speed, and when it is required to stop the cage the starting lever merely has to be brought back to the neutral position, when the regulator causes the brushes to come over to the full braking position until the drum stops. The entire absence of sparking on the brushes of either the motor or the generator at any period of a hoisting operation is most noticeable, and the system admits of the easy application of an overwinding device.

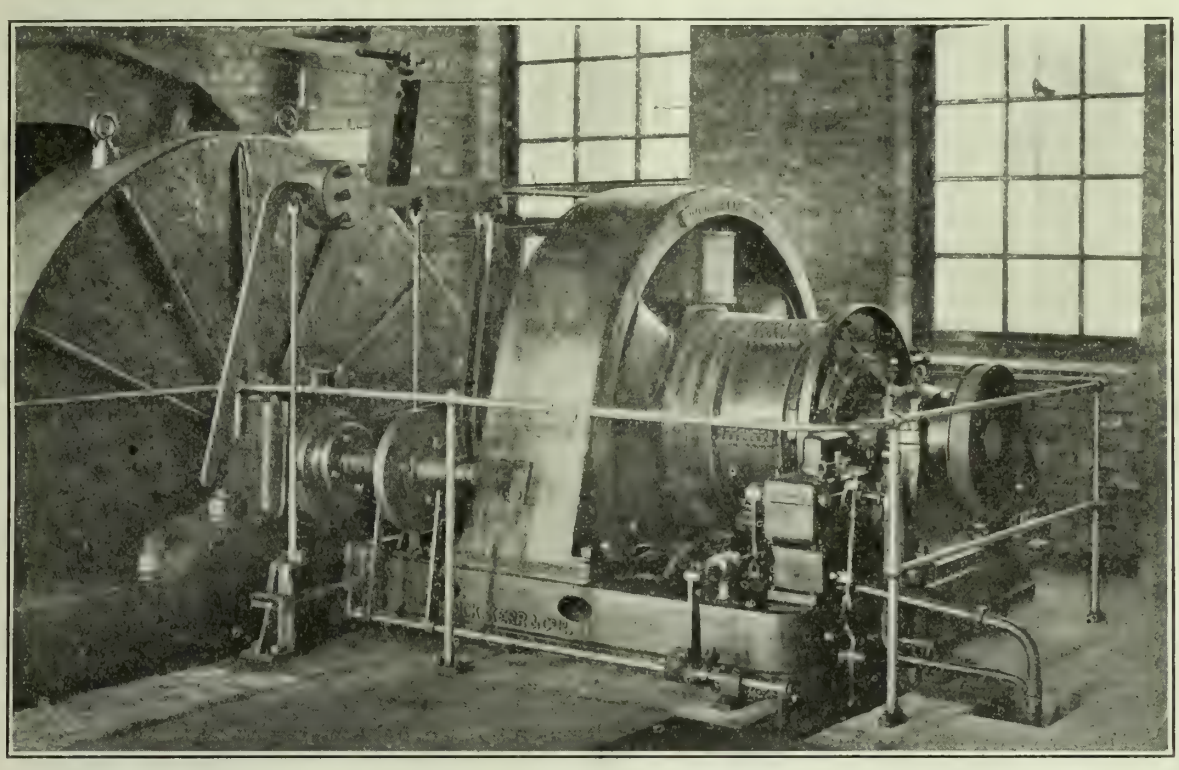
There is a depth indicator dial facing the operator, and at his side is a main switch and a voltmeter which indicates the load. This switch is the only one in the motor circuit,

and is used to short-circuit the line when it is desired to cut off the current of the hoist motor, equivalent to a main stop valve in steam hoisting practice. No rheostats or starting resistances are needed. The speed of the motor is controlled by the regulator when the electrical control is being used. Operating in conjunction with this regulator is a magneto, which is so connected that the stronger the magneto current the slower will be the speed of the motor. What is done, therefore, is to put a resistance on the back of the depth indicator dial, together with a pointer fixed on the indicator spindle. While the cage is between levels resistance is kept in the magneto circuit, thus allowing the hoist motor to obtain full speed. But when the cage is close to the top, this pointer cuts out the resistance, and the drum automatically slows down; the arrangement is thus exceedingly simple, and the resistance is adjustable, so that any required speed may be used.

It is said that under the new English Mines Act every hoisting plant with a vertical shaft is required to have a device which will prevent overwinding. For this reason a tripping device has been arranged, by which means a powerful brake is applied to the drum as soon as the cage passes the predetermined level. This arrangement, as fitted, is composed of two distinct parts, one, purely electrical, designed to reduce the speed and momentum of the cage to within convenient limits before it reaches the surface level, while the other is a mechanical contrivance for applying a brake if the cage actually passes this level; thus both cages are protected by this system.

In this equipment there is a hollow spindle bolted on the end of the drum shaft, with grooves, opposite one another, along its length and connected with its interior; inside is a screw fixed at the end farthest away from the drum, so that the screw does not revolve with the drum. There is a circular cam on this spindle which can slide along its axis. On the interior screw is a nut with two side-pieces to it, which project through the grooves in the spindle, and fit in the cam. When the drum revolves the spindle moves the nut around on the fixed screw, and this cam is pushed in one direction or the other by the projecting pieces of the nut. Exactly underneath the spindle, and parallel to it, is a steel rod on which two levers are keyed, at a distance capable of adjustment. To one end of the rod is connected a trip-plate, on which rests the lever holding the weight for the emergency brake, which acts on a brake-ring fixed to the motor-shaft. The other end of the rod is joined through a suitable lever to the brush-rocker of the motor and regulator, the operation being simple. The levers underneath the revolving spindle are set so that when the cage is at the end of its travel the cam meets one of the levers and pushes it over, thus operating the trip-plate, applying the brake, bringing the brushes on the motor to the neutral position, and putting the regulator out of action. If the cage is traveling in the other direction, then the cam meets the other lever. The operation of re-setting the device is very simple.

The electric hoist has a drum 10 ft. diameter. The output for each shaft is 600 tons in 8 hours, and the depth of the shaft is approximately 80 fathoms, while the average coal hoisted per trip is one ton. The duration of hoisting is 33 seconds and the duration of stop 15 seconds, while the period of acceleration is 12 seconds, and the period of retardation 4 seconds. There are several distinct advantages claimed for this hoisting system in comparison with other electrical systems in addition to those already noted. A motor generator set is not required for each hoist, and several hoists can be operated by one set. If the central station is situated at a suitable point, several hoists can be operated in series. As more pits are sunk they can be linked up without any difficulty, there being no necessity to increase the section of the main cables owing to the new load, as the value of the current remains the same. The efficiency of the system is high, owing to the large percentage of energy returned to it because of its excellent regenerative capacity.



ELECTRIC HOIST MOTOR AT AUCHINCRUIVE.

Bureau of Mines returns show the following output from the mines and plants of Ontario for the six months ended June 30:

		Value.
Gold, oz.	11,854	$ 235,198
Silver, oz.	14,258,403	7,936,600
Copper, tons	5,170	736,469
Nickel, tons	10,179	2,166,895
Iron ore, tons	12,342	33,060
Pig iron, tons	283.926	3,942,638
Lead ore, tons	17	849
Cobalt, etc., lb.	854,324	192,073

Ore Reserves and Life Extension

By Morton Webber

A basic advance made in mine valuing is the classification of developed ore according to the various degrees of risk involved. These risks may be regarded as the varying possibilities of discrepancy between the appraised metal content of the blocks of ore standing in a mine and the metal content known after their removal.

Ore which is a certainty is so surrounded by sampled faces sufficiently near to each other, taking into consideration the particular type of deposit, that the continuity of ore of that grade into the centre of the block can be regarded as assured. This is axiomatic. The multiplication of sampled faces therefore decreases the risk, and conversely. As the number of levels, shafts, raises, and winzes which can be sampled varies throughout every mine, there are varying degrees of risk. Reform in mine valuing involves dividing such blocks into classes dependent upon risk, so named that the corresponding degree of risk attached to any block will be understood by others. In valuation such blocks, depending upon the number of faces exposed, are segregated and named according to the class of risk to which they belong. Experience in the application of this theory of risk has shown that little is gained by an increase beyond 'three comparative degrees.' It is imperative in competent valuation to consider other forms of risk, such as the risk of metal prices, the risk in estimating costs, and the risk of metallurgical efficiency, especially when basing an opinion on surface evidence. These, however, should not be referred to as 'degrees' of risk in a comparative sense. This conveys an impression of tangibility, while such risks are purely nebulous. The three groups in which ore blocks are segregated are called 'positive ore,' 'probable ore,' and 'possible ore.' Ore-blocks which can be sampled on four sides are regarded as positive ore, and are eligible as a first-class risk. They approach nearest the ideal referred to above. Blocks which can be sampled on three sides are regarded as 'probable ore,' the questionable grade of the unknown fourth side increasing the hazard. Blocks where data for only two sides is available are only eligible for the risk under 'possible ore.'

There is yet another class called 'life extension.' Owing to the nature of the mining industry, this has great significance. Different engineers use different expressions to distinguish this phase; my preference is for the term here used. This class constitutes a risk, especially if it is a factor in a mine appraisal. In young mines this is frequently essential. In my judgment, this class is better considered from a different standpoint, as the application of the word 'risk' indicates a connection with the three universally recognized risks, which are based on tangible specific data. To refer to it as a risk suggests something less valuable than possible ore, being further removed from the ideal four-sized condition. It therefore seems more logical to regard life extension not as a risk, but as a possibility. If a money equivalent is attached, it should be considered from the more logical basis of 'good-will.' Life extension should therefore be considered separately, as it is a phase by itself and is not necessarily connected with or dependent on the three main classes into which ore-blocks are grouped. This is a fact that should be thoroughly understood. A frequent mistake is made in regarding the importance of positive ore, probable ore, possible ore, and life extension in the order presented. This is illogical. Mines are always drawing nearer exhaustion, and their ore reserves are frequently greatest just before the epoch when ore-shoots commence to pinch or the grade decrease in depth. A mine when first opened is seldom provided with a large ore reserve, yet this is a period when its life extension is generally most valuable.

The energetic but expensive policy of developing ore on four sides does not alter the natural characteristics of orebodies. The developing of extensive four-sided ore reserves is commonly due to the requirements of corporations that have their shares listed on the stock exchange. The annual presenting of book valuation is essential. This refinement has done much to increase the repute of the mining industry, but a large ore reserve should not materially influence the judgment of the mine valuer in respect to life extension. The risk beyond exposed faces is not necessarily minimized; merely more geological facts are presented. In a mine having a laterally short orebody, the risk in prognosticating future extension is greater. The maintaining of four to six, or even more, levels below the immediate productive zone of the mine will bring the lowest level proportionately nearer the horizon where ore-shoots terminate. To associate life extension with ore reserves in any fundamental way is therefore illogical and will lead to unreasonable results.

A longitudinal section showing the contraction of ore-shoots with each succeeding level offers unmistakable evidence. Simultaneously, administrative policy may exhibit an abnormal proportion of unconnected blocks of probable ore, accompanied by an even greater proportion of possible ore. Such seductive evidence might convey the conclusion that the future possibilities were better than they are. The evidence supplied by the development of a succeeding lower level may show the termination of the ore-shoot or the creeping in of low-grade primary sulphides.

One method of life extension appraisal was emphasized several years ago by J. H. Curle. The net profit of ore reserves was estimated to represent from 65 to 80% of the total valuation. The remainder was allocated to life extension. The proportion allocated substantially depends on the condition of the bottom levels. In this way the possibilities are compounded by formula with the known ore of a mine. This basis of appraisal is still popular with many engineers. In my judgment it is illogical and as likely to overvalue possibilities as to be conservative. Mr. Curle's system has been, however, of great value. It teaches the investor to always consider mining from the business-like standpoint of assets. Its defect is that the relative magnitude of the ore reserve in any particular mine is largely a matter of administrative policy. A small mill in combination with an energetic policy of development will result in a mine maintaining a large ore reserve. A large mill in combination with an ordinary development policy will not permit of a large ore reserve. The same mine might be developed down to the same horizon under different administrative policies and exhibit identical evidence of permanence. Therefore any method of appraisal that depends on formula would result in entirely different valuations of the same mine bottom, or lateral extensions, as the case may be. Such a method of valuation disregards the primary basis on which the appraisal of life extension should rest, namely, geological evidence. It disregards the widely varying geologic nature of different mines, and it ignores the important collateral evidence supplied by adjacent properties. The prognosis of life extension should rest on how far ore-shoots may be expected to extend beyond the limits of present development. It is illogical to vitiate this by introducing the transient factor of the remaining ore enclosed within development extremities.

Professional experience in this country and Europe with capitalists who operate mines, will reveal occasional friction between engineers and their sometimes plutocratic employers. While this has in some cases been caused by the engineer being insufficiently pliable to see things that are

not to be seen and unable to imagine that which is absurd, I believe that the boot is frequently on the other leg. Future possibilities are what mine operators want. Life extension, instead of being regarded as fourth in importance, as hitherto explained, is, in my judgment, of paramount importance. A carefully formulated opinion of this aspect should constitute a primary part of a report either for or against a property, and its evasion or its limitation by formula must handicap the usefulness of an engineer. The fundamental nature of mining, which requires the return of capital before dividends can be considered profit, demands the incentive of large speculative possibilities. If the critic who doubts this should attempt to promote a property offering as its only attraction a history of uniform production, he would find that a large proportion of those who would be otherwise interested prefer an investment in a railroad, or some other constructive enterprise that may go on indefinitely depending on trade. The mining engineer has to deal with conditions as well as ethics. He belongs to a profession which has the privilege, or otherwise, depending upon viewpoint, of meeting the requirements of finance and trade. In this he differs from the doctor, lawyer, and his less responsible brother the geologist. The thorough but conservative understanding of this fact has perhaps helped some engineers to success.

The accompanying illustrations are longitudinal projections of three gold mines. They illustrate life extension as a distinct factor. Fig. 1 represents the frequent condition of the simultaneous curtailment of orebodies at depth, at an epoch when ore reserves are greatest.

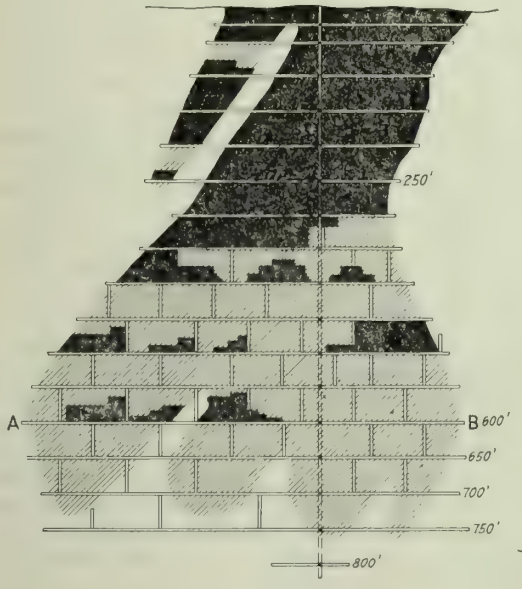


Fig. 1.

Fig. 2 represents a famous producer. It has an active stock exchange demand. To meet the requirements of a large list of stockholders, the administration has preserved the policy of maintaining an ore reserve averaging three to four years ahead of the immediate necessities of the mill. Dividends aggregating $3,000,000 have been paid. At the last annual meeting, shareholders were informed that the present net profit in the ore reserves was estimated at $2,500,000. Four-fifths of this estimate was due to ore developed on at least three sides. Life extension was referred to as normal, the ore of the lowest level being similar to the preceding two above.

Fig. 3 represents a mine of markedly dissimilar characteristics. The property is owned by a private corporation. There are no popular market conditions to meet. Development has been primarily done in the search for new sources of ore supply. Utilizing the major portion of the money supplied for development in this way is considered preferable to blocking out ore on four sides. The deposit is a replacement along a main fracture plane in andesite. The impregnation of the walls varies within wide limits. This is characteristic of the deposit. Blocking out ore on four sides in a deposit of this type is expensive and often financially prohibitive. The property

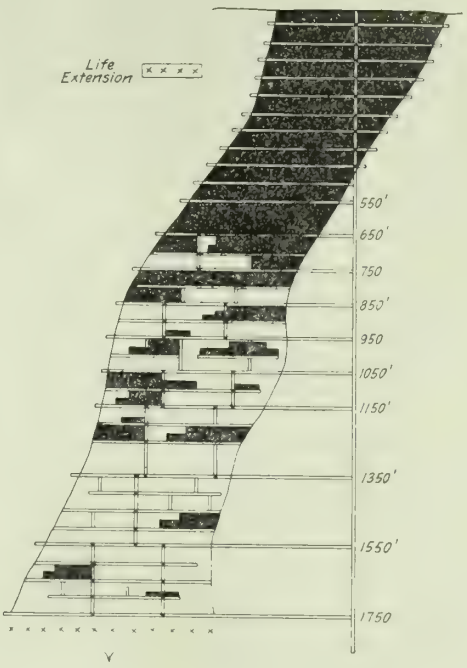


Fig. 2.

has earned $800,000. The present known ore reserve of the mine is estimated at $1,000,000 net. This figure is deduced by taking all the ore down to workable two-sided ore. This aggregate is then subjected to a process of elimination in order to arrive at a net figure that can be relied upon until the present faces are further developed and

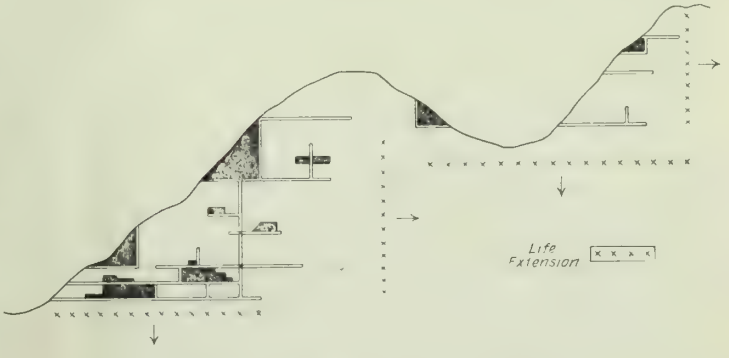


Fig. 3.

additional faces exposed. The result is as presented. This procedure will be understood by those familiar with this type of metasomatic replacement deposit. As a sequence to such a development program, when the data were compiled the mine could only show $300,000 net in four-sided ore.

From the viewpoint of book value in ore reserves, Fig. 3 presents a poor comparison with Fig. 2. Notwithstanding the disproportion in the net value of ore reserves, in event of both properties being for sale at the same price, I would prefer No. 3. This statement is made with the proviso that the basis of purchase should be time payments with the privilege of substantially discounting at the option of the purchaser. In the case presented, the life extension possibilities of Fig. 3 constitute the greatest asset of the property.

Comparing them in further detail, it is seen that the uniform production of Fig. 2 has been phenomenal. In the light of past experience in depth, a not unusual risk

would be contracted in anticipating similar extension for three succeeding levels. This would be 300 ft. Each succeeding zone is, however, drawing proportionately nearer the horizon where ore-shoots will eventually terminate. Two other levels may reveal similar tooth-shaped barren lenses as shown by subsequent development below A B in Fig. 1. Previously to the unmistakable evidence subsequently furnished by the succeeding horizons below A B, the mine never looked better, and simultaneously the ore reserve was at its greatest. In my judgment the really superficial nature of ore deposits, even apart from secondary alteration, should be thoroughly understood. A chart showing the productive depth of twenty producing mines will prove this.

Fig. 3 presents the reverse condition. Instead of being dependent on the extension of a bottom that is now down at a depth of 1750 ft., it has not only two bottoms, but also two sides. The latter will advance through comparatively superficial zones where the recognized enriching effects of secondary alteration are most prevalent. Physically the mine offers the attraction of adit development. Assuming equality in economic location, this will permit working costs with which the deep-level conditions of Fig. 2 could not compete. Grade for grade, Fig. 3 will be more profitable, and ore zones will yield a profit that in Fig. 2 could not be treated.

It is hoped that the foregoing will show the varied conditions that cannot be computed by formula, or any process of measurement available to the valuing engineer. The consideration of life extension should be a matter of individual judgment of the case presented. There is no formula for judgment, which must rest on a proper balancing of geologic and economic evidence. The only prescription is experience founded on a college training in combination with native business abilty. Business ability is essential in the proper balancing of economic evidence and delivering an opinion on the selling conditions.

Prospective life must wholly depend, I believe, on how far ore can be reasonably expected to continue beyond exposed faces. This can be converted into expected tonnage. This convertible term can then be introduced into an annual report or considered separately as a factor in a sale. If the price asked for a property requires an unreasonable or dangerous proportion of the total price to rest on expected ore, better terms must be demanded.

As a result of long observation, mainly of mines partly or completely exhausted, geologists have evolved certain hypotheses. While remaining still hypotheses, with their inherent fallibility, they have widely accounted for underground experience. They are so important that no valuing engineer is properly equipped to deliver judgment on the life extension of a mine without a thorough grasp of the underlying principles laid down by Lindgren, Emmons, and Van Hise.

There are five geologic heads under which life extension should be considered. After presenting them they will be discussed seriatim. It should be understood, however, that in the space afforded, it is difficult to present even a digest. The five geologic heads are:

I. Character of the deposit in respect to past experience of the geology of similar deposits.
II. Size of the deposit in respect to length and width.
III. Secondary alteration.
IV. Depth to which the mine has been worked.
V. Experience in the immediate neighborhood as to the persistence and continuity of orebodies in depth.[1]

Character of the Deposit in Respect to Experience of the Geology of Similar Deposits

In the study of continuity, ore deposits may be roughly divided into three classes: (A) Infiltration deposits, such as, for example, the South African banket and the copper conglomerates of Lake Superior. The continuity of ore in these deposits is a maximum. Tonnage estimation can often be computed from data supplied from levels 300 ft. apart. (B) Deposits depending on profound earth movements. To this class belong fissure and contact veins. Opinion as to the continuity of ore must be largely based on local experience, as, for example, the persistence of the ore-shoots of the San Juan district in comparison with others that show a sad mortality before even entering the zone of secondary enrichment. (C) Deposits depending upon replacement or impregnation along fissures or other openings. This class presents widely differing phenomena, and generalization is impossible. Valuable producers of this class are found in Tonopah and Goldfield, Nevada, Mexico, and Western Australia. Continuity beyond sampled faces should generally be considered with great caution. In contrast to these are the copper deposits of Arizona and Utah, the result of the impregnation of porphyritic rock, that exhibit great regularity. This classification is only intended to conduce to simplicity of explanation. In practice a deposit may exhibit characteristics of more than one class.

Size of the Deposit in Respect to Length and Width

From a structural standpoint, eliminating the increase of risk from one horizon to another in approaching the termination of secondary enrichment, the depth of an ore-shoot bears some proportion to its length. Ore deposits, especially of the fissure type, are usually lenticular in shape, therefore the vertical aggregate height, above and below any horizon, should fall somewhere between the lengths of the minor and major axes. The practical limitation of this assumption is that it is impossible to know the vertical position of any level on which opinion is based. The greater proportion of the ore may be above that horizon, leaving only a small remainder below. The line A B, Fig. 1, will illustrate this.

As the risk beyond exposures is in proportion to the distance assumed, the advantages in length and width of a deposit are best illustrated from a purely commercial standpoint. As explained, life extension can be represented in additional area expected, and this expectation should be based on the geologic evidence of the particular case. To illustrate, assume that in a purchase the valuation of a hypothetical mine requires $50,000 of the total price to be represented in life extension. Assuming that the orebody on the lowest level is 400 ft. long and of an average width of 5 ft., every additional foot of depth will equal approximately 140 tons. Should the orebody be only 300 ft., with an average width of 3 ft., every additional foot will produce 60 tons. Assuming an expected profit of $3 per ton in both cases, the risk in extension in the larger orebody is only approximately 120 ft., compared with 280 ft. in the case of the smaller. The operation of the larger deposit should offer not only lower underground cost, but also the economic attraction of a larger reduction plant.

Secondary Alteration

The solubility of the metals of many ores in descending solutions is generally understood. The vast commercial effect of such metal migrations on the lower sulphide zones has, however, only comparatively recently been recognized. In considering the extension of ore in depth this phase demands the most thorough investigation. Not only do the upper ore zones become oxidized by descending solutions, but a complex migration of metals takes place with re-precipitation lower down. These phenomena differentially enrich the upper oxide zones in the least soluble minerals, and enrich the lower sulphide zones in re-precipitated minerals. The upper zones are robbed of easily soluble minerals, and therefore, in proportion, enriched per original unit of content in those minerals more able to withstand migration. The effect of migration to lower horizons has in many cases completely altered the character of a mine. The Mt. Morgan copper mine, in Australia, was originally a famous gold producer. The gold content for many years averaged $20 per ton. Leadville is now mainly a producer of zinc. The copper mines

[1]'Estimating and Valuing the Future of Mines,' Morton Webber, *Mining and Scientific Press*, Sept. 16, 1911.

of Butte were once important in the production of silver.

The most reasonable explanation for these phenomena is based on simple chemical properties of the metals. Zinc, iron, and lead are in common primary combination. These metals are rendered soluble by oxidizing agents in the order presented. Their ease of precipitation as sulphides is in reverse order. Gold and silver are the most insoluble metals that play an important part in mining. Copper, on the other hand, may be regarded as one of the most soluble. In solution and migration, ore deposits may be considered to have four horizons. These horizons are seldom sharply defined. (A) The zone near the surface where the main characteristic is oxidation, and the leaching of soluble contents. This horizon may be differentially enriched by silver and gold, in consequence of its abandonment by the metals that have migrated. (B) A lower oxide zone where the predominating feature is the precipitation of the metals as carbonates and oxides. (C) The upper horizon of the original orebody, where the characteristic is enrichment by re-precipitation as sulphides of the metals that came from above. (D) The region below the influence of secondary alteration, where the orebody is unaltered.

In districts of rough topography situated in wet climates, surface denudation rapidly follows alteration and migration. This is especially the case when, as the result of glaciation, the primary ore may appear at the surface. Flat and arid country offers more favorable conditions. Denudation is slow and conditions are favorable for the deep penetration of oxidizing solutions, and consequent secondary enrichment.

As explained, zinc, iron, and lead are soluble in sequence and precipitate in inverse order. The progress of oxidation of a complex vein containing these metals, together with gold and silver, will explain the theory of secondary alteration: The migration of surface waters will result in the easy leaching of zinc and iron. There is, therefore, a differential enrichment per unit area, of the gold, silver, and lead that remain. Such lead as goes into solution quickly precipitates. In this way the lead zone is extended. Such silver as may go into solution will quickly precipitate with the lead, explaining the formation of silver bonanzas. Similar reasoning will account for the varying characteristics of the rearrangement of the other metals. The oxidized zone contains an abnormal differential enrichment of gold and silver. The silver-lead zone contains silver bonanzas, the aggregations being due to the ease with which silver precipitates with a lead reagent. Coming to the lead-zinc zone, some of the zinc now having precipitated, this changes with depth into zinc-lead and iron, with the former metal predominant. This finally merges into primary low-grade ore, containing gold, silver, lead, zinc, and iron.

In copper deposits the comparative ease of solution, migration, and re-precipitation frequently results in extensive impoverishment near the surface. The familiar 'iron hat' at the surface, with oxides and carbonates forming the second zone, enriched by secondary copper sulphides at the third, with copper-iron sulphides below, is characteristic. The primary deposits of Michigan previously referred to, should not be confused with this class. A majority of productive copper mines can be tabulated in this way that finally merge into uncommercial unaltered primary ore.

In a general way, the following facts that depend on secondary alteration should be remembered. Oxidation influences treatment problems. Some oxidized gold ores that can be treated profitably become unprofitable in the sulphide zone, or require a new mill. Conversely, low-grade ores of lead, copper, and zinc may be profitably treated by concentration when in sulphide form, but as oxides are unprofitable. Copper ores show maximum enrichment at the base of the oxide zone and top of the sulphide zone. Silver and silver-lead bonanzas are usually found at this junction. Lead-zinc ores exhibit lead enrichment and zinc impoverishment in the lower oxide and upper sulphide zone; the converse taking place with depth. The sad mortality of gold mines on entering the sulphide zone is directly due to the fact that the oxidized portions were only rendered profitable by differential enrichment.

Depth to which the Mine Has Been Worked

Mines have three phases of existence: youth, productive middle life, and a decrepit old age. As a rule, the most speculatively attractive period in the life of a mine is the transition from youth to the productive possibilities of middle life. Like children, there is great mortality in the prospective or youthful epoch of their existence. To forecast an extension of ore in the purely prospective life of a mine is assuming extreme risk and hazard, but as exploration in depth progresses, the property either dies off in its youth or the risk materially decreases. The mine then emerges to a period of maximum production with minimum risk. This in turn is succeeded by a return of increasing risk. This hazard accumulates as the expectations of life are dependent on horizons approaching the extremities of secondary enrichment and the generally superficial boundaries of ore deposits.

Experience in the Immediate Neighborhood as to the Persistence and Continuity of Orebodies at Depth

Neighboring mines are usually dependent on similar geologic conditions. The depth and lateral extension of the orebodies of adjoining mines is therefore of infinite value. Many important discoveries have been made by closely following experience of adjoining properties. In certain cases the value of a mine has increased on reasonable grounds, as the outcome of the favorable extension of the orebodies by nearby development. Special examples of this condition, bearing on both the valuation and administration of mines, are to be found in Nevada, Mexico, and Western Australia.

The minimum or basal value of a mine is the net profit of its existing ore reserves. In the case of base-metal mines, this estimate should be computed on a metal price somewhere between the average over a past period and the low peaks during cycles of trade depression. As sub-normal metal prices are introduced to conservatively compute a metal market that can be relied upon, likewise, for the same reason, supernormal operating costs should be introduced. This result produces the *A* value of a mine. To this should be added the *B* value, or the asset of life extension, which should represent the judgment regarding this individual case under the five geologic heads presented. As the *A* value was founded on a sub-normal estimate of metal prices, the profits to be expected as the outcome of operating under normal metal marketing conditions should be introduced. This is the *C* value. To this should be added the *D* value: the result of expected operating economies, the outcome of modern plant and efficient management. In this way the total value of a mine may be regarded as A + B + C + D. The able engineer who has profited by experience will place these facts unreservedly before his employer. The serious mine-operator will require them of his engineer.

Practically no work is being done on the new discovery at Kumalpi, mentioned in special correspondence from Kalgoorlie in the issue of September 14. The original prospectors, who found a large nugget, have about 20 sacks of ore on hand. No fresh discoveries have been made along the supposed line of lode. An area of 1333 acres has been staked, and applied for at the registrar's office. A geologist has been examining the Kumalpi field, and the water-supply is receiving attention. The district inspector of mines stated that "if, in cross-cutting the oxide of iron formations in the Gessner and Huffa claim, gold should be found, it will be an important development for the field." Three new mills, all using Huntington mills and cyanide treatment, to crush 1250, 1250, and 12,000 tons per month respectively, have just been started, the first two at Kalgoorlie, and the large one at Ora Banda, about 40 miles northeast of the latter place.

The Institute Constitution and By-Laws

Proposed Changes

The following amendments to the constitution and by-laws of the American Institute of Mining Engineers were proposed by G. C. Stone and C. R. Corning, at the adjourned annual meeting of the Institute, in New York, October 7. These will be voted upon at the annual meeting in February next.

CONSTITUTION.

Article I is to remain unchanged.

ARTICLE II.

Replace Section 1 by the following: 'The membership of the Institute shall comprise four classes, namely:

1. Members.
2. Honorary Members.
3. Associates.
4. Junior Members.

Honorary Members, Junior Members and affiliated Societies in their corporate character shall have no votes. Members and Associates residing within the United States of America, United States of Mexico and Dominion of Canada, shall be entitled to vote at the meetings of the Institute in person or by proxy, or as hereafter provided for by letter ballot.'

Explanatory Comment. Class 4 is added; the object being to bring in students in schools of Mining and to give them the advantages of membership under favorable conditions and without the payment of an initiation fee. Also to permit voting by letter ballot.

Section 2. No change.

Section 3. No change except to add after the last sentence, 'As Junior Members, any student in good standing in engineering schools or related educational institutions who has not taken his degree and who is nominated by at least two of his instructors. (A Junior Member may remain such not longer than three years after leaving said educational institution, when he must be passed upon by the membership committee to become a Member or Associate and pay at that time the entrance fee and dues of a Member or Associate).'

Section 4. The portion of this Section reading "Not less than three-fourths of the votes cast shall be necessary to an election. Every person so elected shall become a Member or Associate, as the case may be, upon payment of his first dues as hereinafter described. Each candidate for Honorary Member must be recommended by at least ten Members or Associates, must be approved by the Council, and must be elected by ballot at a meeting of the Board of Directors by unanimous vote of all the Directors present, providing, however, that the number of Honorary Members shall not, at any time, exceed twenty," to be replaced by the following:

'Not less than three-fourths of the votes cast shall be necessary to an election; newly elected candidates shall be immediately notified of their election by the Secretary of the Institute and also by him of their obligations. Every person so elected shall become a Member or Associate or Junior Member of the Institute in the Class to which he is chosen upon payment of his initiation fee if required by this Constitution, and first dues, as hereinafter stated. Each candidate for Honorary Membership must be recommended by at least ten Members or Associates, must be approved by the Council and must be elected by ballot at a meeting of the Board of Directors by the unanimous vote of the Directors present, provided, however, that the number of Honorary Members shall at no time exceed twenty.'

Section 5; reading at present as follows, "If any person elected a Member or Associate does not, within sixty days after notice of his election, accept the same and pay his initiation fee and dues for the current year, his election may be cancelled at the discretion of the Council," to be changed so as to read:

'If any person elected a Member, Associate or Junior Member does not within four months after the mailing of notice of his election accept the same and pay his initiation fee if required and dues for the year in which he was elected his election shall be null and void and he shall be notified thereof by the Secretary of the Institute; providing, however, that if elected in the months of November or December the candidate may, at his option, pay dues only for the ensuing year, in which case he shall be entitled to receive the Bulletin of the Institute for the months of November and December but not the Annual volume of the year during which he was elected to membership.' *Comment.* Four months is substituted for sixty days to admit of remote addresses. Changes make action automatic.

Section 6. No change.

ARTICLE III. DUES.

Section 1, reading as follows: "The dues of Members and Associates shall be Ten Dollars per annum, payable in advance on the first day of each calendar year. Each newly elected Member or Associate shall pay, when notified of election, an initiation fee of Ten Dollars in addition to the dues for the current year. Honorary Members shall not be liable to initiation fees or dues. Any Member or Associate in arrears for one year, may, at the discretion of the Council, be deprived of the receipt of publications or stricken from the list of Members, provided that he may be restored to membership by the Council on payment of all arrears or may be again proposed and elected after an interval of three years," to be changed to read:

'The dues of Members and Associates shall be Ten Dollars per annum and of Junior Members shall be Five Dollars per annum. All dues shall be payable in advance on the first day of each calendar year, and notice to this effect shall be published in the last number of the Bulletin of each calendar year, and a bill shall be mailed to each Member and Associate on the first day of the month of January in each year stating the amount of dues and date when payable and the penalty and conditions incident to default in payment within the limit of time set by the Constitution.

'Each newly elected Member or Associate shall pay, immediately on notification of his election, an initiation fee of Ten Dollars; Junior Members shall not pay any initiation fee. Honorary Members shall not be liable for initiation fee or dues.

'If any Member, Junior Member or Associate is in arrears for four months the Bulletin shall no longer be sent to him and he shall be notified by the Secretary of the Institute that no publications will be sent him until his arrears are paid.' *Comment.* The changes are made partly to correspond to the new grades of membership, partly to cut off delinquent Members after a reasonable time of non-payment, and partly because of the Postal regulations.

Section 2, reading "Any Member or Associate not in arrears may become, by the payment of One Hundred and Fifty Dollars at one time, a Life Member or Associate; and shall not be liable thereafter to annual dues," to be changed to read:

'Any Member or Associate not in arrears may become, by the payment of One Hundred and Fifty Dollars at one time, a Life Member; and shall not be liable thereafter to annual dues. The fee received from Life Memberships shall be invested by the Directors and only the income of such investment shall be used for current expenses.

'Section 3. The Board of Directors shall have the right at any meeting thereof to increase the dues of the membership for the next ensuing year or years by any sum not to exceed the amount of Five Dollars per annum, such increase of dues to be applicable solely to the extinction of the principle of the landed indebtedness of the Institute. As soon as such indebtedness is paid the dues shall automatically lapse back to the present amounts and this power cease.'

ARTICLES IV and V.

To stand as in the present Constitution.

ARTICLE VI.

Section 2. The first sentence, reading "The officers of the corporation shall be a President, Vice-President, Secretary and Treasurer, who shall be elected by the Directors from among their number;" to be changed to read:

'The officers of the corporation shall be a President, Vice-President, Secretary of the Board of Directors, to be known as Secretary of the Institute, also a Treasurer of the Board of Directors who shall be termed the Treasurer of the American Institute of Mining Engineers. All of these shall be elected by the Directors from among their number, excepting the Secretary, who may or may not be a member of the Board.' The remainder of the Section to read as at present.

Section 3 unchanged.

Section 4. In the last sentence, which reads, "Any Director who shall under this Section or in any other manner cease to be a Member of the Board shall at the same time be held to have vacated any other office to which he shall previously have been elected; and the Board shall elect a new incumbent to the said vacant office," change the words "any other office" to read 'any other office of the corporation.' *Comment.* The change is in the interest of clearness.

Section 5. No change.

NEW SECTIONS.

'Section 6. No two of the three offices of Secretary, Treasurer or Assistant Secretary of the Board may, under any circumstances, be united in one person.

'Section 7. All salaries or other pecuniary compensations paid by the Institute shall be fixed in advance by the Board of Directors.

'Section 8. The funds of the Institute shall be paid out only by check signed by the Treasurer; or, in case of his absence or disability, either by the President or Vice-President.'

ARTICLE VII.

Section 2, reading as follows, "Special meetings of the Board of Directors, at which any business may be transacted, may be called to meet at any time at the office of the Institute in the City of New York, by notice in writing mailed at least five days before the meeting, by the Secretary to each member of the Board at his last known Post Office address, signed either by the President or the Vice-President or by three members of the Board," to be changed so as to read:

'The Board of Directors shall meet once each month in the year, excepting the months of February, July and August, on a regular date to be fixed in advance, for the transaction of such business as may come before them. They shall meet in the month of February as already provided in the Constitution, in Section 1 of this Article.

'Special meetings of the Board at which any business may be transacted may be called to meet at any time and place in the State of New York by notice in writing mailed at least five days before the meeting or by telegram sent at least five days before the date of meeting, by the Secretary of the Board to each member of the Board at his last known Post Office address, on request of the President, Vice-President or three members of the Board.' *Comment.* These changes make mandatory the very desirable practice inaugurated in 1911.

Section 3. Change to read as follows: 'At all meetings of the Board of Directors the presence of three members shall constitute a quorum.'

ARTICLE VIII.

Section 1, reading: "The professional, technical, scientific and social interests of the Institute shall be committed to the supervision of a Council composed of a President of the Council, six Vice-Presidents of the Council, a Secretary of the Council, and nine Councilors, who shall be elected from among the Members and Associates of the Institute in the manner hereinafter prescribed. Members of the Council may or may not be members of the Board of Directors," to be changed so as to read:

'The professional, technical, scientific and social interests of the Institute shall be committed to the supervision of the Council composed of a Chairman of the Council, a First Vice-Chairman of the Council, six Vice-Chairmen and nine Councilors, who shall be elected from among the members and associates of the Institute in the manner hereinafter prescribed. Members of the Council may or may not be members of the Board of Directors.'

Section 2 unchanged.

Section 3, which deals with the election at each Annual Meeting of the President, Vice-President and Secretary of the Institute, change President and Vice-President to be Chairman and Vice-Chairman and strike out in the fourth and fifth lines from the bottom the words "A Secretary of the Council to serve for one year." Wherever the words "President of the Council," or "Vice-Presidents" appear they should be respectively replaced by the words 'Chairman' or 'Vice-Chairman' or Vice-Chairmen. *Comment.* Provision is made in proposed Section 6 for a proper election of Secretary of the Council.

Section 4. Unchanged.

Section 5. Replace the present Section reading as follows: "The presence of five members of the Council shall constitute a quorum; but the Council may appoint an Executive Committee, or any business coming within the authority of the Council may be transacted at a regularly called meeting thereof, at which less than a quorum may be present, subject to the approval of a majority of the Council subsequently given in writing to the Secretary and recorded by him with the minutes," with a new Section to read:

'The presence of three members of the Council shall constitute a quorum.'

Abandon Section 6, which will be replaced by Article IX (see below), and add the following new Sections:

'Section 6. At their first meeting after the Annual Meeting the Council, and with the approval of the Board of Directors, shall elect a Secretary of the Council to serve for one year or subject to the pleasure of the Council; and for such salary as may be fixed by the Board of Directors.

'Section 7. The Council shall not finally decide on any course of action involving expense for which appropriations have not been already made without submitting the same to the Board of Directors, with an estimate of the expense, and obtaining the written approval thereof by the Board or of its Finance Committee.

'Section 8. The Council may from time to time in its discretion elect any past Secretary of the Council to the office of Secretary Emeritus to serve for such period and to perform such duties as the Council, with the approval of the Board of Directors, may designate. The incumbent of this office shall receive such compensation as may be fixed by the Board of Directors. *Comment.* These new sections, 6, 7 and 8, respectively are proposed so as to make the Secretary of the Council directly responsible to the body which he serves; to preclude situations which may have heretofore frequently arisen; and to provide a dignified position, such as does not at the moment exist, for officers of the Institute who retire from service; and yet by their length of association and by eminent service are entitled to continue in dignified association with the membership.

ARTICLE IX.

Nominations for Officers, Etc.

'An official ticket of nomination for officers and places annually falling vacant in the Council and Board of Directors shall be prepared by a Committee on Nominations of which no member shall be, at the time, in the Council or on the Board. This Committee on Nominations shall be appointed by a majority vote of the Council and Board of Directors in joint meeting on recommendations made by the President of the Institute not more than ninety days after the Annual Meeting, and it shall immediately proceed to the selection of candidates and the naming of a ticket. The official ticket thus formulated shall be transmitted to the Secretary of the Institute not later than November 1st of the same year for publication in the November *Bulletin;* and shall be separately printed and mailed to the membership not later than January 1st next following. Any complete or partial ticket of nominees signed by any twenty-five members or associates of the Institute and transmitted to the said Secretary by December 15th shall also be printed and circulated with the official ticket and over the names of the Nominators.

'Nominations may also be made viva voce at the Annual Meeting by any properly qualified voter.'

Present Article IX becomes Article X. Present Article IX, Section 2, becomes Article X, Section 2, as follows:

ARTICLE X. (Old ARTICLE IX.)

Section 1. Is to remain unaltered.

Section 2. The first sentence, reading, "A meeting of the Council may be held on the day of the Annual Meeting of the Institute without previous notice," change to read:

'A meeting of the Council shall be held on the day of the Annual Meeting of the Institute with or without previous notice.'

The remainder of the Section the same as at present, except that the last eight words on the last line be changed to read:

'Twenty days before the date of the meeting' in place of "ten days before the date of the meeting."

"ARTICLE X now becomes ARTICLE XI.

ARTICLE XI. (Old ARTICLE X.)

Section 1. Unchanged.

Section 2. The first sentence reading, "The copyright of all professional papers communicated to and accepted by the Institute shall be vested in it unless otherwise expressly agreed between the Council and the author," change to read:

'All professional papers communicated to and accepted by the Institute shall be copyrighted at the corporation's expense and the copyright shall be vested in the corporation unless expressly otherwise agreed between the Board of Directors and the author on advice of the Council.'

ARTICLE XIII.

Business Manager.

'The Directors shall appoint a Business Manager who shall, under the instructions of the Board, have charge of the business affairs of the Institute. The duties of the Business Manager shall be such as the Board may assign to him and must not include incurring of expense not provided for by appropriations nor the disbursal of funds except as provided for by the Constitution. The salary of the Manager shall be fixed by the Board and he shall hold office during its pleasure.'

ARTICLE XIV.

Subdivisions.

'The Council, with the approval of the Board of Directors, may authorize the formation of Local Sections and Topical Divisions, or arrange affiliations with other Societies in accordance with this Constitution and the By-Laws.'

ARTICLE XI now becomes ARTICLE XV, not otherwise changed.

ARTICLE XXII becomes ARTICLE XVI, not otherwise changed except to replace in the fourth line the words, "Previous meeting" by the words 'previous business meeting.'

BY-LAWS.

I. PRESIDING OFFICER.

Reading at present as follows: "At all other meetings of the Institute the President of the Council, or in his absence, one of the Vice-Presidents, if present, shall preside,"

change to read: 'At all other meetings of the Institute the Chairman of the Council, or in his absence the first Vice-Chairman of the Council, or one of the Vice-Chairmen of the Council, if present, shall preside. If none of these be present the meeting shall elect its own Chairman *pro tem.*'

II. ORDER OF BUSINESS.

Unchanged.

III. SECRETARY OF THE BOARD OF DIRECTORS.

The first paragraph of this By-Law reading, "The Secretary shall keep a record of the proceedings of all meetings of the Institute. He shall be custodian of the Corporate Seal, of the Minute Books, and of all Legal Documents belonging to the Institute. He shall conduct, on behalf of the Institute, all correspondence relating to business matters, except such as pertains directly to the office of the Treasurer," change so as to read: 'The Secretary of the Board shall keep a record of all business meetings of the Institute in a record book with permanent binding. He shall also be the official custodian of the Corporate Seal, of the Minute Books, and of all legal documents and records belonging to the Institute. *Comment.* The remainder of this first paragraph as it now stands is to be omitted. The second paragraph to remain unchanged.

IV. SECRETARY OF THE COUNCIL.

The second paragraph reading as follows, "He shall be custodian of all technical or scientific papers submitted to the Institute for its consideration, shall have charge of the editing and printing of all material published by the Institute, and of the distribution thereof, etc.," change to read: 'The Secretary of the Council shall be custodian of all technical or scientific papers submitted to the Institute for its consideration.' The rest of this second paragraph to remain as it is.

Paragraph 3, reading "The Secretary of the Council shall receive a salary to be fixed by the Board of Directors. He may appoint an assistant with the title of Editor, who shall likewise receive a salary to be fixed by the Board of Directors." Change this paragraph so as to omit the first sentence. It is already covered by the general statement that the Board of Directors shall fix all salaries. The last paragraph of this By-Law to remain unchanged.

V. ASSISTANT SECRETARY.

This By-Law reading as follows, "The Secretary may, with the approval of the Board of Directors, appoint an Assistant to whom both he and the Secretary of the Council may delegate such of his or their duties as he or they may see fit. This Assistant Secretary shall receive such salary as shall be fixed by the Board of Directors, which shall cover his services both to the Secretary and to the Secretary of the Council," to be changed to read: 'The Board of Directors shall, at their first meeting after the annual meeting of the Institute, appoint a Business Manager of the Institute to hold office subject to their pleasure whose duty it shall be to have full charge, under the Board of Directors or such Committees or official as they may designate, of all of the corporation's business affairs, to collect annual dues, subject to instructions by the Treasurer of the Institute, conduct the business correspondence, and attend to the publication and distribution of such documents, circulars and notices as may be transmitted to him for that purpose by the Chairman of the Committee on Papers and Publications.

'He shall receive such salary as may be fixed by the Board of Directors, and shall give his entire time and attention to the business of the Institute.

'The Board of Directors may appoint an Assistant Secretary of the Board to whom the Secretary of the Board may delegate such of his duties as he may see fit. His salary as determined by the Board of Directors shall cover all of his services, in whatsoever capacity, to the Institute.'

VI. TREASURER OF THE INSTITUTE.

The last sentence of the first paragraph reading as follows, "He shall report in writing at each annual meeting of the Institute and at every meeting of the Board of Directors at which such report shall be called for, the balance of money on hand, and any existing appropriation which may affect the same," to be changed to read: 'He shall report in writing at each annual meeting of the Institute and at every meeting of the Board of Directors the balance of money on hand and any existing appropriations which may affect the same.'

Paragraph 3 of this By-Law, reading, "The Treasurer may, at his discretion, place funds of the Institute, not at any time exceeding $5,000, in a special account in a Bank or Trust Company, subject to the draft of the Assistant Treasurer, and may delegate to the Assistant Treasurer the duty of paying, out of this account, the current expenses of the Institute," to be entirely omitted.

Present By-Law VII dealing with the office of Assistant Treasurer should be entirely omitted as it is not proposed to continue the office of Assistant Treasurer.

VII. STANDING COMMITTEES.

To the first paragraph reading, "The Standing Committee of the Institute shall be three in number, known respectively as the Finance Committee, the Library Committee and the Committee on Membership," add 'and a Committee on Papers and Publications;' and replace the word "three" in the first line by the word 'four.'

Change, in the third paragraph, the words "President of the Council" to read 'Chairman of the Council.'

Add to this By-Law the following new paragraphs: 'The Committee on Papers and Publications shall consist of not less than ten members. It shall be appointed by the Board of Directors at its first meeting after the Annual Meeting in each year, and one of the appointees be named by the Council as Chairman; all members to be appointed for one year. It shall be the duty of the Chairman of this Committee to receive all papers sent to the Institute for publication and all circulars and announcements which it is proposed to issue in the name of the Institute, to distribute them to the proper members of the Committee for their consideration, to receive them back and to transmit them to the editor and from him to the Business Manager for printing and distribution. All matter intended for publication shall be submitted to this Committee and shall not be published without its approval. This Committee shall have power to make its own rules subject to the approval of the Board of Directors. This Committee shall have power to add to its own membership, any such additions to be subject to the approval of the Board of Directors.'

VIII. EDITOR.

'At its first meeting after the Annual Meeting, the Council shall nominate, subject to appointment by the Board of Directors, to hold office for one year, an Editor whose duty it shall be to edit such papers as he may receive from the Chairman of the Committee on Papers and Publications and to transmit them back through the Chairman of such Committee to the Business Manager of the Institute for printing and distribution.'

IX. FINANCE COMMITTEE.

In the first paragraph, which reads, "It shall be the duty of the Finance Committee to inquire into and examine the financial condition of the Institute, and to consider ways and means of increasing its revenue and of limiting its expenses. It shall report from time to time to the Board as often as it may deem expedient, and whenever it shall be directed so to do; and the Treasurer shall at all times furnish it with such statements and information as it may desire," change the second sentence so that it shall read: 'It shall report at each monthly meeting of the Directors, and whenever it shall be directed to do so; and the Treasurer shall at all times furnish it with such statements and information as it may desire.'

Omit, in the third sentence, "It may, at any time, examine the books and vouchers of the Treasurer and Assistant Treasurer," the last three words "and Assistant Treasurer." Add to this By-Law the following new paragraphs:

'The Finance Committee shall present a budget to the Directors at the meeting preceding the Annual Meeting of the Institute. This budget shall give an itemized estimate of the receipts and expenses of the Institute for the ensuing year. The Directors shall pass on this budget, modifying it as they consider necessary, and make definite detailed appropriations for the following year.

'The Finance Committee shall check and approve all bills presented for payment and shall not authorize any payments in excess of the appropriations. If at any time any of the appropriations seem in danger of being exceeded, the Finance Committee shall report the same to the Directors.

'All bills, accounts, salaries, pay rolls and claims of every kind against the Institute shall, before being paid, be examined by the Finance Committee and be approved by at least one member of the Committee.' Remainder of the By-Law as at present.

X. LIBRARY COMMITTEE.

Add to the second sentence of the first paragraph, reading, "It shall on the first day of May each year receive from the Secretary of the Council and receipt for the same to him all the volumes of Transactions for the preceding year not then distributed by said Secretary," the words, 'and shall audit and compare the number of documents of each kind received during the year with those distributed and those turned over to it.'

In the second paragraph reading in part, "It shall cause to be kept, under the direction of the Assistant Secretary,

a catalogue of all books in the Library," etc., replace the words "Assistant Secretary" by the words 'Business Manager.'

XI. COMMITTEE ON MEMBERSHIP.

Replace this By-Law, reading, "All nominations for Members or Associates of the Institute shall be submitted to and passed upon by the Committee on Membership, who shall report thereon to the Council. It shall receive and consider all communications respecting candidates, and shall make diligent inquiry as to the character and qualifications of each one. Its proceedings shall be secret and confidential. No member of the Committee shall propose any candidate," by the following: 'All nominations for Members or Associates of the Institute shall be submitted to and passed upon by the Committee on Membership. This Committee shall meet at least once in each calendar month commencing with the month of January each year with the exceptions of the months of July and August. It shall receive and consider all communications respecting candidates and shall make diligent inquiry as to the character and qualifications of each one. Its proceedings shall be secret and confidential. No member of the Committee shall propose any candidate.'

By-Laws 12, 13 and 14 to remain unchanged. Then insert a new By-Law, which will become Number 15, as follows:

XV. OBLIGATIONS TO MEMBERS.

'Any member of whatever grade whose dues are paid within the limits set by Section 1, Article III of the Constitution shall receive the *Bulletin;* and all members and associates who pay Ten Dollars annual dues, also all life and honorary members, shall receive in addition the *Transactions.*'

To the foregoing By-Laws add the following new ones:

XVI. LOCAL SECTIONS.

'Section 1. A Local Section of the Institute may be authorized by the Council at the written request of twenty-five members of the Institute residing in the territory comprising the proposed Section.

'Section 2. Any Member of the American Institute of Mining Engineers who shall be a resident of or whose principal business shall lie within the geographical area alloted to a given Section by the Council of the Institute shall be eligible as a Member of the Local Section and shall become such on due proposal by two members in good standing in the Local Section and on election by the officers of this Section.

'Section 3. The Council shall define the territory of the Sections and shall have the right to adjust it at any time.

'Section 4. Local Sections shall elect their own officers and make rules for the government of the Section, subject to the approval of the Council and providing they be not inconsistent with the Constitution and By-Laws of the Institute. The Council shall have the right to amend, annul or add to these rules.

'Section 5. The officers of a Local Section shall be a Chairman, Vice-Chairman, a Secretary-Treasurer and an Executive Committee. The Chairman, Vice-Chairman and Secretary shall be members of the Executive Committee ex officio. These officers shall hold office for a year or until their successors are elected.

'Section 6. A Local Section may receive for its own uses and with consent of and on appropriation by the Board of Directors an amount not exceeding 10% of the annual dues of its members and in no case exceeding $250 a year, such amount to be drawn from the treasury of the Institute and expended in accordance with the rules to be made by the Directors. If the expenses of the Section exceed the amount so provided, the difference must be made up by voluntary contributions; in no case shall the members be assessed for local purposes.

'Section 7. The Council or the Board of Directors shall have the right to dissolve any Local Section.

'Section 8. Each Local Section shall, by the 1st of February in each year, furnish the Board of Directors of the Institute with an annual financial statement of the Section in the form which may be specified by the Board of the Institute.

'Section 9. The Board of Directors shall dissolve any Local Section whose annual financial statement shows that it is unable to meet its expenses.'

XVII. DIVISIONS.

'Section 1. Professional groups to be known as Divisions of the Institute and to be organized from its members, may be authorized by the Council with the assent of the Board of Directors. Any Member of the Institute may register for membership in any Division in which he is interested and may resign therefrom providing he be under no financial obligation thereto.

'Section 2. The officers of the Division shall be a Chairman, one or more Vice-Chairmen, a Secretary-Treasurer, and an Executive Committee. The Chairman, Vice-Chairman and Secretary shall be ex officiis members of the Executive Committee of the Division. All officers of Divisions shall be elected annually by letter ballot by the members of the Divisions, and shall take office at the close of the meeting at which they are elected. They shall hold office for one year or until their successors are elected.

'Section 3. A Division shall have the right to make rules for its own government, subject to the approval of the Council and the Board of Directors, not inconsistent with the Constitution and By-Laws of the Institute. The Council or Board of Directors shall have the right to amend, annul or add to these rules.

'Section 4. Any Division may raise or collect funds to be expended for its own purposes and may have the entire management and control of such funds in so far as said management or control does not conflict with the provisions of the Constitution and By-Laws of the Institute.

'Section 5. The Council or Board of Directors shall have the right to recommend the dissolution of any Division subject to approval of such recommendation at any annual meeting of the Institute, in which case the net property of such Division shall be divided pro rata among all members thereof in good standing.

'Section 6. Each Division shall furnish the Board of Directors on the 1st of February in each year an annual financial statement of its affairs in such form as the Board of Directors may require.'

XVIII. AFFILIATION WITH OTHER SOCIETIES.

'At the request of the Council, or of its own initiative, the Board of Directors may arrange for affiliation of other Societies having objects allied to those of the Institute, Provided:—

'A. That the total membership shall be qualified to become and that at least three-quarters of the members desiring affiliation shall be, or become, members of the Institute; and that the affiliated Society shall pay to the Institute, out of its funds, an annual contribution for each of its members not a member of the Institute equal to the dues he would have paid if a member.

'B. After affiliation membership in the Institute shall be a prerequisite qualification for admission to such Society.

'C. No member of such affiliated Society who is not also a member of the Institute shall have the right to vote or hold office in the Institute or attend business meetings, but he shall have all the other rights of membership.

'D. Such Societies may elect their own officers and retain and maintain their own Constitution and By-Laws provided the same do not at any time conflict with the Constitution and By-Laws of the Institute and that they are approved of by the Board of Directors of the Institute.

'E. Such affiliated Societies shall have the right to assess dues on their members in addition to the dues of the Institute and shall have the exclusive control of all funds so raised.

'F. All papers and transactions of such an affiliated Society shall be published in the *Bulletin* and *Transactions* of the Institute if approved by the Committee on Papers and Publications, and if not in conflict with the Constitution and By-Laws of the Institute. All members of such affiliated Societies shall receive all of the publications of the Institute on the same terms as the members of the Institute. Any such Society will retain its right to issue special publications under its own name, which must be announced in the *Bulletin*, in which case all of the members of the Institute shall be entitled to receive such publications free of charge.

'G. The connection between such a Society and the Institute may be terminated by either giving six months' notice and settling all indebtedness.'

Replace the present By-Law XV, concerning membership, which reads, "These By-Laws may at any time be altered or amended by a vote of two-thirds of the Board of Directors, or by the Members, at a business meeting of the Institute, in the same manner provided for amendments of the Constitution in Article XII thereof," by a new By-Law to read:

XIX.

'The nomination tickets mailed, as provided for in the Constitution, shall be accompanied by adhesive envelopes marked "Ballot," addressed to the Secretary of the Institute and with a space marked "Member's Name" in the upper left hand corner. Each member may seal up his ballot in this envelope marked "Ballot" and writing his name and address upon the letter mail the same to the Secretary, who shall give them unopened to a Committee of three tellers to be appointed by the Board of Directors at their regular meeting in January immediately preceding the annual meeting. The tellers may receive the ballot at any time within three days preceding the opening of the session of the annual meeting of the same year.

'In case of failure to act on the part of the Board of Directors, or in case at time of meeting there should be no

tellers or a lesser number than three it shall be the duty of the presiding officer at the annual meeting to appoint sufficient tellers to make up the number of three.'

XX AMENDMENTS.

'A. Amendments to these By-Laws may be proposed at any regularly convened business meeting of the Institute or adjournment of such, to be voted upon at the next succeeding business meeting or its adjournment, by any member or associate in good standing at the time and providing they be submitted in writing to such meeting. Or they may be proposed for action at such meeting by sending the same in writing to the Board of Directors so that they are received by them at least sixty days before the meeting at which they are to be passed upon, and providing they may be endorsed by the signatures of at least twenty members or associates in good standing at the time.

'It shall be the duty of the Board of Directors to have all such proposals printed in the next succeeding issue of the *Bulletin* and to provide proper facilities in the form of proxies to vote thereon at the meeting. At the meeting at which they are voted on they may be amended in form but not in substance.

'B. Amendments to these By-Laws may also be made by a joint vote of a majority of the Directors and Council, provided the amendments have been proposed at a meeting of the Board of Directors or of the Council and copies of the same sent to all the members of both bodies at least twenty days before the meeting at which they are voted on. At the latter meeting they may be amended in form but not in substance. Voting may be by letter ballot sent to the Secretary of the Board of Directors.'

Action of Oxidizing Agents on the Velocity of Solution of Gold in Potassium Cyanide

By suspending a piece of Au for 10 minutes in a 0.2 *N* solution of KCN saturated with air and determining the loss of weight both in absence and in presence of other substances, the following results were obtained by Ya. Mikhailenko and M. I. Meshcheryakov, as given in the *Jour.* Russ. Phys. Chem. Soc., 44, 567-70: Introduction of H ions gradually diminishes the velocity of solution, an excess of them entirely arresting the reaction. OH ions do not accelerate the solution, and an excess of them has a retarding influence. In neutral solution, the following substances have no influence on the velocity: quinone, $Na_2SnO_3.3H_2O$, $KBrO_3$, KIO_3, $KClO_3$, $Hg(CN)_2$, $CuCl_2.2H_2O$, while $KClO_4$, $KMnO_4$, NH_4SO_4, Na_2O_2, KSO_4, $NaSO_4$, Br, $K_3Fe(CN)_6$, and KCO_3 accelerate the solution. Taking the accelerating influence of $KClO_4$ (which is not large) as unit, the influence of the following substances can be represented as follows: KIO_4 or KCO_3 2, NH_4SO_4 3, KSO_4, $NaSO_4$, and Na_2O_2 4, $K_3Fe(CN)_6$ 5. The accelerating influence of these substances increases with their concentrations, but only up to a certain limit, above which they begin to exercise a retarding effect. This maximum is 0.02 of an equivalent (*E*) for Na_2O_2 and NH_4SO_4, 0.04 *E* for $K_3Fe(CN)_6$, $NaSO_4$ and KIO_4, 0.1 *E* for KSO_4, and 0.2 *E* for KCO_3. The minimum amount capable of accelerating the reaction is in most cases 0.004 *E*. A variation of the concentration of the KCN solution from 0.2 to 0.05 *N* had no influence on the maximum effect of the oxidizing agent $K_3Fe(CN)_6$. The sum of the influences of several oxidizing agents is less than the maximum of the strongest of them. Addition of NaCl, $CuCl_2$, $Hg(CN)_2$, and $CoCl_2$ has either no influence on the velocity or retards it.

From time to time new minerals are being discovered, and although they may be at first hidden away in the collections of chemists and geochemists who are working along geologic lines, the time may come when their economic value may be recognized and they will find place in the industries of the world. Most of these minerals as discovered or determined by the geochemists are of only scientific interest and appear to have no relation to the arts and manufactures. But no one can determine when the mineralogic curiosity may prove to be a revolutionary factor in some industry. For instance, vanadium once belonged in this group, yet today its use in the manufacture of steel is increasing rapidly because it imparts to the steel ability to withstand stress and strain and lessens 'fatigue.' Tungsten, too, was well known for 100 years, but only recently was it found that this mineral could be made into an electric-lamp filament which yields a light that is stated to be the nearest approach to daylight. The properties of minerals already known and of those newly discovered are constantly being determined by the mineralogist, whose province it is to work out his scientific problems irrespective of any application that the industrialist or the technologist may evolve from his conclusions.

Mount Morgan Turbo-Blower Plant

The new turbo-blower plant at the Mount Morgan Copper Reduction Works comprises four furnace turbo-blowers and three converter turbo-blowers, electrically driven. Each of the furnace blowers is capable of compressing 18,000 to 20,000 cu. ft. of free air per minute to 64 oz. per square inch pressure. Each is driven by a 500-volt, direct-current, variable speed, electric motor, the speed varying from 2200 to 2700 r.p.m. The three converter blowers each have a capacity of 5000 cu. ft. of free air per minute to 12 lb. per square inch pressure, the speed varying from 2700 to 3050 revolutions per minute.

The blowers are all C. A. Parsons & Co. latest multiple-stage centrifugal type. The air is drawn from a chamber under the floor, which is connected to a tower, the inlet to which is about 30 ft. from the ground, in order to secure freedom from dust. The delivery from the machines is beneath, each machine being connected by means of a branch and valve to a main blast pipe. There is, therefore, no obstruction on top of the machines. An overhead hand-operated crane enables the various parts to be handled with a minimum of labor.

The main switchboard is placed parallel with the row of machines. Each machine is served by a starting panel equipped with overload and no-load circuit-breaker, special interlocked rheostat, field rheostat, and ammeter. The field rheostat, together with ammeter and pressure gauge, enables the machines to be run exactly in step. The main bay of the power-house is 114 ft. long by 32 ft. wide, with a side aisle, 10 ft. wide for the whole length. An overhead crane spans the main bay, and the switchboards occupy the side aisle.

The floor is of reinforced concrete, built 8 ft. above the ground level. The space in the basement beneath the floor is divided into two compartments, one being the suction chamber for the blowers, the other is utilized for the electric cable suspension and as a store-room for electric supplies. A portion of the floor at the eastern end is at the ground level, enabling material to be brought in by tramway under the overhead crane. The walls up to the floor level are of reinforced concrete, and above that level of timber framework lined with tarred galvanized iron, the roof being of the same materials.—*Queensland Government Mining Journal.*

The Iron Industry of Tennessee

From the best information that can be obtained, the first iron mined in Wayne or Lawrence county, Tennessee, was in 1832. H. P. Seavy, of Iron City, is authority for the statement that what is known as the VanLeer mine was opened by Sam VanLeer and worked by him from 1832 to 1837. This mine was on top of the ridge a mile and a half west of the present site of Iron City. The old pits from which the ore was taken are scattered over probably more than 100 acres, and are yet plainly to be seen. They were worked by slave labor and the ore was hauled by wagon to a small charcoal furnace situated some five miles distant on Butler creek. Only the large lumps that could be sorted from the clay by hand were used, no attempt having been made to wash out the 'shot ore.' The pig iron was shipped down the Tennessee river to the Ohio, thence to New Orleans, and from there to Baltimore.

Standard Screens for Grading Analyses

By H. Stadler

*After full and careful consideration and after ascertaining the views of kindred societies and of a large number of authorities in various parts of the world, the Institution of Mining and Metallurgy adopted, in November 1907, a series of specially manufactured standard laboratory screens for the purpose of bringing about unification in the measurement of screen products. In order to meet metallurgical requirements it was necessary to put a large number of screens at the disposal of metallurgists, but as in ordinary practice only a comparatively small number of screens is required, it is suggested, with a view to securing still greater uniformity, that engineers and metallurgists, in making a choice, should preferably adopt the screens specified in the annexed table. The selection of the screens of the restricted set here recommended has been made in such a way that the apertures are in agreement with, or very close to, those of the mathematically correct reduction scale, so that the series of the products of these screens will show a regular reduction in volume, or weight, of 1 : 4 from grade to grade.

Standard Screens for Grading Analyses.

Mathematically correct scale. Reduction ratio 1 : 4.			Nearest I.M.M. Standard laboratory screens.			Commercial Hand sieves.
Ord. No. mech. val.	Mesh aperture.		Mesh per lin. in. . .	Mesh aperture.		Mesh aperture, approximate . . . . .
EU.	In.	m/m.	No.	In.	m/m.	In.
0	1.0	25.4	..	....	....	1
2	0.630	16.0	..	....	....	5/8
4	0.3969	10.080	..	....	....	3/8
6	0.250	6.35	..	....	....	1/4
8	0.1575	4.0003	..	....	....	5/32
10	0.09922	2.52	5	0.10	2.540	
12	0.06250	1.5874	8	0.062	1.574	
14	0.03937	1.0	12	0.0416	1.056	Grading
16	0.0248	0.630	20	0.025	0.635	by
18	0.01562	0.3968	30	0.0166	0.421	classification
20	0.00984	0.250	50	0.01	0.254	(Quartz)
						Velocity, m/m per sec.
22	0.00620	0.1575	80	0.0062	0.157	16.0
24	0.00391	0.0992	120	0.0042	0.107	6.35
26	0.00246	0.0625	200	0.0025	0.063	2.52
28	0.00155	0.0394	..	....	....	1.0
30	0.00098	0.0248	..	....	....	0.4

The diameter of wire of the Institution of Mining and Metallurgy standards is equal to, or very closely approaches that of the clear mesh aperture. The area of discharge is therefore fairly constant for all screens. The 50 and 80 I.M.M. mesh have the same mesh apertures as the 60 and 90-mesh screens, respectively, already in common use on the Rand. As the difficulties attending the manufacture of the 200 I.M.M. mesh have not yet been overcome, and as the commercial so-called 200-mesh screens are very unreliable, and in fact not much finer than the 120 I.M.M. mesh, it is more advisable to drop for the time being the 200-mesh altogether and to rely on classification for grades beyond the 120 I.M.M., which with an aperture of 0.0042 in. marks actually the limit of accuracy for screen measurements. When screens are described simply by the mesh number it will be understood that the I.M.M. standard is referred to. In reporting grading tests it is desirable to state whether wet or dry screening has been employed.

*Abstract from the *South African Mining Journal.*

Operating a Stationary Filter

By H. G. Smith

At the Concheño mill of the Concheño Mining Co. a standard 30-leaf semi-gravity type Butters filter is in use. The operation of this required a longer solution wash than the crushing plant permitted, and trouble was occasioned by the cracking of the cakes during the transfer of charges, which made an even wash impossible. In the ordinary cycle of operations 15 minutes was consumed in pumping the excess charge, and about the same time was required to fill the filter-box again; thus the cakes were exposed to the air about 30 minutes, during which time large cracks were formed, and filtration practically came to a standstill.

To prevent the cracking of the cakes and at the same time to devote the 30 minutes time to useful account, I hit upon the following expedient. Instead of pumping back the excess charge of slime, and filling the filter with wash solution from the bottom of the tank, I connected the solution-line with a 4-in. pipe and valve, and to it a 4-in. pipe, perforated with 3/4-in. holes with 2-in. centres, which rested on the filter leaves and extended the length of the box. Then, after the formation of cake on starting the pump, I ran in the solution wash through the perforated pipe at the top of the charge, keeping the leaves covered all the time. In this way the 30 minutes consumed in filling and emptying the filter-box is utilized in cake-making and washing, and the leaves being submerged the cake has no chance to crack, an even wash is assured, and an additional 30 minutes wash is possible, or the cycle can be shortened to that extent.

Of course there is some mixture of slime and solution, but not as much as might be supposed. By watching the discharge of the pump the change can be detected almost instantly when the slime charge ends and the mixture of charge and solution comes in. Then the mixed part is turned to another tank, and pumping continued until the solution runs clear; when the pump is stopped until time to change the charge. The mixed slime and solution is allowed to settle, and the thickened slime is run to the agitators again, while the clear solution is turned to the mill solution or to the zinc-boxes. Possibly more solution is precipitated than would otherwise be the case, though not necessarily, as the dilute pulp can be run to the settlers, or thickeners, and the overflow of solution can be handled by passing to the zinc-boxes or run into the circulating mill-solution. More solution is handled and more power is consumed than ordinarily, but in any case there is always a certain amount of mixed slime and solution to be taken care of under any conditions.

In some cases it might be of advantage to carry the method a step further and replace the solution wash by the water wash; this could be done by having the sump tanks graduated so a definite amount of solution could be pumped and the stock of solution could be kept constant. This might be of advantage where the solution wash is very weak (as in some gold plants) where the mixed portion (which would have to be run to waste) could be kept at a low cyanide content. I offer this method to my co-workers for what it is worth; and while the application is original with me, I make no claim other than that by using the system the cracking of the cake is avoided (assuring an even wash) and that the time saved in the cycle over the ordinary method more than offsets the objection of the extra pumping solutions. Where a saving in the cycle of operations of 30 minutes can be made another charge can be run through the filter in the course of 24 hours time, which is quite an object where the filter is crowded to keep up with the crushing department.

There does not seem to be any immediate likelihood that the engineers of the Central Mining Corporation will rejoin the Mines Trials Committee, according to the *South African Mining Journal*; and it is possible that if they do not do so by next year, the organization may dissolve.

Railroad Valley Potash Fields

By G. L. Sheldon

Railroad valley is in northeastern Nye county, Nevada, and Potash Camp, where the Railroad Valley Saline Co. is drilling, is 72 miles southwest of Ely, Nevada, and 125 miles northeast of Tonopah. The valley is from 10 to 20 miles wide, east and west, and over 100 miles north and south. At the north end, over a low divide, White Pine valley continues for 40 miles farther. At the south end, over a low watershed, Kawich and Penoyer valleys extend for 20 to 25 miles. The valley is bounded on the east by the White Pine range, 200 miles long, with an elevation of 8000 to 10,000 ft. On the west the Pancake and Reveille ranges form the near boundary, with an open drainage from Hot Creek and Reveille valleys into Railroad valley. These two valleys are bounded on the west by the Hot Creek range, which is broken by Hot Creek canyon, affording drainage from Fish Spring valley. Pancake and Reveille ranges have a general elevation of 6000 to 7000 ft. excepting isolated peaks. Hot Creek mountains have an elevation of 8000 to 9000 ft. The Kawich mountains, to the south, are an extension of the Reveille range, with an elevation of 7500 to 9000 ft., which constitutes the western boundary of Reveille valley. The Belted range, the southern boundary of Kawich and Penoyer valleys, is 25 miles farther south, with an elevation of 7000 to 8000 ft. The divide between Railroad valley and Penoyer and Kawich valleys is 6200 ft. The present old lake bed of Railroad valley has an elevation of 4700 ft., with a maximum length north and south of 15 miles and a width of 6 miles. The area of the present drainage basin into the old lake bed is 6000 square miles. The topography is such that a heavy rainfall on any of these valleys or mountain slopes must drain into this old lake bed, which has never had an outlet. It is a matter of record since the earliest settlement in 1865, that rare floodwaters, from all parts of the present drainage basin, have been seen to flow into the old lake bed. It is reasonably certain at some earlier time Kawich, Penoyer, and Little Smoky valleys all drained into Railroad valley. Of the exposed strata within the drainage basin, 85% is eruptive, or water-laid formation derived from eruptives, mostly rhyolitic and granitic rocks, which usually contain 3½ to 8% potash. Detailed descriptions of the formations are given in U. S. Geol. Surv. Bull. No. 208, pp. 61-68, 84-49, 161-164, 181-184, and Bull. No. 308, pp. 96-140. From the beginning of the Pliocene age to the present the erosion has been hundreds of feet, filling the valleys to their present condition. Of the enormous amount of material eroded and carried into Railroad valley, probably 4% was potash, in insoluble form in feldspars and micas. Part of this was decomposed into soluble salts that went into solution and later evaporated in Railroad valley.

The average amount of potash contained in the waters of the alkaline and salt lakes of the Great Basin, according to U. S. G. S. Bull. 330, is 0.29 part in 1000 parts of water. Reduced to tons of chloride of potash per cubic mile of water, this is approximately two million tons. Searles lake, California, contains about one cubic mile of water and is estimated to contain 10½ million tons of chloride of potash. In various parts of the valley there are lake bed terraces from 50 to 1500 ft. above the present lake bed. The lowest is at the north end, where an old shore line of sand and fine gravel reaches across the valley except where cut out by recent floodwaters, and is utilized as the crossing of the proposed Ely, Tonopah & Goldfield railroad.

Toward the north end of the old lake bed surface deposits of salt occur the incrustations being ¼ to 3 in. thick, and are composed of soda, magnesia, borax, and 5 to 20% of potash. The water, which is generally found in the discovery holes of the placer claims, contains 4 to 15% potash; even the surface soil of the lake bed shows 1 to 5% potash. Thirty years ago the management of the Tybo mines (45 miles distant) gathered a lot of this surface salt for use in the chlorination of silver ores, but it contained so much potash that it could not be used.

The potash content attracted the attention of the management of the Railroad Valley Saline Co., and after much time in examinations operations were commenced. The valley has been examined by several of the engineers, geologists, and chemists of the Survey and Department of Agriculture, and hundreds of samples have been taken from various parts of the valley and analyzed. The Railroad Valley Saline Co., in financing its operations, has made only a plain statement of the facts, as it is practically a gamble until potash is found in workable quantity. The drill-hole reached 1200 ft. by reducing the casing from 9⅝ in. to 7⅝, then to 5⅝, and finally to 4⅝ in., using a Keystone drill. Experience has shown that this is not heavy enough, and a standard 4000-ft. rig such as is used for oil wells has been purchased.

Much trouble has been experienced with quicksand and artesian water-flows. The first artesian water in notable amount was at 285 ft., after driving the 9⅝-in. casing to 305 ft. It was reduced to 7⅝ in., and the continuous flow of good water has afforded an ample supply for operations. The quicksand rose as high as 275 ft. in the casing; probably every foot below the 200-ft. level has been re-drilled a dozen times. Three-quarters of the depth of the hole is in sand, though layers of clay a few feet in thickness were cut. Only one was of any thickness, 50 ft., between 500 and 600 ft. in depth. There were many flows of artesian water, which were shut off with the casing. Except at one place, where the water carried some sulphur, it has invariably been fresh and not more than a trace of potash has been found.

The superintendent, D. H. Walker, has made tests every 3 to 5 ft., and a part of each sample has been sent to the United States laboratory at the Mackay School of Mines at Reno, Nevada, as a check. The fact that all of the water from the well has so far been fresh encourages the belief that in depth, below some thick impervious clay bed, potash in commercial quantity will be found. As there has never been an outlet to the valley, it is expected that the potash will be found in soluble form. This will conduce to cheap operating costs. The Railroad Valley Saline Co. has recently reorganized and increased its capital stock to 1,000,000 shares of $1 each, and has placed 600,000 shares in the treasury. It has recently bonded all of the ranches and water rights on the Duck Water creek, in the north end of the valley, and has segregated 57,000 acres of Government land under the Carey act. A dam will be built at a natural reservoir site on Duck Water creek, affording a large amount of electric power. The water will then be used for irrigation, it being the intention to supply the Government land with artesian water by drilling wells. Of the proposed irrigation and water-power enterprise, more than three-quarters is included in the property of the Railroad Valley Saline Co. It is the intention to drill several wells in various parts of the old lake bed for potash. As there are no deep wells in any of the basins of the arid basin country, the present development is pioneer work. Part of the year some places in the lake bed are very soft, and this has necessitated the building of several miles of roads. By the efforts and financial assistance of the company, both Nye and White Pine counties have very materially improved their roads, one of which is now used as an interstate automobile road between Salt Lake, Ely, Tonopah, Goldfield, and Los Angeles. With the exception of an occasional jackrabbit, horned toad, or mouse, animal life is entirely absent in the old lake bed. On the northern portion there is some thin salt grass, rushes, and small greasewood. A part of the lake bed has many sand-dunes, in some places from 3 to 6 ft. high, and in others 10 to 30 ft. high. The dunes are peculiar in that they do not shift. Snow and rain appear to cement the sand, forming a hard crust.

In places a team can be driven over it, and in other places there are occasional holes a few inches in diameter containing water and mud with no bottom. There are other places where the surface soil is soft and the shoe sinks in 2 to 8 inches in walking. This is called 'self-rising' ground and caused by soda, it is said.

About four or five miles south of the present drill-hole is a perfectly level lake bed which evidently has water at times over its surface, but in the summer is hard and smooth, so that it is possible to drive over it. The sand-storms here are simply 'fierce'; it is impossible to see, even with goggles on, so that it is easy to get lost. The discovery holes, 10 by 6 by 4 ft., sometimes fill up in one week. The pencil marks on the corner stakes of the claims on the south side cut away in a few days, the sand acting like a sand-blast. For much of the foregoing data I am indebted to the kindness of D. H. Walker.

Diamond-Fields of Pretoria

The increased activity in prospecting operations in the Pretoria diamond-field as a result of the better outlook for diamond mining, has brought to more prominent notice a somewhat peculiar igneous deposit about twelve miles west of the Premier mine, and eight miles northeast of Pretoria, on a farm known as Derdepoort. This deposit is described by the Transvaal Geological Survey as a 'volcanic breccia,' a better description not yet having been found. It appears to represent a volcanic mud flow in one of its numerous early stages, of which true kimberlite may be said to be one. This volcanic breccia is about a mile across, and while it presents many features in common with 'blue producing diamond ground,' some of the essential mineral accessories are absent and foreign elements are present, among them hornblende. The most important discovery claimed, however, is that the volcanic breccia contains diamonds, but to what extent has not yet been proved. This display of reticence to prove its true value tends to cast doubt upon the real value of the find. There was a time when the value of a diamond-bearing deposit was judged entirely by its likeness to that at Kimberley, not only in constituents but in the geological age of the surrounding rocks. Since that time, however, many of these diamond-bearing ground illusions have been dispelled, and it is recognized that a true diamond pipe can exist in any description of rock, igneous or otherwise, and containing minerals not yet recognized or found at Kimberley. There does not seem any sound geological reason why this volcanic breccia should not be related to and formed in exactly the same manner as the blue ground forming the volcanic diamond-bearing pipe at the neighboring Premier mine. The deposit or mud flow may be of a somewhat different age, but as long as it is amenable to the usual method of treatment and carries enough diamonds of adequate quality to make mining operations profitable, its precise method of origin or geological status is only of academic interest. The hesitancy displayed by the owners to fix by actual tests on an adequate scale the true diamond yield of this volcanic breccia only tends to confirm the views, so frequently expressed, that the discovery is of little or no economic value.

THE present plant at the Bushtick mine consists of 20 stamps and three tube-mills, and is being enlarged by adding four Nissen stamps and one Krupp tube-mill. These additions will increase its capacity from 6000 to 10,000 tons per month. During its past financial year the Camperdown claim of the Wanderer mine produced 125,766 tons of ore, which were dry crushed by rolls and cyanided. The total profit was only $39,500. During June the yield was valued at $37,500 and expenses $31,500. Ore reserves are stated to be 350,000 tons in the five properties, and as 220,000 tons is mined yearly, this tonnage should keep the mill working for 18 months. Noel Griffin is now in charge.

Profits in Lead Smelting

By LUCIUS L. WITTICH

Lead smelters handling ores from the Joplin district buy their galena at a rate of $62 per ton, upon an assay of 80% metallic lead, and convert it into metal which sells for $76.38 on the East St. Louis market, their margin being $14.38 for every ton of galena treated. This margin is unusually great and means an enormous profit to the smelter. As a result, the demand for galena is strong, but prices are not strong enough to warrant an unusually heavy production. The figures given above are the highest prices quoted, both for metal and ore. The former ranges down to $5 per hundredweight, whereas the top price of $5.025 per hundredweight is used. Ore, on the other hand, ranges down to $60, whereas the $62 quotation is used. Thus, if there is any discrepancy in the above figures it is slightly in favor of the smelter, and the margin quoted should be even greater than it is. In the year of record galena prices, 1907, when the top price went to $88.50, lead was quoted at $6.35 per hundredweight, which meant

A LARGE PILE OF LEAD CONCENTRATE.

a margin of $10.02. In October 1911, lead smelters produced pig lead at a margin of $7.42.

The lead ore from the Joplin district is regarded as the purest mined in the United States, its average metallic content being placed at 80%. When pure, galena contains 86.6% Pb and 13.4% S. (H. O. Hofman places the average metallic content of the Granby, Missouri, product at 84%.) However, in selling lead an 80% metallic basis is recognized, and if the ore carries more than this amount the smelters pay extra for it at the rate of $1 per unit, and in return, of course, derive a larger percentage of metallic lead. The Joplin product also carries on an average of 1.25 oz. silver per ton, but no effort is made to recover this. As the average metallic content in galena is 80%, a ton of ore carries 1600 lb. of metal, and of this approximately 95% is recovered at the smelter. Thus a ton of ore produces 1520 lb. of pig lead, which, at present prices, sells for $76.38, or $14.38 more than the ore cost.

When ore sells on a $62 basis a heavy tonnage of galena can be mined at a profit. Many of the outlying producers of the district figure conspicuously in the production of galena mined from shallow levels. Much of this ore is free 'chunk lead,' requiring only the removal of the adherent clay by washing or hand cobbing to make it ready for the market. Hand-jigs are in common use at lead mines where the galena occurs in fine particles. At other places concentrating plants are employed, but few mines are worked solely because of the presence of lead. Zinc-blende is the chief product at the majority of the milling properties and the recovery of the galena from the first cell of the jigs often represents a source of clear profit. However, the production of lead ore could be increased ma-

terially. The entire central district, including districts in Missouri, Kansas, and Oklahoma, is now producing about 960 tons of galena per week. This could be increased by several hundred tons, at a conservative estimate, if ore prices were high enough to warrant the working of much thin galena-bearing ground, but such an increase can hardly be expected at present prices.

Much of the lead produced in this district is treated at local smelters. A large plant is in operation by the Picher Lead Co. at Joplin. Here both pig lead and white lead are produced. The same company has the controlling interest in the Webb City Smelting Co. The Granby company operated a smelter at Granby, Missouri, but fire destroyed this plant recently. It may be rebuilt. At several points in the Kansas natural-gas zone, lead ore is smelted. Webb City, Missouri, holds first place in the weekly production of galena, the output averaging 450 tons; Joplin comes second with an output of about 125 tons; while Miami, Oklahoma, is a close third with about 100 tons, and its present rate of increase bids fair to surpass Joplin in the near future.

The Lead Market

Owing to the car shortage and the probability that this shortage will be more acute as the season advances, shipments of lead are being delayed all along the line. The continuation of the Utah strike is also likely to affect the Utah lead smelters before long. Stocks of lead in the hands of producers as well as consumers are lower than for many years. In view of these conditions, L. Vogelstein & Co. warn consumers not to be deceived by the recent advance in prices into the belief that favorable conditions have been fully discounted and that the American Smelting & Refining Co. will be ready to aid consumers at lower prices whenever they are in need of metal. Lead is the only metal which is still cheap, and the price, therefore, cannot be affected by the presidential election or the possibility of tariff changes. The European price of lead has never been as high as at present, while the American price has time and again reached a level of more than 1c. per pound above present prices.

While large new sources of supply of other metals, notably copper and zinc, have been discovered during the past few years, nothing worth mentioning has been added to the lead supplies of the world. In fact, the rich mines of the Coeur d'Alene and the enormous deposits at Broken Hill in Australia have been gouged of their richest ore. The only increase in production in this country has come in recent years from the old mines in Missouri, where, however, decreasing percentage of metal contents in the ore is also a warning that the limit has been reached. There is no reason why the American Smelting & Refining Co. should continue to supply consumers with lead at low prices as they have been doing during the past few years of depression. Outside producers have sold their product for months ahead; there are no stocks; speculators do not exist. Business in white lead and material for paints is excellent. The consumption of lead-covered cables is larger than ever before, and consumers are cautioned against the danger of a squeeze which might be produced by a sudden awakening of the demand in this country—a demand which can only be supplied to a limited extent by the American Smelting & Refining Co. Consumers should not fail to recognize the importance of carrying at least a month's supply of lead, even though the price has advanced and is probably 10% higher than during the average of the past few years of depression.

ANNOUNCEMENT is made by the Civil Service Commission of an examination to be held shortly to fill a vacancy in the position of mineral technologist with the Bureau of Mines at Denver, Colorado, at a salary of $3000 per year. The subjects upon which rating will be made are: general education and technical training, 30 points; experience in connection with the rare minerals, and fitness, 40 points; publications or technical or professional reports, 30 points. The examination is open to citizens of the United States who are between the ages of 25 and 40. A similar examination will be held to fill the position of mine sanitary engineer in the field service of the Bureau of Mines at a salary of from $1800 to $2400 per year.

Unwatering the Plymouth Shaft

The Pacific shaft of the Plymouth Consolidated mine is vertical and 1650 ft. deep. The workings connecting with it had been filled with water since June 1892 until reopening was commenced this year. The method used was that of bailing with 500-gal. skips, operated by an electrically driven geared hoist. A sinking pump having a capacity of 100 gal. per minute was used in emergencies only. It was used from the surface to a depth of about 200 ft. during the first months of operation, pending the completion of the hoisting plant. The operation of the latter was commenced on March 7, 1912, and the unwatering was completed on October 1.

It was estimated from the incomplete data available that approximately one million tons of material occupying 12,000,000 cu. ft. of space had been excavated from the workings to be unwatered, and it was estimated that one-half of this space, namely, 6,000,000 cu. ft. would be found to be filled with water. In round numbers, this would amount to 48,000,000 gal., in addition to the current flow during the period of unwatering, which was estimated at 720,000 gal. per month. The amount of water actually removed was 43,663,000 gal., and assuming that the figures for current flow are approximately correct, about 5,000,000 gal. would be accounted for from this source, leaving 38,663,000 gal. as the actual content of the mine workings.

The shaft timbers were generally found to be in good condition, and in repairing the shaft from the surface to the bottom there were used only 45 complete shaft sets and 11 single-compartment sets. The principal cost of repairs was due to the labor required in cutting out and removing old shaft ladders, compressed air and ventilating pipes, and replacing them with new ones. Aside from equipment, which was expensive, the cost of unwatering and repairing the shaft, exclusive of administration, was about $15,000, nearly equally divided between taking out the water and the shaft repairs.

The shaft was, of course, always slippery, slimy, and full of falling water, and at times the air was so bad that men could work in the bottom only a half-hour at a time, and yet the entire operation was conducted with an injury to only one employee, who was incapacitated for work for one week only. This reflects great credit on the care and attention of James F. Parks, the superintendent.

September Copper Review

By MISHA E. APPELBAUM

The copper market during September exhibited practically the same tendencies as during the past few months, excepting that Europe made more liberal purchases. The statistics for September again show a large production for the month, but, contrary to expectations, there was an increase in the visible supply of about 16,000,000 lb., which is nearly all accounted for by the fact that domestic deliveries fell off some 15,000,000 lb. I consider the let-up in the domestic deliveries as temporary, and believe that the statements from now on will show some decreases. The business with the copper consumers in this country is excellent and Europe has still to buy large quantities of copper. The metal situation, therefore, seems to be in about as good a statistical position as the producers could wish, but they are to be heartily commended in selling as much copper as possible at 17¾c., although they were several times in position to quickly advance the market considerably higher.

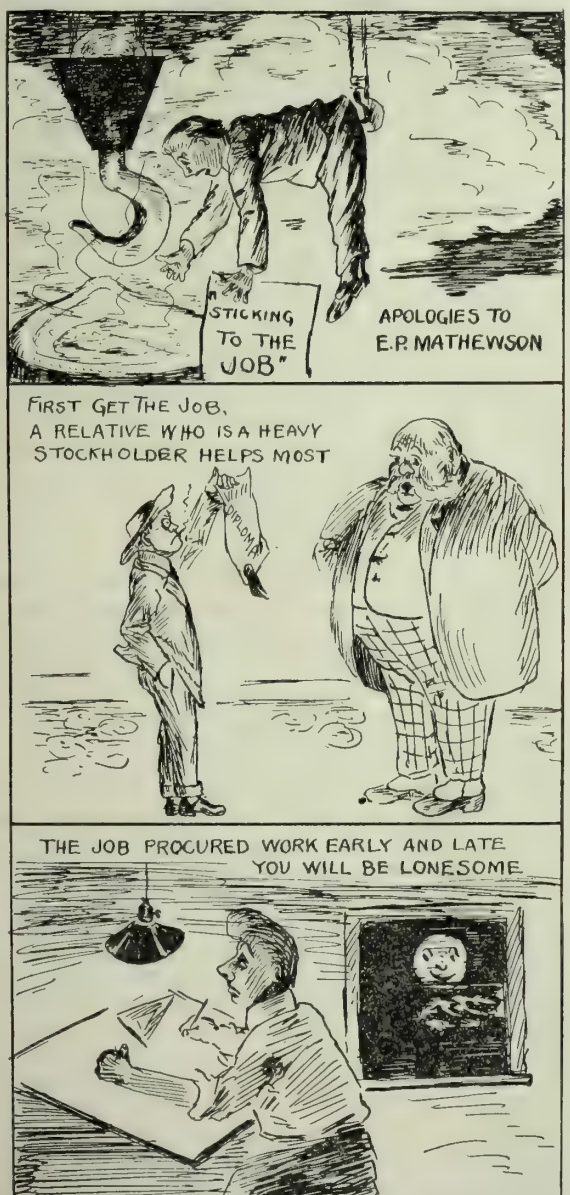
Discussion

Readers of the MINING AND SCIENTIFIC PRESS are invited to use this department for the discussion of technical and other matters pertaining to mining and metallurgy. The Editor welcomes the expression of views contrary to his own, believing that careful criticism is more valuable than casual compliment. Insertion of any contribution is determined by its probable interest to the readers of this journal.

Sticking to the Job

The Editor:

Sir—Every one gives advice to the young engineer. I (a young engineer) refuse to take seriously any more of


STICKING TO THE JOB"
APOLOGIES TO E.P. MATHEWSON
FIRST GET THE JOB, A RELATIVE WHO IS A HEAVY STOCKHOLDER HELPS MOST
DIPLOMA
THE JOB PROCURED WORK EARLY AND LATE YOU WILL BE LONESOME

it, till we have the other side presented. Let us hear some of the experiences of those who have followed the advice given in recent class-day addresses.

JOVEN.

De Todo Lugares, September 23.

Step-Bearing for Slime Agitator

The Editor:

Sir—I have had my attention called to an article in your issue of September 21, 1912, entitled 'Step-Bearing for Slime Agitator,' by Douglas Waterman, in which he describes one of our most valuable inventions, patented by the L. C. Trent Engineering Co., Inc., in the United States letters patent No. 937,974, October 26, 1909, as well as in a number of other foreign countries. Mr. Waterman, at the end of his article, states, "It only remains to add that

THEN SOME DAY THE OLD MAN WILL GIVE YOU A $10 RAISE
GRATI-TUDE
OFFICE
$10.00
BY ALL MEANS GET MARRIED
ROCKYHUT $30 A MONTH
AFTER YEARS YOU WILL BECOME SUPERINTENDENT AND EVEN YOUR THIRD COUSINS WILL REMEMEBER YOU
UNCLE WILL SAID YOU MIGHT GIVE ME A JOB

this device is not patented, and can be turned out by any foundry at small expense."

This is a remarkable statement for Mr. Waterman to make because the article, precisely as described by Mr. Waterman, certainly is patented in the United States and abroad.

L. C. TRENT.

Los Angeles, October 1.

Water as an Indication of Ore

The Editor:

Sir—On this topic, G. E. Collins says, "a dry dusty condition in the bottom of deep mines often seems to coincide with a lessened amount of quartz in the gangue; and a vein-filling consisting of clay and crushed 'country'." The average percentage of silica in the Kalgoorlie group of mines is about 65%, up to 75% in the Great Boulder mine, and there is an increase of silica with depth, also with dry and dusty conditions. At the Waihi mine, in New Zealand, where 727,000,000 gal. of water is pumped yearly, there is 96% of silica in the ore down to 400-ft. depth, while from 400 to 850 ft. there is only 91%. But still, water is there looked upon as a good indication of ore.

M. W. VON BERNEWITZ.

San Francisco, October 5.

DET NORSKE NITRIAKTIESELSKAB, with $2,700,000 fully subscribed capital, has been formed in Christiania to produce sulphate of ammonia from the atmosphere, after the method of an Austrian engineer, Dr. Serpek, according to a consular report. The invention has been developed by a French company, Société Generales des Nitrures, and the patent right for Norway has been acquired by Det Norske Aktieselskab for Elektrokemisk Industri. The new company has been started jointly by French and Norwegian interests. Construction of the plant will commence immediately at Arendal, operations to start in the autumn of 1914.

Special Correspondence

NEW YORK

THE COPPER SITUATION.—PRODUCERS AND DIVIDENDS.—THE TRINITY JOKEBOOK.

The October statement of the Copper Producers' Association, while not greatly affecting the share market, was not without considerable significance. Surplus refinery stocks were found to have increased during September some 16,300,000 lb. The consumers and those of the public who have persistently maintained a skeptical attitude regarding the disappearance of the copper surplus have not been slow to point to the reported sales of copper metal, the shutdown at Bingham and at Ely, and the unexpected increase in stocks as a justification of their position, in which many of them have been somewhat stubborn. While there was a slight falling off in both export and domestic deliveries as compared with the average for the preceding eight months, deliveries for September were not far below normal figures. Domestic deliveries were in round numbers 63,000,000 lb., which, while 15,000,000 lb. below the high record of August, is still only 5,000,000 lb. below the average for the year, and the year's figures have so far broken all previous records. There was a decrease in exports of 10,000,000 lb., but exports were but 4,000,000 lb. under the monthly average for the year. Production was, in round numbers, 140,000,000 lb., which has been exceeded but once—in August—when all records were broken with an output of 145,628,521 lb. Copper producers are saying that they are greatly pleased with the statement, as it will make it unnecessary to adopt any extreme measures to avoid a 'runaway market.' The consumer has heard about the impending 'runaway market' until, in a measure, it has ceased to frighten him. The price to which the market has been manipulated has greatly stimulated production, and the real question now is the ability of those in control of the situation to maintain a balance. The big new low-cost coppers, with all or nearly all of their productive life ahead, must and will make hay while the sun shines. Shut-downs of these larger properties are almost out of the question because of the tremendous expense which at once begins to pile up. The Bingham strike has already cost a loss of $2,000,000, to say nothing of the extra expense incurred.

The manipulation which withdrew the threatening surplus, at least from public view, and the financial strength of the factors which assumed control, and still have control, of the copper situation are elements which, for a time, have overshadowed the new copper which must find a market. The consumption abroad has been at an unheard-of rate, and a reaction is admittedly long over-due. At home conditions are not such as to justify too great confidence in the immediate future; to use the language of the street, everybody seems to be advising bull tactics for the other fellow and practising a great deal of caution for himself. From this it may be fairly argued that the next few months are more likely to see production at an abnormally high figure than consumers scrambling for metal. It will be strange if the copper surplus does not grow steadily during the next quarter. However, the financial strength of the copper group is without limit. It is one of the largest manipulations ever attempted, and if money is required to save the situation it will be forthcoming in amounts never dreamed of by any of the syndicates that have heretofore, from time to time, attempted to control the copper market. Nor in any of the past manipulations was there ever such unity of the sellers or handlers of the metal and the mining companies. In the present situation these are largely identical. The strength of the consumer, or rather the main dependence of the consumer, lies in the fact that curtailment is next to impossible. Present-day mining operations are on a scale where profit is won by the handling of tremendous tonnages only, and the 'porphyries' must keep going in any event.

The strike at Bingham and at Ely is reported to be wearing itself out, happily a spirit of compromise seems to have prevailed and by concessions on both sides an early agreement and resumption of work is expected. One important result of the strike at Bingham was the closing of the smelter at Tooele, all of the copper furnaces being shut down. Some properties that were shipping custom ores to Tooele have also temporarily ceased operations. Among these, the South Utah, which had a small strike of its own on hand at the same time and was experiencing trouble with water in the lower levels, has stopped production for the time being.

So far as the share market is concerned all the ammunition consists of dividends. Amalgamated is to be put on a 6% basis, and the stock to be sold at par; this is to be heard around nearly every ticker where bulls and bears congregate. Utah Consolidated is to pay one more dividend this year if the labor troubles at Bingham are settled within a short time, as expected. Greene Consolidated has declared a dividend of 40c. per share, which goes almost entirely into the Greene-Cananea treasury, and will be thence distributed to shareholders by a dividend of 25c. per share, payable November 30. This payment will make 75c. per share paid this year by the Greene-Cananea. Chino is expected to announce a dividend date very shortly and to make an initial distribution either late this year or early in 1913. Chino is earning at the rate of about $6 per share per annum and producing copper at the rate of 42,000,000 lb. per year. Nevada Consolidated and Utah were confidently expected to make an increase in the next quarter in the rate of payment to shareholders, but probably this will be postponed for at least one quarter, owing to the expense entailed by the strike.

The reading public has always paid to Thomas W. Lawson the tribute of reading with intent interest the various products of his pen. Lawson was the individual who first stirred to action the forces of revolt against the old financial regime in New York and Boston. As a phrase-maker, a user of originally compounded adjectival descriptions, bizarre, but forceful, and on a level with his public instead of above its head, he is unique, illuminating, and instructive. But not all of Lawson's ability is given to the letting of the light into dark places. He can obscure when need be and make phrases which neither commit the writer nor enlighten the reader. A recent report just mailed to the stockholders of the Trinity Copper Co. says in part: "The only thing of interest to stockholders in A. H. Brown's report is that the Trinity mines, with equipment of buildings and machinery, are under constant care and repair by intelligent caretakers, and are ready to resume operations upon short notice; all legal matters are attended to and competent annual assessment work performed upon any and all of the possessory locations; the property is in good condition and *the ores as great an asset as in former years.*" Surely after reading this summary, every Trinity stockholder would feel that he knew all about his ore reserves, their probable extent, net and gross value, the probable life of the mine, and so on. No one but Lawson could be expected to 'get away' with so good a joke.

John K. Erskine, Jr., has sold the old New England & Clifton Copper Co. property to the Detroit Copper Co., a Phelps-Dodge subsidiary. In the deal the Detroit Copper Co. acquired all of the New England properties and also control of the Standard Consolidated Copper Co., which owns a majority of the stock of the Standard Copper Mines, the Clifton Copper Mines, Ltd., and a 26% interest in the Coronado Mining Co. The Shannon Copper Co. is a large holder in the Coronado. New England & Clifton was largely floated abroad, and something more than $2,000,000 was expended upon the properties, but financial trouble accumulated and the interests sold to the Detroit Copper Co. were acquired by Mr. Erskine at sheriff's sale over a year ago. The lands purchased by the Detroit company amount to about 1200 acres.

Prospectors and claim owners in British Columbia are interested in the movement of a group of English and American capitalists, some of whom have operated on the

Rand in South Africa, who are preparing to do some systematic exploratory work north and west of Edmonton. Assay offices are to be established, and if mining properties of sufficient merit can be developed, a smelting plant will be established at Tete Jaune Cache or in the Fort George district. Some samples brought in from the Fraser River district are said to justify careful prospecting.

There are a great many New York people interested in the properties at El Oro, Mexico, and these are concerned over the report that this mining district, one of the largest and most important in Mexico, is besieged by rebel forces. The plant of the American Smelting & Refining Co. at Anganueo, in Michoacan, is said to have been raided. The Batopilas and San Toy companies have been operating, however, and the trouble at one time said to be acute at Cananea has apparently been avoided. The general opinion seems to be that the rebel forces have degenerated into brigandage, mostly unorganized, and that wherever a leader desires to do so, he can rally a band of followers who loot and rob, dispersing when any force threatens them. Evidently Mexico's main need is a policeman with a heavy and active night-stick.

An echo of past history in copper was heard this week in the taking up for examination of the old copper properties at Bluehill, Maine, which were closed down when the Secretan syndicate collapsed in 1889. Engineers are going over the ground, and there is a possibility that the Douglas mine will be unwatered and re-opened. This particular property was unwatered in 1907, but the people interested were a little too late to get any benefit from the high prices that ruled just before the 1907 panic, and just about the time the unwatering was completed the drop in copper began and in consequence the work was abandoned.

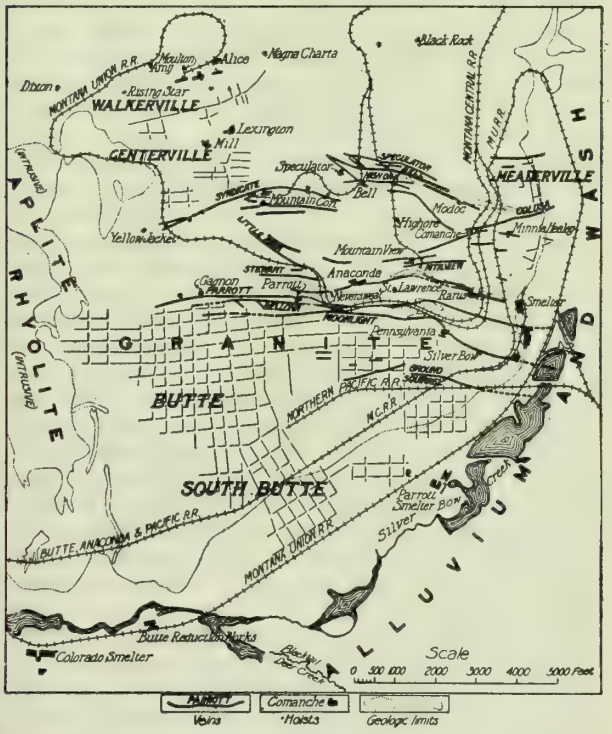
BUTTE, MONTANA

LEACHING OF COPPER ORES.—NORTH BUTTE DISCOVERY.—AIR HOISTING AT BUTTE.

The proposed copper-leaching plant at the Bullwhacker mine calls attention to the activity in copper-leaching in other parts of the state. Frederick Laist, of the Anaconda smelter, has been experimenting for several years on a leaching method wherein the sulphuric acid consumed in dissolving the copper will be regenerated when the copper is precipitated by hydrogen sulphide. He prepares the hydrogen sulphide from an iron matte produced from auriferous pyrite. It is reported that his method has been perfected, and that a commercial plant to treat the concentrator sand tailing is soon to be erected at Anaconda. At Maxville, in Granite county, the Royal Mining & Milling Co. has a small leaching plant for treating silicious copper ores. John D. Fields, engineer for the company, claims that the extraction costs are about 4c. per pound of copper produced. The method is briefly as follows: After crushing the ore and leaching with sulphuric acid, the resulting copper sulphate solution is passed into precipitating cells 10 ft. long, containing 30 anodes of 12 sq. ft. each, and corresponding cathode surfaces. The copper is precipitated at the rate of 10 lb. per day on each cathode by a 3000-ampere current at 5 volts. A 90% leaching extraction is claimed. It is planned to treble the capacity of the plant.

The East Butte Copper Mining Co. has opened up a fine chalcocite and bornite orebody on its 1200-ft. level. It is said to average 10% copper. This find is stimulating activity in surrounding properties. To the east on the Tropic claim, the Anaconda company is sinking a shaft, and one is proposed for the Atlantic claim farther north. Adjoining the East Butte company's property on the east, A. B. Wolvin and associates are doing some work on the Brundy property; the Montgomery claim showing up silicious oxidized ores like that in the Bullwhacker property. It is rumored that the Butte & London Copper Development Co. is to be rehabilitated under the supervision of Duluth capital, and that the present 1100-ft. shaft is to be continued 500 ft. deeper.

The North Butte Copper Mining Co. has made another important discovery, this time in the north cross-cut of the 2800-ft. level. Ten feet of average 5% ore was found in what is thought to be either the Jessie vein or Gem vein. This discovery is cited by some as proof that there is a lean zone in the Butte district at about the 2000-ft. level, followed by a richer zone below. The facts, however, are that the ore-shoots are limited vertically as well as horizontally, lying in the plane of the vein as lenses, like plums in a pudding. This new discovery appears to be a plum that did not extend as high as the 2000-ft. level. The Great Northern railway, which transports the Butte ores to the Great Falls smelter, was tied up last week by the caving of a tunnel between Butte and Helena. A temporary track has been constructed around the mountain until the tunnel is repaired. Before the completion of the



THE BUTTE DISTRICT, MONTANA.

temporary track, ore trains for Great Falls were routed over the Northern Pacific railway tracks as far as Helena.

The Missouri river is fast becoming the principal factor in the power production for the Butte mines. The Original mine is the next one to be closed, pending the installation of an air-hoisting plant, connected with the electrically driven central compressor plants. After work at the Original is completed, the Badger State mine will be next in line for the new equipment, and within a year very few of the large hoisting plants in Butte will be using steam. The mines now fully equipped with air-hoisting plants are the Leonard, West Colusa, Tramway, Mountain View, Pennsylvania, High Ore, and Diamond. This utilization of water-power from the Missouri river at Great Falls for power purposes at Butte has been made possible by the perfection of long-distance high-voltage transmission lines. At present the current from Great Falls is sent to Butte under 100,000 volts, carried on wires very heavily insulated at the points of support. The judgments held by John P. Reins against the Reins Copper Co. have been assigned to C. F. Kelley, managing director of the Anaconda Copper Mining Co. From this, it would appear that the latter company will take over the Reins property. It will be a simple matter to develop it from the adjacent workings in the Leonard mine. The new 30 by 72-in. hoisting engine for the Black Rock mine of the Butte & Superior Copper Co. is now being installed. The new engine can handle the 7-ton skips to a depth of 3000 ft. A large new head-frame and skip-changing device are also being erected.

Experiments are still under way regarding the machinery for the new Clark concentrator. That the plant is to be erected is now beyond question, as grading on the site north of Timbered Butte is under way, and heavy railway rails are replacing the light street railway tracks on the Montana street line south of the railway tracks. The heavy track will be extended to the new plant so that locomotives can deliver the carloads of machinery to the plant without transfer.

LONDON

CORNISH MINING PROSPEROUS.—HUMBOLDT ROASTING FURNACE.—EXIT THE VANNING SHOVEL ASSAY.

Once more there is a prospect of a boom in Cornish tin mining. Perhaps I ought to say the symptoms of a boom, for the circumstances are such that it is next to impossible to create a furore about an ancient mining district, whatever the chances of profit are under improved metallurgical conditions and a period of high prices of the metal. It is of interest to record that such well known firms as Bewick, Moreing & Co., John Taylor & Sons, Bainbridge, Seymour & Co., and Merricks, Crane & Co., are all at the present time keenly interested in new projects in Cornwall. E. S. King, of Kalgoorlie fame, who has worked such a beneficent revolution at Carn Brea & Tincroft, is being besieged by hosts of capitalists and mine-owners with a view to securing his services as adviser in various reopening schemes. Arthur Richards, who has been the pioneer of re-treatment of old tailing dumps, is also in demand, and under his direction the old Killifreth mine, east of Redruth, is to be reopened. H. C. Hoover is having a shot at an old property between Penzance and Camborne, and during the last few months many other substantial American mining men have also been touring the Duchy and making a study of conditions. The scarcity of tin ore in other parts of the world is stimulating this interest in the old county, and it can hardly be doubted that its numerous tin lodes will still yield large amounts of metal.

The fortunes of the Wheal Jane mine, between Truro and Chacewater, are attracting attention once more, owing to the fact that this mine is the only one that is working tin ore containing much pyrite. After years of struggle the Falmouth Consolidated company, which reopened this property, is now getting its plant into working order, and hopes are high that, in spite of past large outlays of capital and a refractory ore, profits will be earned in the near future. The ore as sent to the stamps shows a content of 18 to 20 lb. of black tin per ton by the vanning-shovel assay. The first concentrate contains about 160 lb. per ton and 28% sulphur. This concentrate is dried and roasted in a Humboldt furnace, and the product passed through pulverizers for the purpose of freeing, as far as possible, the particles of black tin from the adhering friable oxide of iron without further comminution of the tin. The product is sent to another set of tables and buddles for the recovery of a clean tin concentrate. The Humboldt roaster is of interest, as it is designed to prevent attrition of the material roasted and of reducing the amount of fine material carried away by the gases. The furnace is of the multiple-hearth type with central vertical shaft carrying rotating rabbles. To prevent attrition the passages delivering the material from one floor to that below are made with a gentle slope; and for the purpose of preventing much dust being carried away different passages from one floor to another are used for the ascending gases from those used for the travel of the concentrate downward. The battery contains 60 stamps, weighing 1250 lb. each, crushing 3.5 to 4 tons per 24 hours. Only 40 are running at present, pending the completion of the third Humboldt furnace; in fact, it is not possible yet to roast the whole of the current output of the 40 stamps. The monthly tin sales do not, therefore, correspond with the tonnage milled. Absorption towers and condensers have been erected for the prevention of the escape of the sulphurous gases. The arsenic is recovered in flues in the usual way.

But the most important factor in Cornish mining is the recognition that the vanning-shovel assay is the great stumbling-block to progress. The old Cornishmen, and most of the present managers and miners, have argued that this method of estimating the content of the ore was the best, as it indicated the amount of cassiterite that could be extracted by water concentration. This is now an exploded theory. The margin between content and recovery is far greater than was admitted. Not only is the extraction by water-concentration low, but the vanning-shovel assay on which the results are calculated shows considerably less tin than there actually is in the ore as shown by the chemical assay. The discrepancy between the content and recovery was forcibly emphasized by the announcement by Arthur Richards that at the Cornwall Tailings Co.'s plant it is impossible to extract more than 40% of the tin by water-concentration, while Merricks, Crane & Co. have more recently put it on record that, at Botallack, the standard Cornish dressing plant recovers no more than 50%. Mr. Richards also gives some startling figures as to the content of tailing discharged into the Red river. The introduction of the chemical assay has disclosed an even greater imperfection than the average critic of Cornish methods had expected. In tin, as with copper, engineers are engaged in experiments in connection with centrifugal separation and chemical extraction. Up to the present time cassiterite has proved unamenable to oil-flotation, though among those who have devoted attention to this subject there is a general belief that some modification will be discovered before long whereby the process may be adapted to tin.

JOPLIN, MISSOURI

ZINC AND LEAD PRICES CONTINUE HIGH.—REOPENING OF SUNNY BROOK.—NATURAL GAS SUPPLY WANING.—NOTES OF THE MINES.

The heaviest shipments in the history of the Joplin district were made last month. Mention was made in the *Mining and Scientific Press* of September 21 of a shipment for the week ended September 7, valued at $469,972. This was the greatest weekly shipment up to that time. For the week ended September 28 shipments reached a valuation of $472,075, thus setting a new record. The weekly shipments seldom fall below $400,000 in value, and if this rate continues, shipments during 1912 will amount to more than $17,000,000 in value. The nearest approach to this was in 1907, when the aggregate valuation was slightly in excess of $15,000,000. Prices for both zinc and lead are strong, the former bringing $56 to $64.50, assay basis of 60% metallic zinc, while choice lots command as high as $67 per ton. Lead ore has reached $68 to $69 per ton, the highest since 1907, when it went to $88.50. With the exception of the high price of 1907, 1906, and 1905, in each of which years the price touched $80 or better, the present offering is the highest in the record of the district.

Repeated attempts have been made to mill the ore from the Sunny Brook tract, west of Joplin, at a profit, and operations have again been resumed. This is somewhat of an experiment, the ore being extremely low grade, the blende and galena content being less than 20%. Formerly the company was known as the Hackett Mining Co. Metzler and associates, of New York, now operate the property, and C. W. Landrum is superintendent, succeeding W. K. Hackett. The mill is unusual. Formerly it was equipped with the Richards pulsator jigs. These have been replaced with the ordinary jig used throughout the district. The mill has 600 tons per day capacity. Ore is now being hoisted from three shafts, two of which are on the west part of the tract, one being at the mill, the other a short distance west; both of these are in sheet ore at a depth of 190 ft. A new shaft, at the east of the tract and connected with the mill by a long tram-

way, is in soft ground at a depth of 140 ft. and shows thin ore.

The natural gas supply from the southern Kansas and northern Oklahoma fields is gradually waning. Pennsylvania stockholders of the Kansas Natural Gas Co., which supplies gas to the Joplin district, and to numerous cities and towns in Kansas and Missouri, have asked that receivers be appointed. They claim no dividends have been paid for three years. Local operators of the company claim the costs have been in excess of the income. The petition asking for the appointment of a receiver was filed in the Federal court at Kansas City, Kansas. As a result of the gas shortage, gas service has been ordered discontinued beneath boilers and in gas engines. It is to be conserved for domestic purposes only.

SALT LAKE CITY, UTAH

ATTEMPTS TO REOPEN THE MINES.—WEAKENING POSITION OF THE FEDERATION.

The real struggle between the mine operators and the miners in Bingham is now on, with the operators confident of victory. For several weeks the operators have been making preparations for the final contest, the reopening of the mines. A force of over 200 deputy sheriffs has been recruited, a large proportion of them men who have had experience in this kind of work, and careful plans have been made for the fight anticipated as likely. Officers of the National Guard of Utah and of the regular army have studied the ground carefully, and have agreed that a comparatively small force of fighting men can protect the mines if properly placed; but there is little likelihood that troops will be called for, at least until after the approaching election. Governor Spry will call out troops only as a last resort. The operators are inclined to think this will not be necessary, although there are some who would like to shift the burden of expense upon the state, the deputy sheriffs being paid by the mining companies. During the waiting game, the position of the Western Federation of Miners has been steadily weakening. Hundreds of men have left the district, and there have been numerous defections from the ranks, especially among the skilled workmen. Charles H. Moyer, president of the Western Federation, has been making many threats about calling strikes wherever the 'Utah Copper crowd' or the Guggenheims are interested, but all this time he has been losing control of his men at Bingham. Dynamiting is not the popular pastime it once was, and the operators have refused to be scared. Word was sent to D. C. Jackling, general manager for the Utah Copper Co., that the recognition of the Western Federation would be waived if the other demands were conceded. In some mysterious way this communication was 'lost,' and the conference hoped for by the strikers was not held. Meanwhile, the Utah Consolidated started work with a small force, protected by deputy sheriffs. The Utah Copper followed, with one steam-shovel in operation and about 200 men (according to company statements) at work. There was some desultory long-distance firing, but no serious damage. The bitterest feeling was over the beginning of evictions from company houses occupied by strikers. Moyer and his lieutenants openly incited the strikers to resist this by force, and the first day's attempts resulted in the wounding of one Greek striker. The plan of the Utah Copper Co. is to increase the force steadily, giving the men protection, until the full crew is at work. It is not believed this can be accomplished without violence, and every preparation has been made to cope with this. The other mines will follow in the wake of the Utah Copper.

The Tintic operators have averted a strike by an increase in wages. Here the principal trouble came from the shovelers. Under the new schedule an advance of 25c. per day is granted, shovelers receiving $3, hand-steel miners $3.25, and machinemen and timbermen $3.50 per day. The Tintic operators have felt that they wanted to make hay while the sun shone, and that they could better afford to pay the increased wages now and take advantage of the high prices for lead, silver, zinc, and copper than to close down and perhaps have to sell their product later on a lower market.

The strike in Bingham is making itself felt, although the effects have not been so serious as they might have been were general conditions less prosperous. 'Bumper' crops are now being marketed, and other districts are increasing their production, but the loss of the money put into circulation by the operation of the Bingham mines cannot fail to be of importance. Utah Copper reached its maximum production in August—11,841,044 lb.—and the greater part of the cost, claimed to be 7c. per pound, is for labor. One effect is at the smelters, where curtailment is in progress, the International having closed down its copper furnaces.

TORONTO, CANADA

HOLLINGER MILL RETURNS.—DISCOVERIES OF ORE.—PROGRESS AT COBALT.

Owing to satisfactory reports from the mines, the market for both Porcupine and Cobalt shares has considerably strengthened lately, and the volume of transactions has greatly increased. The Hollinger, with 30 stamps in operation, is treating 300 tons of ore per day, and the September clean-up is unofficially estimated at about $300,000. The additional 10 stamps will shortly be running. The recovery of gold amounts to 98%. A statement is promised about the first of the new year and there are rumors that a dividend may accompany it, the company being in a position to make a distribution of profits if it is considered advisable. The Dome is in the same fortunate situation as regards profits, but it is understood that the policy will be to apply them to the liquidation of outstanding liabilities before undertaking to make any return to shareholders. Another tube-mill and slime press are being added to the plant, which will increase the capacity of the mill to 450 tons per day. The inclined tramway from the rock-house has been continued down to the 100-ft. level, and ore can now be taken to the mill from both the 60 and 100-ft. levels, the supply from these two levels being estimated as sufficient for a mill of the present capacity for ten years. The transmission line from the power-plant at Waiwaitan Falls to the mine is nearly completed, and is expected to be in operation early in November. At the McIntyre the foundation for the new mill is under way. It will be a cyanide plant, equipped with rolls, tube-mills, and Chilean mills, in two units, the first two of which it is hoped to have ready by January 1. The ore in No. 4 shaft at the lower levels, which is not suitable for amalgamation, will be reserved for this process.

The recent discovery at the Pearl Lake of an orebody 18 ft. wide, showing good gold content at the 400-ft. level, is regarded as of considerable importance, as it checks the result of diamond-drilling on this vein, and gives a reasonable assurance of profitable development on the 800-ft. level, at which diamond-drilling gave encouraging results. The Dome Lake has begun excavations for a 10-stamp mill. Ore has been found at the 180-ft. level, which is so far the deepest working of the mine. At the McEneany the developed ore is estimated at $750,000, of which over $90,000 is on the dump. The first five stamps of the mill will be ready for work in November, and five more will be added in the spring. For the present, recovery will be made on plates and the tailing retained for further treatment in a storage dam. The difficulties between a large number of the shareholders and the directorate of the Crown Chartered have been amicably settled. The company has been reorganized and the former directors replaced by a body largely representing Toronto interests, and the indebtedness of the company to J. P. Heffernan and L. H. Henault, amounting to $140,000, wiped out by the creditors accepting stock in the new company at 25c. per share. The head office has been moved to Toronto.

General Mining News

ALASKA

Fairbanks

Claims on Fairbanks creek from four above to nine below, inclusive, have been optioned to J. Funchion and J. T. Cowles, who will probably dispose of them to the Alaska Exploration Co., which has a dredge on Fairbanks creek. A big clean-up is reported as having been made on September 10, on three above Fairbanks creek, by Gustafson & Griffin, when from four days' run they recovered $7000 in coarse gold. Eight men were employed shoveling the pay-dirt. The Little Giant mill being erected on eleven above, creek claim, is nearly ready to crush ore from the Pennsylvania claim. Veins of quartz 12 to 36 in. wide, containing gold, have been found at the head of Independence creek near Circle. An electric hoist has been installed at the Free Gold claim, on Bedrock creek, and the mill is working steadily. J. F. Zimmerman has optioned his interest in the Rainbow quartz claim to R. E. Maddocks and G. Nightingale for about $20,000. A good deal of work has been done here; 65 tons averaged $38 per ton at the Chena mill; and 40 tons of ore is sacked and 100 tons on the dump.

Iditarod

It is stated that the Guggenheim dredge at Flat creek is working at a loss on the old tailing in the worked-out portions of the creek; but when the machine reaches the untouched ground which prospecting proved to contain gold, results should be good. Riley and Marston, the largest owners on Otter creek, have bought the balance of the ground on the creek for $75,000 cash. Six additional plants will be installed next season. The Summit claims, at the head of Flat creek, have been optioned to J. Ford for $60,000.

Juneau

The Alaska Gastineau Mining Co., of San Francisco, is installing a complete electric drive equipment supplied by the General Electric Co., at its mines at Juneau. Included in the plant are a 1750-kw. water-wheel type generator, one 200-kw. generator, one 150-hp. motor; 35, 45, 50, and 75-kw. motor-generators; three 1250 and 500 kva. transformers, switchboards, and an electric mining locomotive.

During August the two 120-stamp mills at the Alaska United worked 30.74 and 30.53 days, crushing 18,648 and 20,706 tons, respectively, with a total output of $111,583, and a realizable value of $110,467. There was saved 951 tons of concentrate. Operating expenses totaled $46,255, and construction $10,840, and the net profit was $53,372. Development covered 153 ft. in the Ready Bullion claim, and 352 ft. in the 700-Ft. Claim, the stock of broken ore increasing 5767 in the former and decreasing 2348 tons in the latter.

Nome

The steamer *Victoria* arrived at Seattle from Nome on October 16, carrying 552 passengers, $1,500,000 worth of gold, and furs valued at $500,000. The *Victoria* is leaving again this week for the last trip this season to Nome. Many miners are returning to the States for the winter.

Valdez

The largest mining deal ever made in this part of Alaska has been completed, in which the Midas Copper Co. has transferred its holdings of 12 claims on Solomon gulch, to the Alaska Syndicate. The original partners put in an adit 300 ft., 70 ft. of cross-cutting, and 75 ft. of raises, being in ore all the time, and shipments to Tacoma returned 9.5% of copper and gold content worth $5 per ton. The property is situated about 4½ miles from the bay at an elevation of 800 ft. Good water-power is available. The new holders intend to spend a large sum of money in development, tramway, wharf, and machinery, before any ore is shipped.

ARIZONA

Cochise County

At Tombstone, a case involving title to a placer claim in Ash canyon, in the Huachuca mountains, which was staked during the rush about a year ago, has been decided in favor of Quarles, who sued Harper. One large nugget was found on the claim.

The Great Western Mining Co. is shipping three cars of ore per day to the El Paso smelter, and 90 men are employed. The Calumet & Arizona has 60 men on its Courtland property. The reported labor trouble was of little account, and all have returned to work.

Gila County

A number of officials of the American Smelting & Refining Co. have been inspecting the Hayden smelting plant. It is stated that the smelter will probably be enlarged soon. The Douglas Copper Co. and others operating between Ray and Superior have been notified that, early in January, the Hayden smelter will be ready for custom ore.

Graham County

The Arizona Copper Co. is augmenting its power station equipment by installing new electrical apparatus, among which are eight General Electric rotary converters, four of 300 kw., two of 150 kw., and two of 125 kw., respectively; also 12 transformers of 125 kw. and 12 of 60-kw. capacity.

Greenlee County

The Detroit Copper Co. is making several alterations at its plant. The new steam turbines have arrived, while two new boilers are being built in. Owing to overhauling gear in the converting department, this month's output will be lower than usual.

Yavapai County

The Speck Mining Co. has sold its dredge on Lynn creek to the Hydraulic Gold Mining Co., as it intends to work its placer ground by the hydraulic process. The latter company intends trying the old Lynn creek hydraulic workings, with the dredge, of which there are several thousand acres. The Speck company's recent dredging has yielded 60c. per cu. yd. This is a case of two companies exchanging methods of working, due to configuration of the country. It is generally reported that the United Verde Copper Co. has practically bought the old dumps, aggregating 850,000 tons, at the Congress mines, at $1 per ton. The tailing contains a high percentage of silica and some gold, and will be used for fluxing purposes. A steam-shovel will move the tailing to the railroad cars.

CALIFORNIA

Amador County

It is reported that in sinking in the Keystone shaft, Amador City, a belt of mariposa slate has been found on the hanging wall side of the shaft at a depth of 1900 ft. This is probably the same belt which is known to outcrop several hundred feet east of the shaft, on the eastern slope of the hill.

Butte County

The old Gold Bank mine, at Forbestown, has been purchased by M. J. Cooney, of Oroville, and F. J. Stoer of Oakland, from H. P. Stowe, of the latter place, who was the owner. The mine was shut down seven years ago, and had produced bullion worth $2,500,000. A 40-stamp mill and cyanide plant is to be built, and a number of miners are already at work.

Calaveras County

An old mine near Valley Spring is being inspected by Mr. Warner, of the Kings quicksilver mine, which is said to look promising. The former property will be offered to San Francisco people.

Nevada County

Development at the Birchville mine, near Graniteville, has opened a new ore-shoot 3 ft. wide, and averaging $20 per ton. The company plans to erect a new stamp-mill to replace the plant destroyed by fire some time ago. An

electric power-plant may also be installed. H. Kitto and company have started their dredging plant on Deer creek, below the Kendrick placer. The dredge is operated by electric power, works smoothly, and has a fairly large capacity. At the Kirkpatrick mine, near the Mountain House, a large adit is being driven to under-cut the gravel deposit. It is in 400 ft. and must go 250 ft. farther before a raise is started. Machine drills are used, and the rock is hard. Improvements are being made to the surface plant generally.

A new 22-hp. electric hoist has been installed at the 800-ft. level of the Sultana mine, also an electric pump. These take the place of machines driven by air. A 150-hp. compressor is being erected. Work is being pushed in the 800-ft. level winze, which shows good ore.

San Bernardino County

The Skidoo mine is not working full time on account of the 15-stamp mill crushing lessees' ore. The mine and mill employ about 50 men. The Tuber Canyon mine has six men getting the workings in order. A mill, consisting of two batteries of three stamps each, Merrill equipment, and a 45-hp. gas engine is being erected. Busch brothers, of Denver, have started work at the Happy Canyon silver property.

COLORADO

Clear Creek County

The Dives-Pelican, Seven-Thirty Mining & Milling Co., with a capital of $116,000 has been incorporated. The compressor at the Burleigh adit was started last week, and the many lessees on the Dives-Pelican and Seven-Thirty workings can use machine-drills. The new sampler has been connected at the Capital mill, and it will now deal with any ore sent in from lessees. The Bard Creek company has made an initial shipment of six tons of clean galena ore. About 450 ft. has been driven on a vein which is 4 to 24 in. wide. Denver and Georgetown men are interested. A custom concentrating plant is needed at Georgetown, as there are a number of mines in the vicinity which could be worked profitably if such a mill were within easy reach of them all. The nearest custom mill at present is at Idaho Springs. The Silver Plume adit has been driven about 1600 ft. into McClellan mountain, cutting several veins of a promising character.

Gilpin County

At a depth of 260 ft. in the shaft of the Gilpin Orion mine, the vein is 7 in. wide, carrying a fair percentage of copper, and worth $158 per ton. A shipment of five tons is ready for the smelter. Other small shipments have yielded good returns. The Pittsburg Extension has been mining good ore on the 160-ft. level; Quintress & Co., leasing on the 1000-ft. level of the Grand Army mine, shipped 45 tons of ore yielding $15 per ton; a rich shoot of ore has been opened on the 800-ft. level of the Alps mine; good shipments are being made from the 100-ft. level of the Bates, in Chase gulch, and good progress and shipments are being made at the Square Deal, in the Lake district.

Gunnison County

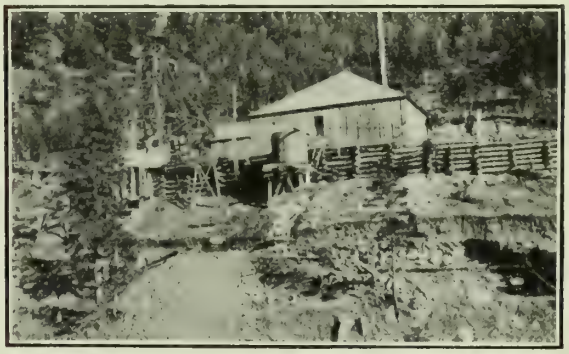
It is stated that the Colorado Fuel & Iron Co. is about to start working a large deposit of bog iron ore, situated about two miles from Crested Butte. The company has 160 acres of ground, and the deposit is from 10 to 15 ft. thick. The ore is practically free from phosphorus. After the broad-gauge railroad is completed over Marshall pass and into Crested Butte, shipments will begin to the Pueblo smelters. The Lead King mine employs a number of men, and several thousand sacks of ore containing copper, zinc, and lead are ready for hauling to the railway at Marble. A peculiar state of affairs is said to exist at the Black Queen mine. The property has been a good producer, but the mine is now full of water, the mill closed down, and the owners are not bothering much about it.

Lake County (Leadville)

The September tonnage was in advance of that of August, this being caused by a number of lessees being able to return to work on account of surface water subsiding. From outlying districts the tonnage was increased, while the large producers remained about as usual. The mining situation throughout the district is good, due to the steady advance in metal prices enabling lessees to work almost everywhere, and zinc buyers are bidding for ore as low as 20%, this being 10% lower than the contract basis of a year ago. During the past week one contract was signed for 1000 tons of ore at a flat rate of $5 per ton for 22% zinc. There are 74 producing mines in the area bounded by Birdseye on the north, to Empire gulch on the south, east to the base of Mosquito range, and west to the Half Moon, Sugar Loaf, and St. Kevin. Additional roasters are being started at the Arkansas Valley smelter on account of ore received.

Teller County (Cripple Creek)

The flow from the Roosevelt drainage tunnel is now 9870 gal. per minute, and water is receding from the Gold Coin, Granite, and Mary McKinney at a satisfactory rate. To offset the construction of a fourth drainage tunnel, and to prove to the mine-owners of the district that pumping by electric power to the level of the Roosevelt tunnel would save them money in the end, a leading engineer has made estimates of such pumping, which have been submitted. If the tunnel costs $600,000, interest and depreciation would be $90,000 per annum; and for this sum it is estimated that the water could be pumped as suggested. Two shifts are being worked at the Anchoria-Leland mine, Gold hill, and there are also four sets of lessees at work. An electric hoist may be installed at the Chickenhawk shaft on Guyot hill, which shaft-house was recently destroyed by fire. Lessees at the Joe Dandy shaft, on Raven hill, will install a 100-hp. air-compressor. This mine produces about three cars of ore per week.



ROOSEVELT DRAINAGE TUNNEL. INTERMEDIATE SHAFT.

IDAHO

Shoshone County

The Tamarack & Custer Consolidated Mining Co. is resuming operations, and the Rex mill, at Nine Mile, has been leased. The lease includes the long aerial tramway, which will be used for carrying ore from the Tamarack property. The mill has a capacity of 400 tons per day. Spokane men have secured control of the Alice and will start work soon.

Two shifts of miners are employed at the Hypotheek, 3½ miles south of Kingston, driving on the 523-ft. level, which is 750 ft. from the surface. Three cross-cuts have been extended from the level, the first having cut some carbonate ore, the second showed galena and iron pyrite, and the third is now out 35 ft. Development generally has been encouraging. The 700-ft. level is to be pumped out, and work will continue through the winter. Claims on Pine creek have been examined, with a view to submitting them to Spokane mining men. Good surface showings have been uncovered, some yielding a high percentage of antimony. A meeting of the Silver Rock was held at Wallace, and directors and officers elected for the coming year. The adit is now in 275 ft., and a further 100 ft. will be driven. At a depth of 175 ft. some gray copper has been found. Over 1000 ft. of work has been

done on the Clear Grit claims on Beaver creek. Trenching has uncovered ore for 150 ft., that returned 52% lead and 61 oz. of silver. The United Lead, near Osburn, is to build a mill.

NEW MEXICO

Socorro County

(Special Correspondence.)—Production from the Ernestine mine for September was 25,500 oz. of gold and silver bullion, and 10 tons of high-grade concentrate. The usual monthly dividend of 1% was declared October 1. The mine is in good shape. Development at the Deadwood mines is opening from 4 to 7 ft. of ore on the 500-ft. level. The Oaks Company shipped 420 tons of ore, valued at $17 per ton, during September. The Socorro mill crushed over 4000 tons in September. The 700 and 800-ft. levels are opening plenty of ore. An electric hoist will be placed over the winze in the Little Charlie adit, which continues to yield a good tonnage of high-grade ore.

Mogollon, October 11.

MONTANA

Beaverhead County

The famous old Hecla mine of the Hecla Consolidated Mining Co., west of Melrose, has been purchased by the Longmaid family of Helena. These operators will rehabilitate the mine at once, installing new machinery and pushing development.

Fergus County

The Barnes-King Development Co. expects to be producing and treating ore before the first of the year, from the newly acquired North Moccasin group. The work of retimbering the caved shaft on the property has not proved as difficult as anticipated. It appears that only the first hundred feet of the shaft has caved, the lower part being uninjured. Electric power is to replace steam entirely at the property.

Granite County

The old mining camp of Garnet, above Bearmouth, was almost wiped out by fire last week. The business part of the town suffered the heaviest loss.

Jefferson County

The Mount Washington mine, at Wickes, mentioned recently, is now producing about 50 tons of ore per day worth $25 per ton. This ore is coming from above the 100-ft. level from stopes 6 ft. wide. Some development is under way on the 200-ft. level, and the shaft is to be sunk deeper.

Lewis and Clark County

There is renewed activity in the Marysville district. Besides the work on the Bald Mountain property, the Bald Butte property is also producing, running its mill regularly. Machinery is now arriving for a cyanide plant for the St. Louis Mining Co. It is said that the Barnes-King Development Co. has enough ore in sight in the Gloster-Piegan property to justify the erection of an up-to-date cyanide plant, and that this work will be undertaken shortly.

Silverbow County

(Special Correspondence.)—The Original mine, of the Anaconda company, is being equipped with the compressed air system and is shut down for about two months. During September the mines of the Anaconda company were not worked on Sundays, owing to a surplus of ore at the smelters, this being due to alterations at the Washoe plant. The Anaconda company is sinking the shaft of the Tropic, a claim east of the central part of East Butte, which is down about 500 ft., but has not been worked for some years. The rest of the machinery for the Butte Central Copper Co.'s concentrating plant has arrived, and the mill will be ready for work in a few weeks. Work in all coal mines of Montana has been stopped, pending the vote on a new wage scale. This will be binding for two years, and work should be resumed in a short time. The Anaconda company recently ordered 12 auxiliary hoisting engines from the Nordberg company of Milwaukee, and the first has been started at the Tramway mine.

Butte, October 7.

The cross-cut on the 2800-ft. level of the North Butte is in 15 ft. in the Jessie vein, and 3½ ft. of the ore is glance and bornite assaying 40% copper, while the whole averages 11%. This is the best find made in Butte, since those on the 1620 and 1800-ft. levels of the North Butte some years ago.

Yellowstone County

Butte business men are investigating some prospective oil lands near Billings. When drilling will be commenced has not been made public.

NEVADA

Esmeralda County

The Florence Goldfield is again shipping ore worth $100 per ton from between No. 5 and 7 levels, or 250 to 350-ft. depth, the levels in this mine, down to the seventh, being only 50 ft. apart. The main shaft is being sunk 70 ft. below the 1200-ft. level, and is making a considerable quantity of water. Sinking is again in progress at the Merger, in the main shaft, which is down 1400 ft. The cross-cut started at 1330 ft. is now being driven about 15 ft. per day. Development on the Deserted claim of the Silver Pick Consolidated is making good progress, and fair assays have been obtained from the drift on the 260-ft. level, which is now near the boundary line of the Mohawk. Driving northwest and southeast is in progress at 320-ft. depth of the Lone Star. Lessees are working from the main shaft of the Combination Fraction, and they have a good chance of making a profit from their work. At the C. O. D. Consolidated, the main or Gold Bar shaft, and the Victor and C. O. D. M. & L. workings have been leased to a company organized by C. S. Sprague, of Goldfield. A report by G. C. Webb shows that there is a large quantity of ore in the property, and it will pay to further open the orebody and erect a mill. The Blue Bull shaft is nearly 600 ft. deep, and at 700 ft. development will be started. The Diamondfield Black Butte is breaking ore in three places, and shipments will be resumed shortly. The heavy snowstorm which fell at Goldfield on October 11 was the heaviest on record for so early in the season.

Lyon County

At the New Yerington, drills are working in the adit 75 ft. east of No. 1 stope. The adit is in about 520 ft., the face being at about 260-ft. depth. At 800 ft. east of the face, an adit has been started and driven 100 ft. in the direction of the west side of the adit. There is a good deal of high-grade ore in both adits. Smith brothers, who have a lease on the old Empire Nevada ground, have shipped to date 56 cars of ore to the Thompson smelter. The ore averages 6% copper. The McConnell Mining Co. has purchased a 10-ton Mack auto truck and 5-ton trailer to haul ore from the mine to the railroad.

After less than 14 days run, the remodeled blast-furnace at the Mason Valley plant has smelted 955 tons in 24 hours.

Mineral County

From Salt Lake comes word that C. E. Knox and J. H. Miller, and the Knight company have secured the properties of the Cain Consolidated company, a group of 50 claims at Aurora. The production from these mines is said to be $17,000,000. The adit, which is in about 1100 ft., will be driven 1000 ft. farther to cut the old Humboldt vein, which yielded so much in former days. The camp now has the advantage of having electric power. The present 20-stamp mill will be experimented with, and perhaps the whole plant remodeled.

Nye County

The Tonopah & Goldfield Railroad Co. reports that, for the year ended June 30, its revenue was $760,442, and net revenue $299,772. The surplus stands at $782,812. A cross-cut from a depth of 60 ft. in the raise of the Big Four mine, between the 400 and 500-ft. levels, has exposed 40 ft. of ore, worth $15 to $25 per ton. Further work has

proved this orebody at 480-ft. depth. On the 200-ft. level two large veins of good grade have been opened in the east drift. At the 400-ft. level, and adjoining the glory hole, a lode 10 ft. wide, worth $75 per ton has been opened. The Merten-Cantwell lease, on the Manhattan-Crescent, cut a rich vein, 10 to 16 in. wide, last week; and now a second lot of ore has been cut. From a small quantity of ore the lessees panned $150 in gold. Rich ore has also been found in the Kendall-Douglas lease of the Manhattan Consolidated; and the Crampton lease on the Tiptop claim of the Seyler-Humphrey company.

The old drill of the Tonopah Potash Co. is now drilling for artesian water, in the northern part of Railroad valley; but the company will sink several more holes in the valley for potash.

The annual meeting of the Montana-Tonopah Mines Co. was held at Tonopah on October 1, when 771,507 shares were represented. Proceedings were of a formal nature. Cash in hand on August 31 amounted to $230,945. A new orebody, 5 ft. wide, was cut on the 565-ft. level, and is a faulted portion of the Shaft vein. Further development of the rich orebody cut on the 1250-ft. level of the North Star proved disappointing, as in driving east and west, high grade ore soon gave out. After the former drift was extended 30 ft. in low-grade ore it broke into 2 ft. of rich ore, containing a high percentage of gold as before. The west drift also is in good ore. A shipment of 48 tons of ore was sent out from these workings. At the Halifax, the west drift from the north cross-cut, on the 1400-ft. level, which has been driven 75 ft. on the contact of rhyolite on the hanging wall, and andesite on the foot-wall, and which showed low-grade quartz for a while, now shows 4 ft. of sulphide ore of high grade. Stations are being cut at 800 and 1000 ft. in the shaft, where quartz 2 and 4 ft. wide, respectively, was cut in sinking. At the 500-ft. level stopes of the West End the orebody is 40 ft. wide and of a good grade. During September the mill produced 45 bars of bullion and 75 tons of concentrate. The Montana-Tonopah September return was 63 bars of bullion and 35 tons of concentrate from 4473 tons of ore treated. During the week ended October 5 the Tonopah Mining Co.'s mill dealt with 3365 tons averaging $18.50 per ton, with 90% extraction. Shipments included 32 bars of bullion and 22 tons of concentrate, of a total value of $56,000. From all the Tonopah mines in the week ended October 12, the production was 10,509 tons valued at $262,725.

Storey County

At the C. & C. pumping shaft, on the Comstock, the second vertical pump is being assembled prior to being lowered to the 2500-ft. level, when No. 1 hydraulic elevator will be taken out. Interest is being taken in the work being done at the Concordia-Mexican Mining Co.'s claim, in the Silver Star district, about a mile east of the north end Comstock mines. The shaft is 156 ft. deep, and a vein has been cut 48 ft. east of the shaft, where it is 2 ft. wide. Other development has met with encouraging results. During the week ended October 12, the Mexican treated 576 tons of ore having a total value of $27,024, of which 436 tons, averaging $58,53, was taken from the north stope on the 2500-ft. level. The new cyanide plant at the Ophir is completed, and is now treating tailing stored in the pond west of the plant. The Consolidated Virginia has been driving at the 2300-ft. level, the present face being in vein formation. The Yellow Jacket mill is crushing 968 tons of ore from the Crown Point mine, in which stoping continues on the 1400-ft. level.

White Pine County

On the morning of October 15, 200 men going to work at the Steptoe smelter at McGill, were met by 50 Greek and Austrian strikers, and were driven away with clubs and revolvers. The furnaces are being worked by 350 men within the stockade. Nearly all the American smelter-men, including machinists and carpenters, have joined the strike against the Nevada Consolidated company. Several acts of violence have been reported during the past few days.

There is little change in the strike situation at Ely, settlement apparently hinging on affairs at Bingham, where a start has been made with a few men. Good order prevails at the former town. The stores are only selling goods for cash, and the mining companies are not forcing the men out of their houses as at Bingham. Departures from the town are from 50 to 75 per day, many Greeks leaving on account of the war in Europe. The Giroux has made no effort to pump out the Giroux shaft.

OREGON

Baker County

The Mammoth mine is being reopened, and is now being pumped out, the mine having filled with water ten years ago, and this is the first time it has been drained since. The shaft is 400 ft. deep and has cross-cuts and drifts every 100 ft. A new boiler and other machinery has recently been installed. It is intended to soon start shipping copper ore from the claims of Haas brothers, below Ballard Landing on Snake river.

(Special Correspondence.)—The Cornucopia Mines Co. is installing additional apparatus in its power plant, consisting of a 400-kw. General Electric water-wheel type generator with a 14-kw. exciter; also six 150-kw. transformers and a switch-board.

Baker City, October 7.

UTAH

The fifty-third dividend of the Grand Central, amounting to 5c. per share, or $25,000, will be paid on October 25. The total to date is $1,652,000. The Iron Blossom has declared a dividend of 10c. per share, payable October 25. During the current year this company has paid $370,000 in dividends. A good deal of activity is taking place in shares of Prince Consolidated of late.

Salt Lake County

During September lessees at the Michigan-Utah mine shipped 511 tons of ore valued at $36.24 per ton. From July to September, inclusive, 1032 tons was sold, with a total net aggregate value of $36,505 in gold, silver, copper, and lead. The Michigan-Utah tramway is in operation, and will help to reduce costs to some extent. Another block on the Darlington claim has been leased, and the lessees will work along the old Lavinia vein.

Summit County

Ore shipments for the week ended October 12 were 474 tons from the Silver King; 430 from the Daly West; and 376 from the Daly-Judge mine. The Daly West has declared a dividend of 15c. per share, totaling $27,000. Adjustments and improvements are still being made to the Ontario mill; but satisfactory results are being shown by the new process used. The Revelator, at Snake creek, is opening in a promising way; and new machinery is to be installed. Work at the Bonanza is confined to the 300-ft. level, where a fair quantity of ore has been opened.

Utah County

The American Ozokerite Co. of Colton is about to make a third shipment of its product to the Eastern market. Utah is one of the few places where this valuable mineral is found. The company has 40 men at work and has spent $135,000 to date. The mill of 100 tons capacity per day is working full time. The veins in this district are from 2 to 30 ft. wide, and average 3% of mineral wax, or ozokerite; and by the process employed, it can be produced cheaply. The largest quantity of solid wax found in the belt was in a shoot on the property at Soldier Summit; while a good deal of nearly pure wax has been taken from claims extending from Media, at the Acme property, to the various claims around Colton.

WASHINGTON

Ferry County

(Special Correspondence.)—Officials of the Washington Water Power Co. have visited the Republic district, and are considering whether there is enough business to justify extending the power-line from the Spokane plant to sup-

ply the mines and mills. This would mean the building of a 60,000-volt line 110 miles long, and would include the mines of the Chewelah district. The cost of electric power would probably be one-third that of steam power. A good display of minerals was shown at the Spokane fair last week; and E. V. Shannon, a 16-year-old boy from Kellogg, Idaho, was awarded the prize for the best educational mineral display from the Coeur d'Alene district. The Empress Mining Co., of Wallace, got first prize for silver and lead ore specimens. Eight state governors and about 500 Alaskans are expected in Spokane for the American Mining Congress meeting, November 25 to 29. The Hope company, of Republic, will build a mill costing $50,000.

Spokane, October 10.

AUSTRALIA

New South Wales

During the quarter ended June 30, the Great Cobar company treated 100,345 tons of ore for 2058 tons of copper, 14,397 oz. of gold, and 72,156 oz. of silver, valued at $1,160,000. The new concentrating plant is treating 200 tons per day, and the tailing stacked for flotation process. The second unit is about ready.

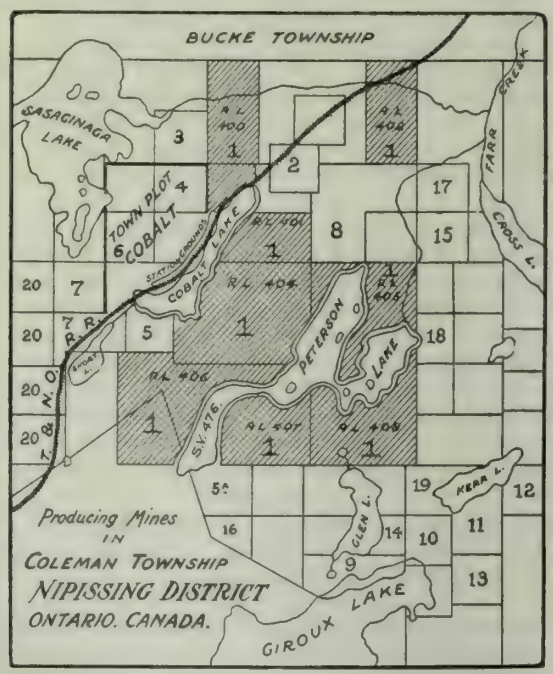
Queensland

The gold output from the mines in this state was valued at $630,000 in August, a decrease of $68,000 compared with last year. The total yield for the first eight months is $4,900,000, a decrease of $380,000. There has been a decline in production at Charters Towers and Gympie, and increases at Mt. Morgan and other small centres.

CANADA

Cobalt

During September 52 cars containing 1779 tons of ore were shipped from the district. With the starting of extra



stamps at the Northern Customs concentrating plant, shipments of low-grade ore have decreased. The Crown Reserve sent all its ore to the old Nova Scotia mill. Excavating for foundations of the Lucky Cross mill, at Swastika, is nearly finished. A good site has been chosen on the banks of a creek which flows through the property. The mill will consist of a Blake crusher, five 1250-lb. stamps, copper plates, classifier, one Hardinge mill, Callow tanks, and Deister tables. The mine is opening in a promising way.

Porcupine

The Hollinger Reserve shaft is down 175 ft. and a 5-stamp mill has been ordered. At the Pearl Lake mine, the shaft is down 500 ft., and is being sunk as fast as possible to 800 ft., where the large lode recently cut will be met without cross-cutting. Some of the mines in the Pearl Lake district were shut down last week, for a few days, on account of lightning striking the power-plant at Sandy Falls. The lode on the 200-ft. level of the McEneany has been developed 285 ft. south and 240 ft. north of the shaft, showing 7 ft. of ore. Foundations for 10 stamps and 2 tube-mills are finished. At the Vipond, the vein has been opened for 40 ft. at the 400-ft. level, and assays are $8 to $12 per ton. The Davidson and Godfrey veins are being opened on the 300-ft. level. At the 300-ft. level of the McIntyre the lode has been cut 130 ft. from the shaft.

MEXICO

Chihuahua

The Batopilas Mining Co. reports that in September shipments of bullion containing 54,000 oz. of silver left the mines by way of Nogales, Arizona.

Sonora

(Special Correspondence.)—The Compania de Minas de Mexico, in the district of Sahuaripa, has its smelter ready to blow in as soon as furnacemen can be procured from the United States. The 40-ton concentrating plant has been in constant operation, while the 100-ton mill will be ready to start on October 15. Shipments of ore are being sent to El Paso, as the bridges burnt by rebels have been repaired on the Tonichi branch of the railroad. The shaft is down 1000 ft., and the ninth level is being opened. About 400 men and 600 pack-mules are working. The men are all contented, and do not wish the mine to close down, and have not been interfered with in any way since starting work three years ago, excepting burning of bridges on the railway. The mules are carrying ore to the railway and wood to the mine.

Tonichi, October 4.

El Tigre mine and mill are being worked full time, according to J. W. Malcolmson, who has gone to Kansas City. The Mexican portion of the district is elated over the $5000 reward for recovery of 21 bars of bullion stolen by Salazar, which were mostly found by a Mexican private soldier.

On the 500-ft. level of the Democrata mine a large orebody averaging 8% copper was recently cut. The company's smelter is operating steadily, while new machinery is arriving for the plant. Considerable work is being done at the Superior-Bonanza mine, in the Magdalena district. A new working shaft is being sunk and an adit driven 1400 ft., of which about half is finished. These will be connected later on, the adit serving to drain the mine and transport ore to the railroad. H. Bollweg is manager. The revolution has interrupted the train service, and is reflected in the exports of the state through Agua Prieta. The September exports were valued at ₱871,600, against ₱1,722,160 in August, while July showed nearly ₱2,000,000. The September tonnage was only 6487, against 14,406 tons in August. The Calumet & Sonora company, on the advice of W. H. Weed, has decided to re-treat the past three or four years' accumulated tailing, as it averages ₱5.60 per ton. On the 300-ft. level, ore worth ₱16 per ton has been cut 125 ft. from the shaft.

PERU

The Director of Fomento has sent out a circular letter calling attention to the new code of civil procedure which became effective on July 28; and as it affects the operation of the mining code to some extent, all who are connected with pending litigation over mining property, or in any way interested in mines in Peru, should secure a copy of the new law and read article 1344, as it is of importance.

SOUTH AFRICA

The production of the Transvaal mines in September was valued at $15,870,000, against $14,870,000 in the same month of last year.

Personal

Professional men are invited to send news of their engagements and travels. Such news is interesting to friends.

MURRAY C. GODBE is at Pioche.
LOUIS WEBB is in San Francisco.
W. E. PRATT is here from Nevada.
CLYDE HELLER is in San Francisco.
OSCAR ROHN has been in New York.
J. PARKE CHANNING is in the West.
M. O. LEIGHTON is in San Francisco.
CHESTER W. PURINGTON is in Seattle.
C. K. LEITH was in New York recently.
P. N. MOORE was in New York last week.
C. R. CORNING has returned to New York.
W. J. SHARWOOD is at Lead, South Dakota.
H. P. GORDON will return to California soon.
H. W. REETH has left Finland for England.
THOMAS KEARNS is at his ranch in California.
F. W. BRADLEY has returned to San Francisco.
A. HULSHOFF-POL, of The Hague, is at the Palace.
J. MORGAN CLEMENTS, of New York, is at Los Angeles.
RICHARD L. GRIDER has gone to Bolivia, South America.
GEORGE E. GUNN is visiting the Mason Valley district.
D. W. BRUNTON has been in New York for a few weeks.
F. H. HELLMAN has returned to New York from the West.
GEORGE LE ROYER is now at 1070 Calle Corrientes, Buenos Aires.

ARTHUR J. HIESTER has left Chicago, and is now at Denver.

H. W. MACFARREN is now at 520 Federal building, Los Angeles.

R. H. CHAPMAN was in San Francisco, and has gone to the Yosemite.

CLARENCE BAMBERGER has returned to Salt Lake City from Nevada.

HENNEN JENNINGS is expected in Montana and California this month.

F. E. LAUBE has returned to Bellingham, Washington, from Treadwell, Alaska.

HOWLAND BANCROFT has been in the Magnolia district, Boulder county, Colorado.

C. COLCOCK JONES has returned to Los Angeles from professional work in Montana.

DESAIX B. MYERS has returned to Los Angeles from Calaveras county, California.

F. W. BRADSHAW, general manager for the Tonopah-Belmont Mining Co., is in town.

F. F. SHARPLESS has been examining the DeLamar mine in Idaho and has gone to Joplin.

J. A. HOLMES, Director of the Bureau of Mines, is expected in San Francisco during the week.

R. T. HOPKINS, formerly of the Peregrina M. & M. Co., Guanajuato, Mexico, is at Bangor, Maine.

F. H. NEWELL is now at Helena, Montana, and expects to reach San Francisco early in November.

A. D. MILES is now assistant to A. P. TURNER, president of the Canadian Copper Co., at Copper Cliff.

J. W. MALCOLMSON was in San Francisco during the week and has gone to Kansas City by way of Denver.

F. B. LAWSON, chairman of the board of directors of the Mountain Copper Co., sailed for Japan last Saturday.

H. C. BELLINGER, general manager for the Great Cobar, Ltd., is starting on a four months' holiday to England and other countries.

G. C. BATEMAN has been appointed to succeed A. D. MILES as Canadian representative of the Canadian Mining & Exploration Company.

B. MAGNUS, manager for the Electrolytic Refining & Smelting Co. of Australia, has been appointed general manager for the Mt. Morgan company, Queensland.

V. H. HUGHES is now assistant to the state geologist of Missouri, not geologist as announced in this column on September 21. H. A. BUEHLER continues as state geologist.

Market Reports

LOCAL METAL PRICES

San Francisco October 17.

Antimony	11—11¼c	Quicksilver (flask)	41.50
Electrolytic Copper	18—18¼c	Tin	52—53¼c
Pig Lead	5.35—6.30c	Spelter	8½—8¾c

Zinc dust, 1400 lb. casks, per 100 lb., small lots $9.50—9.75; large $7.50—8.50

METAL PRICES

(By wire from New York.)

NEW YORK, October 17.—Copper quiet; buyers are scared on account of European conditions. Lead shows a fair demand by consumers. Spelter is offered more freely, but consumers appear reluctant. Average daily prices for the past week, in cents per pound, based on wholesale transactions, standard brands, are given below.

Date.	Electrolytic Copper.	Lead.	Spelter.	Silver, per oz.
Oct. 10	17.35	5.10	7.30	61¼
" 11	17.35	5.10	7.30	61⅛
" 12	Holiday.	No market.		
" 13	Sunday.	No market.		
" 14	17.20	5.10	7.28	61¾
" 15	17.25	5.10	7.28	62⅜
" 16	17.35	5.10	7.28	63

LONDON QUOTATIONS

(By cable, through the courtesy of C. S. Burton & Co., New York.)

	October 17.
Camp Bird Ltd	$ 6⅜
El Oro	3⅜
Esperanza	10
Oroville Dredging	1⅜
Santa Gertrudis	6¼
Tomboy	6½

COPPER SHARES—BOSTON

(By courtesy of J. C. Wilson, Mills Building.)

	Closing prices, October 17.		Closing Prices October 17.
Adventure	$ 7	Mohawk	$ 66
Allouez	44¾	North Butte	38½
Calumet & Arizona	81	Old Dominion	62
Calumet & Hecla	590	Osceola	113
Centennial	21	Quincy	87
Copper Range	58	Shannon	15
Daly West	3½	Superior & Boston	1⅜
Franklin	9¾	Tamarack	46¾
Granby	63⅜	Trinity	5
Greene Cananea, ctf.	10⅜	Utah Con	13½
Isle-Royale	35½	Victoria	2¾
La Salle	5½	Winona	4¼
Mass Copper	7	Wolverine	75

NEVADA STOCKS

(By courtesy of San Francisco Stock Exchange.)

San Francisco, October 17.

Atlanta	$ .17	Montana-Tonopah	$2.25
Belcher	.32	Nevada Hills	1.65
Belmont	9.40	North Star	.38
Big Four	.44	Ophir	.47
Booth	.05	Pittsburg Silver Peak	.88
Con. Virginia	.46	Round Mountain	.36
Florence	.77	Savage	.13
Goldfield Con.	2.60	Sierra Nevada	.44
Halifax	1.75	Tonopah Extension	2.57
Jim Butler	.70	Tonopah Merger	1 12
Jumbo Extension	.34	Tonopah of Nevada	7.00
MacNamara	.23	Union	.64
Mexican	2.77	Vernal	.11
Midway	.55	West End	1.80

MINING STOCK QUOTATIONS—NEW YORK

(By wire from C. S. Burton & Co., New York.)

	Closing Prices. October 17.		Closing Prices. October 17.
Amalgamated Copper	$ 90⅝	Miami Copper	$ 28¾
A. S. & R. Co.	88⅝	Mines Co. of America	3
Braden Copper	7	Nevada Con	22⅜
B. C. Copper Co.	4⅛	Nipissing	8½
Chino	43⅜	Ohio Copper	1¾
First National	1⅞	Ray Con	21⅜
Giroux	4⅝	Tenn. Copper	44⅛
Goldfield Con.	2⅝	Tonopah Belmont	9¼
Greene-Cananea	10⅜	Tonopah Ex.	2⅝
Hollinger	14⅜	Tonopah Mining	6⅜
Inspiration	20⅜	Trinity	6
Kerr Lake	2⅜	Tuolumne Copper	2⅛
La Rose	2⅛	Utah Copper	64
Mason Valley	12⅜	West End	1⅜
McKinley-Darragh.	1⅞	Yukon Gold	3½

Concentrates

Most of these are in reply to questions received by mail. Our readers are invited to ask questions and give information dealing with the practice or mining, milling, and smelting.

PRICE of tin has caused consumers to look around for a substitute, and aluminum may serve for many purposes. Aluminum foil is being used in Europe to some extent for wrappers, one company using about 110,000 lb. per month.

DURING August, the mints of the United States coined 25,101,000 pieces valued at $1,317,000, as follows: gold, 101,000 pieces worth $505,000; silver, 2,400,000 pieces worth $586,000; and copper (one cent) 22,600,000 pieces worth $226,000.

MINERS engaged in bituminous and lignite mining in the United States in 1911 totaled 549,750; and those in anthracite mining were 172,585, making 722,335 in all. The average production per man was 738 tons in bituminous mines, and 524 tons in the anthracite, against 751 and 498 tons respectively in 1910.

VALUE of the brick, tile, terra cotta, pottery, and various other clay products made in California in 1911, according to the United States Geological Survey, was $4,915,866. This is an increase of $73,475 over the output of 1910. From Missouri, the value of the above products was $6,274,353, and New York, $10,184,376.

IN Egypt, coal and other fuels are expensive, but plenty of sunshine can be relied upon at all times of the year. Recently a Shuman sun-heat absorber arrived at Alexandria, from Philadelphia. This plant has been erected at Meadi, near Cairo, and will be used to pump water from the river Nile to irrigate the surrounding land.

NITRATE salts are extremely soluble, and it is unlikely that concentrated deposits will remain anywhere except in places either not subject to or protected from the solvent action of rain, surface water, or moving groundwater. Thus nitrate salts are found chiefly in caverns or caves, or under overhanging ledges, or, as in the Chilean and other South American occurrences, in a region of exceptional aridity.

PEAT amounting to 64,165 short tons, valued at $311,486, was produced in the United States in 1911. Of this quantity, 51,733 tons was used in the fertilizer industry. It is also used as an absorbent for refuse beet sugar and other molasses, so that these excellent materials can be economically fed to cattle and other live-stock. Charred dried peat is also used in poultry food, and other foods for stock.

AIR-BLASTS occur at certain mines in Michigan, South Africa, and Australia, whereby the people are subjected to shocks consisting of a single wave or vibration, followed by a sound of dull thud, as distinguished from an earthquake which consists of a series of waves. On the Rand, R. N. Kotze, government mining engineer, considers that certain shocks owe their origin to the sudden slight subsidence of large masses of ground containing millions of tons on a fault, or over pillars in worked-out areas. Air-blasts have a similar origin, but are mostly due to the weight at great depths, or more probably to the stresses set up by the effects of tectonic pressure, caused by earth movements in the past. When a free face is exposed by mining, the rock has a tendency to crack and disrupt suddenly, and cause serious accidents. At the Brakpan shaft, at 3000-ft. depth, a band of quartzite was passed through which acted in this manner, so sinking was delayed until the sides were lagged.

Book Reviews

Any of the books noticed in this column are for sale by, or can be procured from, the MINING AND SCIENTIFIC PRESS.

MINING WORLD INDEX OF CURRENT LITERATURE. By C. L. Breger. 317 pp., index. Mining World Co., Chicago, 1912. For sale by the *Mining and Scientific Press*. Price $2.

This is a compilation covering the first six months of 1912 of the classified index of the mining and metallurgical literature of the world which is published weekly in the *Mining and Engineering World*. It has been gathered together in convenient form, and the volume will be more useful than the weekly digest. A thoroughly classified index is probably an impossibility; this is one of the best available.

THE MINERAL INDUSTRY DURING 1911. Edited by C. Of. 997 pp., ill., index. McGraw-Hill Book Co., New York, 1912. For sale by the *Mining and Scientific Press*. Price $10.

The twentieth volume of 'Mineral Industry' differs little in form from its predecessors, but contains some new topics and several authors whose names have not previously appeared have contributed matter. The editing of the volume is poor, and the marked disadvantage of frequent changes in the editorial staff is clearly exhibited in the 10 lines devoted to coal in China, where 9 misprints occur in the conveying of an inadequate amount of information. Apparently, preceding volumes are not consulted in the preparation of a new one. The bibliographies accompanying some of the articles are good, but the value of some of them is decreased by a tendency to restrict references to the *Engineering & Mining Journal*. The data in regard to dredging, for example, are defective for the same reason. Examining the teeth of a gift horse is an ungrateful task, and engineers will be more inclined to regard the convenience of this volume rather than the defects of its make-up.

THE SURINAM GOLD INDUSTRY. By J. H. Verloop. 102 pp., ill., maps, bibliography. J. H. de Bussy, Amsterdam, 1911. For sale by the *Mining and Scientific Press*. Price $2.75.

This book contains some interesting general information of the Guiana gold placer in Surinam, but the inaccuracy shown in giving abstracts from articles on dredging in other countries tends to discredit any original statements made. The book would have been greatly improved if it had been carefully revised by some one skilled in the use of the English language. It could have been reduced in size and made much more interesting and intelligible. Some statements are remarkable, as "There is no technical difficulty that allows of a definite circumlocution in Surinam." This, of course, must be gratifying. Those familiar with dredging in California and Alaska will be surprised by the statement that the "Yuba district produced in 1906 gold to the value of 13 million guilders ($5,200,000) by the aid of 41 dredges." Also that "shortly after the discovery of gold in Alaska this country produced for no less than 40 million guilders worth of gold $16,000,000) which had been extracted by dredges." The author has evidently failed to consult the files of the *Mining and Scientific Press* or the publication of the California State Mineralogist, for he says, "as statistical information about the results obtained by gold dredges are lacking, there is very little to be said about it." Mr. Verloop says that the dredge of the Guiana Placer Co. is the fourth dredge to have been tried in the colony, and that the result of working shows a recovery of 1.5 gm. from ground containing 2.5 gm. per cubic yard. It is not stated if this is pure gold. There is a clay overburden of from 2 to 3 metres overlying the gravel deposit, which apparently averages about 1 metre thick. The overburden is dug separately from the gravel and does not pass through the washing plant. No figures of operating cost and yardage dug are given. Several maps and sketches accompany the book.

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EDITORIAL

COSTS are the shibboleth of the mine operator, and their value is only equaled by their inaccessibility. The data regarding operating costs in California which Mr. Charles Janin has compiled will accordingly interest our readers.

ANTHRACITE COAL is likely to continue to increase in price, since the deposits are limited, and improvements in methods of working and washing probably can do no more than counterbalance the increasing cost of labor. The highest price in history was reached at Wilkesbarre, Pennsylvania, on October 14, when stove and chestnut sold for $5.35 per ton net on board railroad cars at the mines.

ADVENT of the United States Smelting, Refining & Mining Company in the so-called Dow copper properties of the Lake Superior has been signalized by the election of Messrs. Sidney J. Jennings and C. G. Rice to the board of the Franklin Mining Company, and the same gentlemen, together with Mr. A. F. Holden, to the directorate of the Indiana Mining Company. The steady progress which the United States company has made in its ventures elsewhere makes the new move an auspicious one for the Lake Superior companies.

MINERS and metallurgists no less than some of the sons of Erin have 'the wandering foot,' and the graduates of Freiberg have scattered to the ends of the earth in the practice of their profession. The classic mining academy forms a powerful bond of union and it is pleasant to learn that a permanent organization of the Bergakademie graduates living in America is in process of formation. Mr. C. L. Bryden, 1015 Myrtle street, Scranton, Pennsylvania, is the secretary of the new organization, and all Freibergers are requested to notify him of their present address.

DRAINAGE of the Cripple Creek mines through an adit lower than the present one has been urged, and the cost of construction as compared with pumping by electric power to the present drainage level is being studied by the engineers of the district. It is computed that interest upon the cost of construction and maintenance will amount to nearly $100,000 per year, and it is pointed out that a considerable flow can be handled with pumps for this sum, with the additional advantage that if the oreshoots prove not to persist to the lower level the loss of invested capital will be less.

WAR between Turkey and neighboring countries has a direct influence upon the mining industry through the number of Greek laborers it has caused to return to Europe. The drain is already severely felt in some quarters, and the exodus still continues. Southern Europeans form a large percentage of the men engaged in common labor throughout the United States, and if the war is protracted it is likely to assume an unprecedented degree of practical importance to the American public, accustomed to regard disturbances in the Balkans as of similar significance to growing pains in children.

HUSTLING the East is apparently not so hopeless a task as generally supposed. The taxicab service recently started in Tokyo is reported to be immensely popular, and it is computed that 20 per cent dividends will be paid. One hundred taxicabs manufactured in the United States will be in operation before the end of this year. Tokyo is a large and well paved city, and for long runs the taxicabs have the advantage over the cheaper ricksha, while the competition between the two is an interesting illustration of the limitations and advantages of cheap labor.

BUSINESS seems not to reflect the uncertainty of a presidential election. Shipments of iron ore down the Great Lakes in September amounted to 7,287,230 tons, the largest on record for that month. The Hendrie & Bolthoff Manufacturing & Supply Company, a well known firm in Denver, has announced that on November 4 it will make a ten per cent increase in the wages of all employees who have been in the employ of the company for more than one year. Several copper mining companies have already increased the wages of their employees as a reflex of the increased profits arising from the increased price of copper, but increased wages paid in general business is cheerful evidence of improving business conditions.

ENCOURAGING results from attempts to reclaim dredged lands are elsewhere described by Mr. J. H. Leggett, who has for some years engaged in this work on his farm at Oroville. It should be remembered in this connection that a good deal of dredging land was originally of little value for agricultural purposes, and efforts at reclamation cannot therefore be expected to yield immensely productive areas, but it is evident that the agricultural productivity of land is not destroyed by dredging operations. In Australasia an even more effective method of reclaiming dredged land is enforced by law. Dredges working in agricultural land are required to remove the top soil separately and deposit it upon the tailing. Illustrations of the soil-chutes employed for this purpose have appeared in earlier issues.

FINANCING the farmer is attracting a great deal of attention just now, our worthy President having discovered that the American farmer is obliged to pay nearly double the interest rate upon his borrowings as compared with that exacted in France and Germany on no better security. Probably interest rates here continue to reflect the condition of some years ago, when the banker who had loaned a small sum on the security of a valuable herd of cattle might have only bleaching bones to show for it by spring time. Conditions have now changed, farm lands are excellent security for loans, and it is significant that the ratio of automobiles to population is highest in the agricultural states of the Middle West. As has been remarked, the farmer does not deprecate the high cost of living, since he is furnishing the living.

EASTERN financial circles have been in a state of frenzy and brokers hung over the news ticker long after market hours. Quotations were hurled from street to window and arbitrage wires between New York and Boston were unable to take care of the flow of inquiries and replies. But the activity centred about the contest for the world's baseball championship, and the quotations have been the prevailing odds, varying from hour to hour as the progress of games was reported in Wall Street. At 2 o'clock business was practically relinquished and the telegraph service abandoned to the news of the games being sent in from the ball-grounds. That the strenuous business population of New York can so completely give itself up to a mad enthusiasm for baseball leaves little room for criticism of the leisurely Latin-American, who throws aside business for the *fiesta* and the bull-fight. Now that the world's championship is decided, business can return to its usual routine.

OLYMPIC games have begun to obtain a reputation as a source of international bickerings rather than of good-fellowship, if the statements which have appeared in home and foreign journals are to be taken at their face value. The discussion in British journals following the recent contest at Stockholm served to place our cousins across the water in an unenviable light, and it is good to find that, according to Mr. Philip J. Baker, an English athlete of distinction and a participator in the contests at Stockholm, it cannot be considered as representative of the opinion of the intelligent British public. Mr. Baker also completely absolves the American team of the charges of unfairness made against them, and this also we are glad to hear, for it is natural to suppose that where there is much smoke there is some fire. One result of the games is evident, the Americans are instructing the world in the spirit of the twentieth century and bringing home the lesson that successful achievement is based on careful forethought and intelligent preparation in every field of human endeavor.

Smelter Fume Control

The control of that complex mixture of substances which continually escapes through the chimneys of metallurgical plants is a persistent problem, and one probably incapable of any general solution, because of the variety of factors which must be considered. Increase of efficiency and economy in operation indicates certain feasible lines of progress to the responsible management, while possible effects upon neighboring areas indicate other and at times conflicting lines of action. In addition, the situation has a legal as well as a practical phase, thus introducing new considerations. From the standpoint of the management, the escape of dust is to be prevented, as a source of direct loss, while the escape of gases should be facilitated as aid to minimizing working costs. Thus the interests of the metallurgist and his neighbor coincide, so far as the solid particles of the fume are concerned, while in regard to the gases they are antagonistic. There is a law for liberty and a law for license, and no one will maintain that the metallurgist should be allowed to damage his neighbors without adequate compensation therefor. Among the economic principles which are being more clearly enunciated in the present readjustment of social conditions is the axiom that each industry should properly bear all the burdens incident to its practice, and the smelting industry is not disposed to shirk its responsibilities in this regard. But the restrictions which may properly be placed upon industry require careful study in order that the ideal of maximum good to the maximum number may be attained, and the application of strict legal requirements may operate to cause an economic loss rather than any social gain.

The conditions to be met at any given smelting plant form an individual problem, for which an individual solution must be provided. The successful adoption of the manufacture of sulphuric acid as a means of dealing with the escaping fume of smelter gases was at first hailed as a universal solution of the problem, but it was soon recognized that the abundant supply of the raw materials of fertilizer manufacture and the large market for fertilizer in the neighboring states gave to the Tennessee smelters an advantage not shared by smelters at other points, and it is now generally recognized that acid manufacture is only feasible in certain especially favored situations, and can not serve as a general solution of the fume problem. It is possible that the methods described

by Mr. G. C. Westby elsewhere in this issue may similarly find application where conditions favor their adoption. In some cases methods which add to operating costs may be adopted, as a proper tax upon the privilege of carrying on metallurgical operations, but it is self-evident that only a reasonable tax can be exacted. A commendable amount of study is being devoted to this general question, and a considerable amount of progress has already been made. It is safe to expect that in this, as in other operating problems, a satisfactory solution will in the end be reached.

The Survey and Its Work

In making his way through unexplored regions the adventurous traveler frequently consults his compass and whatever criteria for guidance he may possess, in order to direct his course, and in every other field of human activity a similar precaution may well be observed. Replying to a criticism that the United States Geological Survey confines itself too closely to the field of practical geology and is not contributing in any large way to the advancement of science, Mr. George Otis Smith, the Director of the Survey, has recently summarized the present work of the organization under his control and its probable influence upon the development of pure science, with commendable clarity of vision and reasonableness of argument. The work of the Survey is of fundamental importance to the geologist, mining engineer, and metallurgist, and it will be worth while to consider briefly its larger phases.

The United States Geological Survey draws its support from the Federal treasury, or, in other words, from all the people of the United States, in order to engage in scientific work of direct value to a comparatively small number of people, though of indirect value to all. It is, therefore, constantly in a position like that of a subordinate department of a large corporation, and must continually demonstrate that the results attained are of sufficient value to justify continuation of the work. It has not, however, to justify its work to those whom it directly benefits, but to the representatives of the larger group from which it derives its support. This fundamental concept is easily overlooked and a neglect to consider this feature is the basis of frequent demands that the Survey engage in this, that, and the other form of activity. Bureaus which derive their support from governmental appropriations commonly lack flexibility of aim, since the funds available are usually restricted to specified lines of work, and it is not infrequently a puzzling problem of management to fit some necessary unusual expenditure into one of the allowable groups. To coördinate necessary and desirable investigation desired by the miner and geologist with activities which Congress can be persuaded into regarding as necessary and desirable is not perhaps the least scientific of the achievements of the personnel of the Survey. This being the case, it is interesting to consider what the Survey is now doing for the geologist, miner, and metallurgist. The work in Alaska is done under an appropriation specifying that the sums provided are to be spent for the investigation of the mineral resources of that northern land. The admirable work that has been accomplished by Mr. A. H. Brooks and his subordinates is too well known to require extensive comment, and it is to be regretted that political considerations have as yet hampered its complete utilization in the development of industry. The work of the Survey on water-supply problems and in the carrying out of topographic surveys is also maintained by specific appropriations for the purpose. The most important phase of the Survey's work in the general field is the conduct of investigations in economic geology. From the viewpoint of the miner these are the *raison d'être* of the Survey, and any criticism of the Survey by mining men is most likely to take the form of deprecating the expenditure of considerable sums upon paleontologic investigations. It is interesting to note that of the reports now in course of publication, 8 deal with economic geology, 6 with paleontology, 3 with areal geology, and 1 each is devoted to the study of glaciers, mineralogy, petrography, Pleistocene geology, and stratigraphy. It is clear, therefore, that the activities of the Survey are distributed over the whole field of geologic research.

In considering whether the Survey is attaining high efficiency in accomplishing useful results we must first come to an agreement as to what results are most desirable. This is scarcely within the bounds of possibility. The miner, whose needs were the chief factor in securing the establishment of the Survey, not unnaturally considers that his requirements should be preëminent, and tends to regard with impatience investigations which have no visible bearing upon any field of practical endeavor. The pure scientist, on the other hand, considers that the greatest results in the end will be attained from the study of fundamental principles, and regards the policy of the miner in demanding results of immediate usefulness as one of quick returns at the expense of total yield. Eminent paleontologists may possibly regard all the economic phases of geological work as an evidence of a low commercial concept of science and regret the expenditure of appropriations in the tracing of orebodies when such interesting problems as the number of toes on a trilobite still remain unsolved. It is evident that we can never hope to reach unanimity of opinion, since the viewpoint of the worker conditions his judgment.

That economic studies do not contribute to the advancement of science, or that paleontologic investigations are of no economic importance is far from the truth. The results obtained from an investigation depend no less upon the habit of mind with which it is pursued than upon the material studied. Sitting under an apple tree is not generally regarded as a high form of scientific work, and yet Newton's observation of the falling apple was productive of the greatest scientific results. Observations bearing on the fundamental principles of ore deposition can as well be made by the light of a candle in a muddy stope as by the use of a microscope in a well lighted laboratory. Whether any study will serve to throw light upon the fundamental principles of science cannot be predicated in advance, even though it is evident that certain fields of endeavor are more likely to be productive of results than are others. It can safely be said that any investigation, no matter how rigidly practical its scope, will not be barren of scientific usefulness when conducted in a scientific spirit, nor will any investigation of a purely theoretic nature fail to find in time some slight bearing upon practical problems if considered in that light. When the Survey hews closest to the right line of progress it may expect to receive some criticism on every side of its proper field of work, and if such criticism is intelligent and constructive rather than partisan and caustic, the net result will be beneficial. In the past we have criticized as well as commended the Survey, and we expect to continue so to do, believing that the splendid work which it has done and is continuing to do demands the careful attention of all who have the progress of the mining industry at heart. Meanwhile we find ourselves in cordial agreement with the position of its Director in asserting that if the Survey is to continue to deserve the recognition and support of the industry it serves, it must be neither exclusively 'practical' nor exclusively 'scientific,' but by a judicious combination of the two continue to advance our knowledge of the practical by the elucidation of the basic principles of science.

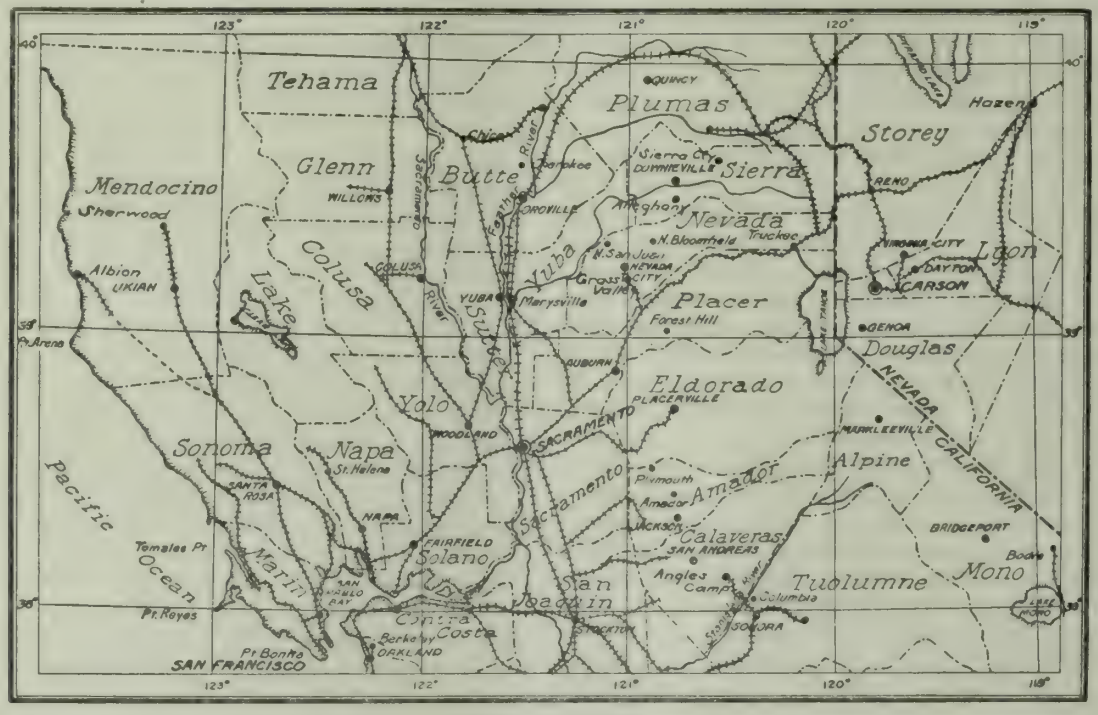
Operating Costs of California Mines

By Charles Janin

A total of 1,963,296 tons of silicious ore from the gold mines in California was milled in 1910, according to the figures of the U. S. Geological Survey. This ore gave an average recovery of $5.23 per ton. From the five Mother Lode counties 1,170,497 tons was treated, with an average yield of $3.78 per ton, and from Calaveras county 365,192 tons was treated with an average recovery of $2.23 per ton. It is obvious that to mine successfully in this latter county low operating costs must necessarily obtain, and no doubt some examples of 'phantom profits' could readily be detected. It may be mentioned that this low average value is due in part to milling rock taken out in exploratory work in the search for new orebodies.

Operating costs are always a matter of interest to the mine manager or mining engineer, but it is sometimes a difficult matter to obtain costs that are truly representative, or that entirely cover all expenses that should properly be charged to operating. Following are given operating costs of several California mines, some of which are taken from my old note books, and others obtained from the management or some one connected with the mine. While many of these costs are not as complete as could be desired, and cannot properly be used in making comparisons, I believe all of them are of sufficient interest for publication on account of the awakened interest and reported success following the opening of some of the old mines in the state that have been idle for years. Many of the costs I have quoted are results obtained previous to the enactment of the eight-hour law. In general, where cost sheets are available, an appreciable increase in labor cost will be noted, unless offset by great improvements in working methods, since this law has been in effect. Some mines were operating upon such a narrow margin of profit that the increased expense of labor, according to the management, made profitable operation impossible. Others contend that while there has been a general increase in milling costs on this account, mining costs are no higher, the same tonnage per shift being produced as formerly.

The operating cost of a mine is governed, among other things, by the size and character of the vein, hardness of the country rock surrounding the vein, depth of mining, amount of water handled, cost and efficiency of labor, the metallurgical treatment, magnitude of operation, cost of power, and other factors. A knowledge of all these conditions is essential in making comparisons of operating costs, as well as the situation of the mine, and transportation facilities, which involve the cost and difficulty of obtaining workmen, supplies, etc. Mines situated in different localities may be operated under closely similar conditions as regards wages, power, size, and character of orebodies, metallurgical treatment, etc., and comparisons of the operating costs of such mines will be both interesting and instructive. Comparisons between different mines on the Mother Lode, for instance, or between different mines in the Grass Valley district, can be suitably made; but not between Mother Lode and Grass Valley mines, on account of the widely different geologic conditions, and methods of mining employed.



CENTRAL CALIFORNIA.

The lowest operating cost for mining and milling in California, a record for low costs which used to be frequently quoted, was that at the Spanish mine in Nevada county, where a schistose orebody was worked by open-cut, and through an adit previously run, the broken rock falling to the adit-level and from there being trammed a short distance, part going to stamps and part to Huntington mills. The total cost of actual mining and milling was 50c. per ton in 1887, and was afterward reduced to 35c. per ton when treating approximately 6000 tons or over per month. Amalgamation was the only treatment, no attempt being made at concentration. For one period of two months 9000 tons per month was treated at a total cost of $2300 per month, or about 25c. per ton, distributed as follows: Total crew, 8 men at $1.60 and 12 men at $2.50, $42.80 per day, or $1284 per month. The power bill was only $90 per month, and the remainder, approximately $900, for supplies, superintendent's salary, etc. The crew in 1887 consisted of a foreman at $3.50, two men at $3, and eight Chinese at $1.50 per day. This crew mined 4000 tons of ore per month. Water cost 15c. per inch at a head of 300 ft. The conditions under which the

mine was worked were most favorable for low operating costs, and will probably never be again equaled in this state. Another example of low mining cost is that of the Gopher & Boulder mine in El Dorado county, as stated in the State Mineralogist's report for 1888. The cost of mining in the open-cut was about 20c. per ton, and of mining underground $1.25 to $1.50 per ton. The vein had an average width of 30 ft., and was 100 ft. wide in some places. It had a dip of about 65 degrees.

The mine that at present has the lowest operating cost in the state, and which will, owing to the different conditions, compare favorably even with the costs at the Spanish mine, is the Melones mine, where during 1910, 148,900 tons was mined and milled at a total operating cost of $1.084 per ton, exclusive, however, of cost of treating concentrate, about 35c. additional per ton of ore treated. The mine is operated through an adit, the distance to the loading chute being about a mile. The ore is trammed with electric motors to a 100-stamp mill. The stopes are 20 to 35 ft. wide, and in places even wider. Practically no timbering is necessary, a shrinkage system of stoping being employed with pillars left in the orebody. To appreciate these figures one should be familiar with some of the conditions that made such low costs possible, principally the running of an adit that practically obviated the necessity for further development for over 10 years, though during 1910 sinking was started below the adit-level. The power cost is low, the mine owning the water-right, which supplies most of the power, though during the dry season it is necessary at times to purchase electric power. The power cost is mostly for upkeep and ditch maintenance.

LIGHTNER MINE AND MILL, ANGELS.

The Gold Bank mines at Forbestown, Butte county, some years ago mined and milled 79,689 tons during a period of two years from the Gold Queen mine, the adjoining property, through the Gold Bank levels and shaft. The total cost, including the treatment of the concentrate by chlorination, was $3.03; the ore was a hard quartz, the country rock diabase, little timber was required, and the cost of water was 10c. per inch at 173-ft. head. This water was afterward caught and re-used for the compressor at a head of about 700 ft. The cost of mining and milling, including chlorination of concentrate, was afterward reduced to $2.75 per ton at the Gold Bank mine. Development charges could not be properly proportioned to the cost of treating ore from the Gold Queen mine on account of this ore being developed by simply extending the levels of the Gold Bank mine a short distance beyond their former faces. The actual operating cost may be considered as fully covering all expenses incident to ore extraction and treatment, as a royalty was paid on the net proceeds from this ore, and there could be no inducement to show low operating cost.

At the Gwin mine, in Calaveras county, the vein was of moderate width for the Mother Lode, being 10 to 15 ft. The walls were at times insecure, and heavy timbering was necessary. The water furnishing power was twice used, as at the Gold Bank, first at a head of 375 ft. and then carried through a pipe over 4000 ft. long to the bank of the Mokelumne river, where at a head of 415 ft. it supplied power for operating a large air-compressor. The cost sheet for 1907-08 shows a total operating cost of $2.507 per ton in handling 80,634 tons. This includes allowance for depreciation on parts of the plant. In looking over some old notes, I came across a statement of the Gwin mine for the year ended March 1903; the ore mined and milled during that year was 138,033 tons and the total cost was $2.285 per ton, being 22.5c. per ton less than for the year 1908. It is interesting to note, however, that the difference of cost is in the amount of development. For the year ended March 1903, charges for development were only $0.027 per ton as against $0.251 per ton for 1908; otherwise the operating costs were practically the same for both years. Costs afterward increased to $3 per ton.

Other mines where the operating costs are available and might be compared to those at the Gwin, are the Utica, at Angels, where the cost for three years preceding 1910 is stated at a little over $2 per ton, with an output for some years of over 200,000 tons; the Royal Consolidated, at Hodson, Calaveras county; the Central Eureka, the Fremont Consolidated, and the Kennedy, in Amador county.

ARGONAUT MINE.

The Royal Consolidated, according to some old notes I have, milled 93,155 tons during the year 1903, at a total cost for mining and milling during this period of $2.93, exclusive of 42c. per ton for concentrate treatment. During part of this time the stopes were narrow and only 20 stamps were running. When the vein was stoped wide and 40 stamps were running, the cost, exclusive of concentrate charges, was reduced to $2.24. Steam-power was used, the mine was dry, water being pumped 4½ miles for mill and boilers. No timber was used. It is interesting to compare some Central Eureka costs I have for 1903 with those of the present time in that mine. In the former year 43,545 tons was milled, and 42,742 tons in 1911.

	1903.	1912.
Mining	$1.975	$2.823
Development	0.519	
Milling	0.490	0.552
Total	$2.904	$3.375

Most of this ore came from the 1900 and 2000-ft. levels. Total present costs at the Central Eureka were $3.375 per ton, for an output of 42,742 tons, according to the report for the year ended April 1, 1912, being $2.83 for mining and development and $0.552 for milling. The South Eureka, which adjoins the Central Eureka, has recently developed a large body of ore and has, according to what information I have, an operating cost of approximately $3 per ton. Owing to heavy ground, and also perhaps to attempting too great an economy in operating, it is stated that several caves have recently occurred in this mine, but no definite information is available. The total operating cost at the Fremont Consolidated, in Amador county, according to the management, was $2.66, with an output of 6000 tons per month. At the App mine, the late W. A. Nevills claimed an operating cost of $1.60 per ton. A system of stoping was employed which, however, seems to have been inadequate to meet the conditions there obtaining, as a few months since the stopes caved badly. The stopes were wide and all material was sent to the mill, sixty 950-lb. stamps handling an average of 240 tons per day. The mine was worked through an inclined shaft 1700 ft. deep.

At the Argonaut and Kennedy mines the operating costs are not made public. This is to be regretted, as both are under capable management and are at present the most successful mines on the Mother Lode. The Argonaut is worked through a 3800-ft. inclined shaft at about 60°; the Kennedy through a vertical shaft 3600 ft. deep. The stopes are as much as 20 ft. wide, the ground is very heavy, and considerable timber is required, the cost for timber being sometimes $1 per ton or over, and the total operating cost is about $3.50 per ton.

The main orebody of the Utica mine was from 40 to 120 ft. in thickness. The formation is amphibolite schist. On the foot-wall side it was talcose and often soft and wet for several feet. The hanging wall, which has a dip of about 80°, is generally solid, but at times great slabs break off. Square-sets were used and considerable timbering and filling with waste was necessary, though in some parts of the mine large stopes have stood open for years. The company owns water and power plants which also supply Angels Camp and vicinity. The profits from these add materially to the yearly income. While itemized costs are not available at the present writing, I have been informed that the total mining and milling costs at this mine approximate $2 per ton, and that for several years past the mill has handled an average of 180,000 tons per year. A considerable amount of this ore comes from the Gold Cliff property of the company.

The Lightner mine, adjoining the Utica, and on the same vein, has a 60-stamp mill; 40 of the stamps are 950 lb., and 20 of 1000 lb. were added in 1908. The mill is operated by two 100-hp. direct-current electric motors. The cost of electricity is $4.50 per horse-power-month; labor $2.50 to $3.75 for eight hours. The stopes were up to 50 ft. in width; the square-set method of timbering was followed. There was no water to contend with, as the lower workings of the Utica drained the mine. There were an average of 100 men employed, about 72 working in the mine. From 1908 to 1910 the total costs averaged $2.56 per ton. This mine was taken over by a new company a few years ago, a new shaft was sunk in the hanging wall, and preparation made to extract ore in the upper workings, previously left behind on account of the poor condition of the old shaft. An interesting description, with costs of sinking the new shaft was given in the *Mining and Scientific Press*, February 4, 1911.

Several mines were operated near Graniteville, Nevada county, at low cost, but unfortunately, even with this advantage, few were successful on account of the low grade of ore handled.

At the Erie mine, from July 1, 1910, to January 1, 1911, 13,587 tons was treated at a total cost during that period of $40,797.50, or a trifle over $3 per ton, of which stoping and milling, including proportion of administration, are given as $1.48. This has been described by S. H. Brockunier.* The main vein is wide and lies within slate. The ground was easily broken and conditions were favorable for low working costs. An adit 1700 ft. long was driven prior to the time of work described but the cost of this and of other previous development does not appear in the mining cost given. Power was derived from Pelton wheels at 330-ft. head at a cost of about $4.50 per horse-power-month. The ore was crushed to 20-mesh. Several changes in working method were made, and for a short period, it is claimed, a working cost of $1.29 obtained, but the mine soon afterward closed down. The Gaston mine is said to have had an operating cost ranging from about $2.25 to $3.50 per ton, depending upon the amount of development attempted during different periods of operation or charged to mining cost.

At the Trinity G. M. & R. company's property, near Carterville, Trinity county, some interesting costs have been obtained. The orebody occurs as an irregular sheet, from 25 to 80 ft. thick, dipping about 20° and covered by about 25 ft. of overburden. Hydraulicking was used to strip part of this overburden. The ore is oxidized, soft, and friable, and is mined through glory-holes. Forty 1100-lb. stamps are operated by electric motors. The ore is crushed in cyanide solution to 30 mesh. The sand is leached, and the slime treated in Oliver filters. Two Merrill filter-presses are used for collecting the precipitate. The following is taken from the last annual report. During the first five months of 1911, there was mined and delivered to the crushing plant 15,995 tons of ore at a cost of 65c. per ton; during the following seven months 41,331 tons was delivered at a cost of 57c. per ton. The average value per ton was $4.77, and extraction 80%; as this period represents about normal conditions the costs per ton are given in detail.

	Per ton.
Development	$0.100
Mining	0.570
Milling and cyaniding	1.000
Refining, assaying, and bullion	0.150
Power	0.104
Maintenance	0.055
Administration, etc.	0.194
Miscellaneous	0.017
Total	$2.190

The mines in the Grass Valley district have narrow, rather flat veins, ranging from a few inches to several feet in width, the stopes averaging about 4 ft. though in some places the ground may be stoped 10 or even 15 ft. high. Mining costs are much higher than on the Mother Lode, and vary greatly at the different mines. This is partly due to the amount of development necessary to open up the orebody, and also, in some cases, to the method of bookkeeping employed and the amount charged against mining operations.

Mining costs are available at only one of the mines, the North Star, the management of which publishes reports annually. It is from the report for 1909 that some of the following figures are taken. During 1909, from the old workings of the North Star mine, 21,819 tons of ore was mined at an operating cost, including mining, milling, and proportion of general expense, of $6.971 per ton; development work in the old part of the mine amounted to $1.425 per ton, making a total cost of $8.396 per ton of ore from the old workings above the 2700-ft. level. The lower workings, operated through the Central shaft, produced 69,791 tons at an operating cost of $4.689 per ton and a development and exploration charge of $1.114; or a total cost of $5.803 per ton for the Central mine. Detailed costs for recent years at the Empire mine are not available. It is, however, generally supposed that total costs are a little in excess of $5 per ton. Figures for this mine are taken from a report on working costs of the Witwatersrand by Ross E. Browne and are, I believe, exclusive of development charges. These

Eng. & Min. Jour., September 7, 1911.

figures can hardly be used for comparative purposes, but are given for such interest as they may have.

	Empire. 1905.	North Star. 1910.
Percentage of recovery:		
Amalgamation	77	84
Cyanidation	..	14
Concentration	14	..
Total	91	98
Average width of stope, ft.	4	4
Tons of ore mined per month	3090	7140
Average number stamps dropping	40	80
Duty per 24 hours	2.53	3.25
Weight of stamps	900	1050
Dip of vein, degrees	28	26
Total costs per ton:		
Mining and milling	$2.72	...
Labor	1.45	...
Supplies	0.32	...
Management, etc.	4.59	$6.21*
Water pumped (gal. per 24 hr.)	750,000	750,000

*Costs at this mine have been somewhat reduced since this report was issued, and are given as $5.36 per ton by the management for 1911.

VIEW FROM THE EMPIRE MINE.

The Pennsylvania and W. Y. O. D. mines last year passed under a new management and it is said that considerable reduction in operating costs has been made. Some time ago, under very close management the W. Y. O. D. operated for approximately $4 per ton.

OPERATING COST, MOTHER LODE MINES.

Mine.	Year	Tons treated.	Costs per ton. Mining	Milling	Development	General	Total
Oneida	1905	56,680	...	...	....	....	2.64[1]
Fremont Con.	1910	72,000[2]	1.66	0.50	0.363	0.116	2.66
Lightner	1908	53,622	2.14	0.24	....	0.42	2.80
Gwin	1907-8	80,634	1.078	0.3018	0.251	0.246[3]	2.50[4]
Cent. Eureka.	1903	43,545	1.79	0.49	0.519	....	2.80
Cent. Eureka.	1911	42,747	2.85[5]	0.55	....	....	3.37
Melones	1910	148,900	0.51	0.27	....	0.31	1.09[6]

[1]Ross E. Browne.
[2]Approximate.
[3]Concentrate charges.
[4]Costs include depreciation and proportion of general.
[5]Total mining, including prospecting.
[6]Exclusive of freight and treatment on concentrate, approximately 35c. per ton additional.

Mines in the Nevada City district are run at considerably lower cost than those at Grass Valley, partly on account of the veins being wider and also because the rock is more easily crushed. At the Ostemah mine, which has had a varied career, the mill during one period of operation crushed 5 to 6 tons per stamp in 24 hours, and the total cost for mining and milling over a short period was somewhat under $3 per ton. The mine was opened through an inclined shaft 900 ft. deep; the vein averaged about 3 ft. wide. I have considerable information on Grass Valley and Nevada City mines, which, unfortunately, I do not feel at liberty to publish. The costs given, however, are representative. Accompanying this article is a table of operating costs of some Mother Lode mines.

CYANIDE PLANT, EMPIRE MINE.

MINERAL resources of the Madras district constitute an important factor in the wealth of the Indian Empire. Gold is mined extensively in the native states of Mysore and Hyderabad, the latter also producing coal in appreciable quantities. In parts of the Madras presidency manganese mines are operated. There are also deposits of magnesite, mica, graphite, steatite, and diamonds.

The total yield of the various gold mines of southern India in 1911 was valued at $10,592,250, which represents an increase in value of half a million dollars during the past four years, according to a consular report. The aggregate ore reserves of the gold mines under operation at the close of the year was reported to be 1,991,679 tons. The record of the Mysore gold mine is remarkable. Since 1886 the company operating this mine has paid in dividends no less than $32,319,000. In 1911 it produced gold valued at $4,351,969, distributed $1,778,760 to its shareholders, and placed $194,400 to reserve. Its ore reserves at the close of the year amounted to 1,300,369 tons, besides an accumulation of 200,000 tons of tailing. The coal produced in 1911 was 447,943 tons, as compared with 460,988 in 1910. Practically all of the native coal of southern India is consumed by the local railroads. The output of the manganese mines in the district has steadily decreased during the past five years, the production in 1910 (the latest available figures) amounting to 46,441 tons, as against 125,820 tons in 1907. The output of mica during the past six years also shows a heavy general decline, for although there was a slight increase in the production in 1910 over that of the preceding year, the former amounted to only 191 tons, as compared with 1214 tons in 1906.

PETROLEUM has been discovered along the Tachin river, in Siam, according to a recent report, in the district north of Korat. It is said that the discovery was first made by some Laos villagers about five years ago, and these men have been utilizing the oil for their own needs and also selling it to neighboring villagers on a small scale. No attempt whatever has been made to bring up the petroleum in large quantities, the present method to draw out the oil being with long bamboos fixed together. A depth of 60 ft. is said to have been reached. The well is in an open glade of the forest, which thickly covers the whole of that part of the country. In its present crude state the oil smokes heavily when burned. The greatest drawback in development of this valuable find seems to be the situation of the well, about 200 miles from the nearest railway station. Reports of oil discoveries in the Siamese districts bordering upon Burma are also current, but have not been authenticated.

Neutralization of Smelter Gases

By George C. Westby

*The question of smelter fume treatment is one of commercial metallurgy, and the application of a panacea a question of dollars and cents. There have been many plans devised for quieting the complaints of injured agriculturists and others to whom smelter fume seems all that is evil, but too often the proposed plan has been merely mitigatory, or has neglected provision for a material return on the investment in the plant. In other cases the process is rendered inapplicable on account of limited demand for the output whose production and sale is the vital commercial feature.

Of the methods proposed for treating smelter fume in an economic way, this article is limited to consideration of methods with which I have experimented. The first of these was developed during 1902-1903 and consisted of a process for producing liquid SO_2 from the fume, utilizing the heat of the fume by means of economizers and air-heaters. The SO_2 was to be liquefied by an ice or refrigerating machine, with the crystallohydrate of SO_2 as an intermediary product. Aside from the mechanical difficulties incident to the arrangements for removing the flue-dust, the crucial objection advanced against the process was the lack of a market for the liquid gas as produced at the rate of thousands of tons per day. The suggestion that it could be used as a refrigerant in place of ice in freight cars, and in the small ice-boxes of private homes, seemed inadequate in face of the fact that the market was both problematic and undeveloped, while awaiting the expenditure of some millions of dollars in providing the necessary equipment.[1]

During the course of further work in connection with the fume problem, the idea suggested itself that the sulphurous gases might be bound with the bases of slag and thus reduced to a more controllable form. Experiment demonstrated that the idea might be practically applied, and also suggested the general method of fume treatment which consists in the neutralization of acid fumes on slag, and ensuing precipitation of the toxic oxides in ponds or other limited areas on the earth, chiefly as harmless and insoluble compounds with iron and other bases of the slag. As developed, the process also involved the recovery of the metal carried away in slag and flue-dust.

The fact that chilled, finely divided slag very rapidly dissolves in hot dilute solutions of HCl or H_2SO_4, is generally known to metallurgists and chemists, and they are also acquainted with the fact that the silicic acid is retained in apparent solution. Experiment proved that hot solutions of SO_2 are also capable of effecting the dissolution of the slag in the same way; this discovery became the basis of our attack on the smoke difficulty.

In carrying out the process the materials at command are a hot acid smoke, laden with flue-dust, vapors, or sulphur, and possibly arsenous or other volatilized compounds, and granulated chilled slag. The acid gas is an immediately available and intensely active chemical agent, but the granulated slag, while susceptible to the vigorous attack of the sulphurous reagent, is preferably finely ground in order to accelerate its solution and incidentally reduce the size of apparatus required in its treatment. In conjunction with the smoke and slag, water, or circulating ferruginous smoke liquor is necessarily used as a medium of chemical translation, in maintaining suspension of the slag pulp and in carrying the compounds formed. The slag and smoke are brought together by means of an apparatus which is introduced as a part of the flue systems. The province of the appliance is the retention of a vast surface of wetted slag in the direct path of the smoke current, in such a way that the smoke, slag, dust, steam, and water become as nearly as possible a hot homogeneous mist.

Chemical action under such circumstances is essentially rapid, and ensures the absorption of the sulphurous gases without recourse to unwieldy apparatus or large chambers. The result of the combination of the constituents of the mixture is the production of ferrous and ferric sulphite, ferrous sulphate, various thionates of iron, and in a smaller degree sulphur salts of other bases. The copper is mainly present in the matte particles contained in the slag, and when ground slag is used in the apparatus, remains for the most part undissolved. That portion of the copper taken in solution may be re-precipitated in the absorber by the action of polythionates developed in the smoke liquor through the interaction of the SO_2, sulphites, and free sulphur in the smoke.

In many of our experiments copper was obtained principally in an oxidized form by blowing molten slag into slag wool. In these cases the copper was maintained in solution and after discharge from the absorber was precipitated in a wooden tank by heating the solution with steam to about 80°C. The development of thionates, on which the precipitation of part of the copper depends, requires no attention under the usual circumstances attending the roasting of ore. Their formation is encouraged in the presence of the sublimed sulphur of the smoke, and by the sulphites and the excess SO_2 of the smoke liquors. During the course of their production there may be a constant representation of all those compounds designated as polythionates, but the dominance of any particular form depends on the chemical and physical characteristics of the smoke, the liquor, and the material treated. The thionates produced are ephemeral and finally break up into sulphates, sulphur dioxide, and free sulphur, as indicated in the following equation:

$$MS_nO_6 = MSO_4 + SO_2 + (n-2)S.$$

To illustrate a possible set of conditions occurring in the absorber during treatment of the smoke, we may take the following successive reactions:

$$4FeSO_3 + 2SO_2 + O_2 = 2Fe_2(SO_3)_3.$$
$$Fe(SO_3)_2 = FeS_2O_6 + FeSO_4.$$
$$2FeS_2O_6 + S_2 = 2FeS_3O_6.$$
$$2FeS_3O_6 = FeS_2O_6 + FeS_4O_6.$$
$$2FeS_4O_6 = 2FeS_2O_6 + 2S_2.$$
$$6FeS_4O_6 + 4CuSO_4 = 2Cu_2S + 14SO_2 + 3S_2 + 6FeSO_4.$$

When sodium and potassium are present in the slag they are dissolved with the other constituents and later appear as sulphates in the discharged smoke liquors, and may be recovered if desired from the residues of the evaporated liquor. Zinc, if present, is similarly dissolved and may be separated from other residues by volatilization or any practicable means. Lead, silver, and gold are retained undissolved with the precipitated copper. In some cases green vitriol would be an important and valuable by-product.

The liquor produced in the absorption chamber may be again used or it may be continuously discharged on waste land, over which it spreads in a thin sheet that will rapidly evaporate under the influence of wind and sun. In the latter case, oxidation and hydrolysis form an insoluble basic sulphate, by translation of the green vitriol in general accordance with the equation

$$4FeSO_4 + O_2 + 2H_2O = 4FeSO_4(OH),$$
$$\text{or } 6FeSO_4 + 3O + 3H_2O = 2Fe_3(SO_4)_3(OH)_3.$$

At the same time deposition occurs of the silicic acid and of sulphur arising from the decomposition of thionates.

Generally the liquor issuing from the absorber contains only very limited quantities of free acid. If, however, any objectionable amount of acid is present, it may be neutralized by passing the liquor over slag or through calcareous or soluble ferruginous material. In some cases the percolation of the liquor into calcareous soil would not be objectionable, as the comparatively small quantity of acid would be effectually neutralized in the formation of insoluble calcium sulphate, and thus the liquor could

*From *The Journal of Industrial and Engineering Chemistry.*

[1]This phase of the control of smelter fume was independently developed by F. R. Carpenter, of Denver.

not seriously affect the ground-water. The flue-dust carried by the smoke is effectually caught by the somewhat glutinous slag particles, and remains with the residues of the reaction chamber.

In carrying out the experiments it was recognized that the development of a simple apparatus was of the first importance; accordingly much time was spent on different tentative designs, but the aim in each case was the form of apparatus which would require the minimum of attention, repairs, and adjustment. The arrangements tried were of two general forms: a tower or vertical chamber and a horizontal rotary apparatus.

The vertical arrangement consisted generally of a wooden tower, provided with a large number of narrow staggered shelves. These pieces were set three or four inches apart, from one end of the tower to the other. A hopper was introduced at the top of the tower for the reception of the slag and water used in the treatment. The bottom of the tower was arranged to permit the formation of a hydraulic seal at the discharge. At each end of the tower pipes were inserted; one of these was connected directly with the flue of a furnace and the other with a fan.

In operation the wet slag was charged into the hopper and was discharged from the hopper by gravity to the shelves. From the top shelves the material spread over the cross-section of the tower and by the action of the series of staggered shelves, fell in splashing cascades to the bottom of the tower, coming in contact throughout its course with the hot current of acid smoke drawn through the apparatus by means of the fan. The liquor derived by the action of the smoke on the wet slag discharged through the hydraulic seal to a large wooden tank in which the copper was precipitated by means of steam. Wooden launders conveyed the residual liquor to a pond.

The horizontal rotary apparatus was cylindrical in form. Shelves or projections were set at intervals along the interior surface, so as to lift the mixture of slag and liquor and drop it in sheets through the gas current in the apparatus. The shelves were set at different angles so that the material would be distributed along the different planes during rotation of the cylinder. The splashing on the sides and bottom of the apparatus caused by the falling material aided in filling the whole of the cylinder with a constant spray of absorbent mixture.

The cylinder rotated about short pipes of comparatively large diameter; these were set at the smoke entry and exit ends of the cylinder and were connected respectively with the flue of the furnace and the intake of an induction fan. The treated smoke was discharged through the fan. Means were provided for continuously feeding the absorbent material into the cylinder, and a pump with a siphon attachment was used in removing the exhausted liquor. The first general test was made with a rotating cylinder. The cylinder was about 10 ft. long and 30 inches in diameter. The results of one of the experiments with the apparatus are given below:

Time:	10:15	10:45	11:00	11:15
Temp. gas inlet °F.....	215°	220°	210°	242°
Temp. gas outlet °F.....	82°	84°	74°	74°
Temp. water inlet °F.....	64°	65°	65°	65°
Temp. liquor outlet °F.....	90°	100°	78°	86°
Cu. ft. gas per min. measured at intake	34.2	32.4	33.0	44.4
Per cent SO_2 inlet.....	4.9	4.7	5.4	4.7
Per cent SO_2 outlet.....	1.9	1.0	0.85	2.7
Absorption in 10 ft., per cent.	61.2	78.8	84.2	42.5

Note.—140 lb. of slag charged at beginning of test; none charged during interval between 10:45 to 11:15.

The test gives results better than average, consequent on treatment of smaller volume of smoke per second than ordinary. The test illustrates a set of experiments where the slag was not fed continuously, but was charged in one mass. The absorption in this case steadily increased for a short period after charging, then fell off rather rapidly. In the experiment given above, the drop is accentuated by the increase in gas current.

In the experimental results given below, the slag was practically continuously charged, although not in sufficient quantity to bring about complete absorption. The tests were made with the tower apparatus of which the general principles have been described. Two towers were used connected at their tops. The total length of the apparatus was 77 ft. The cross-section was 4 square feet.

Time.	Temp. in °F. of: Ingoing gas.....	Outgoing gas.....	Ingoing water...	Outgoing liquor..	Gas per min., cubic feet.....	Absorption SO_2 by volume, %...
10:00 A.M.	 320	90	96	110	68.4	81.1
10:20	 355	90	..	...	84.6	79.6
10:30	 355	90	..	...	84.6	82.0
11:00	 355	..	..	...	84.6	82.0
1:00 P.M.	 350	..	96	109	112.2	74.8
1:20	 340	..	..	...	85.8	79.1
1:35	 345	..	..	...	85.2	81.1
1:40	 350	..	..	...	91.8	81.6
1:50	 360	..	..	...	99.0	83.0
2:00	 380	..	..	...	132.0	80.3
2:10	 380	..	..	...	98.4	84.4
3:30	 390	90	96	111	99.2	79.0

The analysis of the solutions of the set of experiments, of which the above is an example, varied with the relative quantities of slag and water charged, the rate of smoke supply, and to a large extent depended also on the temperature of the gases. The constituents of the solutions varied between the following figures:

	Minimum, %	Maximum, %
Fe	0.54	3.0
S	0.49	2.9
Cu	0.00	0.8
SiO_2	...	3.2

The average temperature of the incoming smoke was 393°F. and that of the discharged gases 92°F. Throughout the series the volume of smoke treated varied between 90 and 235 cu. ft. per minute. On the whole, these tests were the most satisfactory, as no trouble was experienced with the apparatus or in the introduction and application of different conditions.

Succeeding the experiments described, tests were begun for the treatment of 5000 cu. ft. per minute of smoke assaying 4.5% SO_2, a volume representing the total gases discharged per minute from a 35 to 40-ton McDougall roaster. The apparatus used consisted of a rotating cylinder 36 ft. long and 12 ft. in diameter, arranged as previously described. On account of an underestimate of the charge to be carried, the foundations, running equipment, and apparatus generally were designed to sustain only a fraction of the slag and water charge necessary to absorb all of the SO_2 in the smoke; our absorptions were therefore seldom greater than 45 to 55% of the SO_2 in the smoke. For brief periods in one case absorptions of 92% and 100% were secured. A satisfactory degree of elimination of the SO_2 from the smoke was never approached, except at the expense of a break-down with this particular apparatus. The results obtained, however, were valuable as the basis for a successful design for a cylindrical apparatus.

A study of the set of results given below will show the trend of the experiments and also make clear the limitations of the apparatus used, when it is understood that the entry 'Period of run, minutes' implies 'Period of anxiety before smash-up, minutes.' The entry 'Slag required, theoretical' is a factor derived from the analysis

of the solution, in consideration of the ratio of iron dissolved to sulphur absorbed. The weight of iron dissolved is multiplied by 2.7, a constant derived from the fact that the weight of slag was approximately equivalent to 2.7 times the weight of iron contained in the slag treated. 'Slag required' represents the quantity of slag which would be required per minute, to exactly neutralize the weight of SO_2 driven from the furnace per minute. It is obvious that in practice the mere presence of this computed amount would be altogether inadequate to actually neutralize the SO_2 given off minute by minute from the furnace, since the whole of the mass is not instantaneously acted on. Depending on the degree of subdivision, the constitution of the slag and other physical and mechanical factors, a slag excess of 3000 to 10,000% is requisite to effect a complete elimination of the SO_2 from the smoke.

	1.	2.	3.	4.	5.
Period of run, minutes....	70	57	200	280	110
Temp. of gas entering.....	250	425	400	387	250°F.
Temp. of gas discharge.....	77	80	80	94	100°F.
Temp. of liquor discharge...	100	118	...	130	130
Water supplied per min., lb.	620	396	359	138	270
Total Fe in solution, lb.....	479	208	604	732	652
Total S in solution, lb.....	309	307	656	594	548
Rate of adding slag per min.	30.0	35.3	22.3	14.2	50.0
Slag required, theoretical per min.	44.3	19.4	30.8	37.8	37.0
Total available slag charged, lb.	2120	2015	4470	3998	5512
Per cent SO_2 absorbed of total passing through apparatus	38.2	46.8	39.0	19.8	43.3
Analysis:					
Mg. Fe per 100 c.c. sol...	1008	924	1053	1897	2194
Mg. S per 100 c.c. sol....	710	1360	1143	1540	1837
Mg. Cu per 100 c.c. sol...	21.4	10.5	15.0	15.0	9.1

By comparison of the data it is seen that the absorption of SO_2 tends to rise as the rate of charging slag is increased. Consideration of 2 and 5 would suggest also that the absorption rises with the temperature; this indication is confirmed in other experiments not given here. In 1 the temperature is low and the absorption high; this is probably due to the high rate of water supply combined with the comparatively high rate at which the slag wool is charged.

In order to determine the practical effect of maintaining the slag excess, which had been deduced as the necessary amount to insure complete absorption of all the SO_2 discharged from the furnace during any period, a cylinder experiment was made by introducing 1500 lb. of slag wool before starting operation. The results were as follows (period of run, 10 minutes, 300 lb. of slag added during run):

Rate of adding slag, lb. per min.....	180*
Water supplied per minute, lb.....	1195
SO_2 absorbed, per cent.....	100
Milligrams Fe in 100 c.c. solution.....	1260
Milligrams S in 100 c.c. solution.....	1050

*Comparative.

After ten minutes the apparatus was stopped, measurements made, and samples taken. Five minutes later the apparatus was again started and operated 15 minutes, a stop being necessary at the end of that time on account of the great weight accumulated in the apparatus—principally liquor in excess of the pump capacity. The result at the end of the second period was (period of run, 15 minutes):

Rate of adding wool, lb. per min.....	100
Rate of adding water, lb. per min.....	1001
SO_2 absorbed, per cent.....	90.2
Milligrams Fe per 100 c.c.....	908
Milligrams S per 100 c.c.....	1036

The experiments stopped short of a commercial realization of the process, due to circumstances not affecting the question of SO_2 elimination. However, the net results of the work sufficiently established the following facts:

(1) The acid gases of smelter fume can be effectively neutralized by means of chilled slag, with the complete elimination of flue-dust from the discharge.

(2) The toxic action of the smelter vapors and gases can be controlled by converting them into constituents of harmless compounds and causing their deposit in an insoluble form on waste land.

(3) In bringing about the control of the gases in the manner stated, it is both feasible and desirable to recover copper, lead, and other metals contained in the slag and in the fume.

(4) The conservation of by-products such as green vitriol, potash and soda salts, and silicic acid is possible where markets for the material are not too far removed from the smelting plant.

(5) The indirect use of sulphurous fume in the treatment of slime and tailing waste from the concentrator is sometimes feasible. The reaction given below will suggest general procedure:

$$Fe_2(SO_4)_3 + SO_2 + 2H_2O = 2H_2SO_4 + 2FeSO_4.$$
$$nH_2SO_4 + CU_2S + 2Fe_2(SO_4)_3 = 2CuSO_4 + 4FeSO_4 + S + nH_2SO_4.$$

Mineral Resources of the Copper River Basin

The search for gold and copper which began in the mountains south of Chitina river, Alaska, with the rush of prospectors to the Copper River basin in 1898 has been carried on spasmodically since that time. As a result copper was found in the mountains east of Taral during the first summer, and the gold placers of Bremner river were discovered a few years later. No copper has yet been produced in this district, according to the United States Geological Survey, but the facilities for transportation offered by the Copper River & Northwestern railway during the past year have stimulated interest in the development of copper properties, so that considerable prospecting has been carried on.

One small stream, Golconda creek, a tributary of Bremner river, has yielded most of the gold so far produced in this district, although Little Bremner river has contributed a part. Gold in commercial quantities has not been found near Taral nor between the Chitina and the Bremner in Hanagita valley. The total production of the district is not known, but several thousand dollars' worth of gold has been produced each year since mining began. The high cost of supplies and difficulty of access have done much to discourage prospectors.

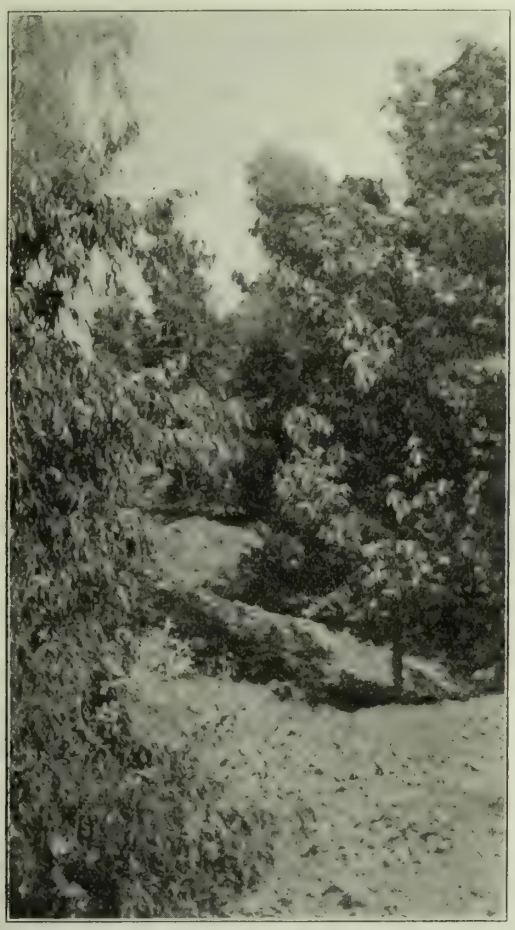
All the gold so far produced in the Bremner River valley has been obtained from stream gravels. This valley is practically unprospected, so far as lode deposits are concerned. The three parts of the valley of present or prospective importance because of known placer-gold deposits are Golconda creek, Little Bremner river, and the lower part of Bremner above the Little Bremner. The geology of the region so far as known and the prospects for the development of gold in the Bremner River valley, on Golconda creek, and on Little Bremner river are described in *Bulletin* 520-C of the United States Geological Survey, which also discusses the character of the copper deposits in the mountains between Canyon creek and Chitina river.

MEMBERSHIP in the Mining and Metallurgical Club of London has increased to 921, of whom 700 are mining engineers, the average daily attendance at the Club, which is in the heart of the business district, being 200. The initiation fee is $15 and the yearly dues $15. Visitors are allowed the privileges of the Club for two weeks and can continue thereafter by the payment of small monthly dues. The gross receipts from the dining room for the year were over $16,000, and the surplus of total income over expenditures for the year 1911-12 is about $7000.

Reclaiming Dredged Land

By J. H. Leggett

*From certain results observed on land that had been reclaimed following hydraulic operation during the eighties and early nineties, I concluded that dredged land could also be restored. When I began dredging my farm in 1902 I planned to test out my belief that the land would again produce. During the season 1903 and 1904 I planted some small eucalyptus trees and black figs on unleveled dredged land. These did surprisingly well, and the eucalyptus are now 50 ft. high and 12 in. through at the base. The figs are lost in the jungle. That season alfalfa, blackberry, bamboo, and Johnson grass roots went through the dredges and grew of their own accord luxuriantly in the hills and hollows of the débris. These bunches of alfalfa are 3 ft. high by February 1 of each year.



EUCALYPTUS GROVE ON DREDGE TAILING.

Being very busy with my dredging interests it was not until the season of 1907 and 1908 that I did any regular planting except eucalyptus, of which I have a forest. That season I leveled off with scrapers 10 acres and planted it to grapes, peaches, apples, pears, apricots, walnuts, chestnuts, pomegranates, and oranges. I put no soil on the land except a three-gallon bucketful of earth in the hole with each tree or vine, and covering it up with clean cobbles. Fertilizing is all that is necessary. I watered the trees first planted a few times with a hose, but found this unnecessary if I planted them deep enough. With vines, a long cutting planted with a crowbar is the best method, and no further attention is necessary, except fertilizing and pruning. The gravel is at all times damp at 2 ft. in depth, and turning over loose cobbles will not accomplish much as cultivation. Grapes, peaches, apricots, and cherries proved a great success. Apples, pears, and oranges made no headway, but might with deep planting.

It was not until last summer that it dawned upon me that the venture was a commercial success. The grapes and peaches then yielded wonderfully. I did not ship any then, as the local market took them quickly at high prices, as they were in the market ahead of any other products of a similar variety. I noticed that my Tokay, Muscat, and black grapes were ready before the first crates were shipped from Vacaville, so this season I made arrangements to beat them to it, with the following result.

From ten vines of Tokay grapes planted 1908, I picked 9 crates which yielded a net profit of $9.98. The Muscat grapes, of which I had several hundred crates, I chiefly sold locally at 4c. per pound, but have sold about 100 crates in San Francisco at 85 and 90c. per crate. I should have shipped them two weeks earlier, but it did not dawn upon me how many I had until about August 15.

GROWING GRAPES ON COBBLES.

In 1909 I sold to the Natomas rock crushing plant the gravel and cobbles on 165 acres, of which the company has cleared off about 15 acres, and now is making great headway owing to large demand and the building of the state highway, which will quickly absorb all of the cobbles on my land. About four feet of cobbles is left above the sand and soil, which is ideal for planting, and this is where I will do my greatest development. I expect to plant 20,000 vines and cuttings this winter, and follow the steam-shovels as they proceed in the future. The acreage that I leveled originally I will work entirely into grapes.

Two years ago my Tokay grapes were colored on July 10, but last year and this year have been late, the season attended by cloudiness until June 20. One reason that this fruit is earlier is that it starts to grow two weeks before similar products on natural soil, and it is not until midwinter that the leaves are frozen. Frank B. McKevitt, manager of the fruit company, says that my Muscat grapes are two weeks ahead of those from Vacaville, that their

*Excerpt from the *Pacific Rural Press.*

quality makes a prime shipper of them, and advises me to plant them largely.

Contrary to what might be expected, these vines are extremely vigorous, and bear second and third crops. The older vines cover a space 16 ft. square. All diseases and blight I used to be troubled with prior to dredging seem to have disappeared. This coming season I plan to plant cucumbers and early tomatoes.

I am still learning, but have reached that point where I know that the thing to do is to go ahead and plant. The details of the best way to train the vines I will work out in the future. They may do better on trellises, but they are doing well with common pruning, and Muscat grapes are particularly fine where they spread flat on the rocks. I could write much more on this subject, but no one will believe what I have written. When I get a few hundred miles away, I question whether it is so myself. I know why the cobbles are productive, as I have been through a course of 25 years observation, but I cannot make others see, in a little while, what it has taken me so long to absorb.

Metallic Minerals of Brazil

The total output of gold in Brazil since the colonization of the country up to the present time has been estimated as reaching 700,000 kg., according to a correspondent of the London *Times*. About nine years ago the government granted a series of concessions for the exploration of a number of river beds for gold and other minerals. Gold has been found in the states of Minas Geraes, Goyaz, Matto Grosso, Bahia, São Paulo, Rio Grande do Sul, Maranhão, and elsewhere. It has been traced to three mountain ranges, extending parallel to the coast. The Mantiqueira range, an offshoot of which, the Espinhaço, contains the most important of the gold-mine workings; the mountains between the rivers São Francisco and La Plata, and the mountains bounding the river valleys of the Araguay and Paraguay. Gold deposits are found in pyrite veins, quartz, and itabirite; the last is not known outside of Brazil. Alluvial gold is found along the rivers.

Low-grade gold ores have in some cases been very skilfully treated in Brazil. The Ouro Preto gold mine may be instanced. The ore is composed of quartz, tourmaline, arsenopyrite, and iron pyrite, with some bismuth. The pyrite content varies from 4 to 6%; pieces up to 5 gm. in weight have been found, which are, however, exceptional. The size of the particles of free gold present in the ore may be inferred from the fact that 5% remains on a 40-mesh sieve, and 45% on a 100-mesh, the remainder passing through. The presence of bismuth with the gold caused difficulties, which were successfully surmounted. Water supply was obtained from a source six miles away, with a fall of 350 ft., the supply varying from 1300 to 1500 ft. per minute. The mine was planned with several inclined shafts, radiating from a centre like the spokes of a wheel, with lines of rails in each.

It has been reported that quicksilver has been found along the valley of the Tripuhy river; cinnabar-bearing lodes in coarse, more or less porous, sandstone have been discovered, but have not been sufficiently developed to enable experts to state whether they can be profitably worked. Traces of platinum have been found in deposits of the Candado river, but the parent rock has not yet been traced. Even in the Urals, from which the world's main supply is obtained, the weight of platinum per ton of deposit is extremely small, and deposits along the Candado river containing a larger percentage than those hitherto known will have to be found before the platinum industry can be made a profitable one. The present price, however, is so high, and it is so obvious that the supply is not equal to the demand, that a vigorous search of the river beds might repay the cost of exploration. Last year the price per ounce rose from £7 12s. 6d. in January to £10 in December, and it has practically kept to that level all through this year, so that there is every inducement to follow up the traces, which may point to richer deposits.

Minas Geraes also contains deposits of lead ore, which are likewise found in São Paulo and Rio Grande do Sul. Within the last few years the output of manganese ore has very considerably increased; important centres are Miguel Burnier and Queluz, where mining operations were commenced about eighteen years ago. At the latter centre there are now five works. The ores mined there are made up of the following component parts: metallic manganese, approximately 52%; iron, 3%, with smaller percentages of silicon and phosphorus. At one of the works at Queluz the output reaches 600,000 tons per year. The known supply may last for several generations. Considerable quantities of manganese ore are shipped to England during recent years, as follows:

	Tons.	Value. £	Cost. £ s. d.
1907	72,200	192,100	2 13 3
1908	56,900	120,000	2 2 1
1909	69,900	126,600	1 16 0
1910	80,000	156,600	1 19 0
1911	71,200	139,600	1 19 1

Copper is known to occur in at least seven states. The most important mines are situated at Camaquam, where the ore contains over 50% of copper. Four lodes are now being worked by means of adits; their thickness averages four feet. The richest portions of the ore are shipped and the rest smelted locally to matte containing 50 to 60% of copper. Elsewhere sulphide ores are worked and deposits have been opened in the states of Bahia, Ceará, and Maranhão.

Extraction of Tin from Ores

By Edward Walker

The pioneer of chemical extraction of tin from ore and tailing is Arthur Richards, whose work is deservedly attracting the attention of everyone connected with Cornwall or with tin mining in other countries. He adds a small percentage of common salt and coal to the finely ground material and treats the mixture in a furnace at a bright cherry-red heat. The effect is to volatilize the tin as fume, consisting chiefly of chloride. His experiments have shown that practically the whole of the tin as estimated by chemical assay can be removed in this way, for his residues never contain more than ½ lb. of metallic tin per ton. The cost of the operation is not expected to be greater than that of water-concentration, that is to say, 4 to 5 shillings per ton of ore. As regards the subsequent treatment of the tin fume, in all probability the electrolytic method will prove the most suitable. The cost of this method does not count in the same way with a high-priced metal like tin as it does with lead or zinc.

Whenever a new method for the commercial beneficiation of ores is introduced, it is inevitable that some one will bring forward past instances. Thus we shall probably hear of the work done by the Metals Volatilization Co. in Colorado ten years ago, where a somewhat similar idea was applied to the extraction of copper. Also, the old process for extracting the tin present in silicate slag by means of calcium chloride may be adduced as an anticipation. From the point of view of the latter process, it may be advisable to mention that a chloride does not react directly upon tin oxide to produce tin chloride; but that the presence of silica is necessary. Mr. Richards has this fact in view when he mentions in his specifications that the process is only intended for low-grade ores, and that if a high-grade ore or concentrate is to be treated it must be mixed with low-grade ore, or have some sand or silica added to it. I ought to mention also that other metallurgists in Cornwall are experimenting on chemical methods of extraction. Their investigations have not progressed sufficiently to warrant the publication of details. The high price of tin and its steady demand in the tin-plate industry serve to stimulate research for better methods of its recovery from its ores.

Copper Production of Arizona

By B. S. Butler

*Arizona produced 303,202,532 lb. of blister copper in 1911, as compared with 297,250,538 lb. in 1910. This is the largest output in the history of the state and continues Arizona in first place among the copper-producing states. The steady output of copper from Arizona began about 1875, though there was intermittent production prior to that date, the earliest record of production being for 1862. Since 1880 the growth of the industry has been steady and rapid. To the close of 1911 Arizona had a recorded production of 3,494,333,111 lb. of copper, or 21.38% of the total output of the country, thus giving the state third rank among the copper-producing states. Arizona produced 27.63% of the total output of the country for 1911. Nine copper-smelting plants operated within the state during the year. The greater part of the production was from five districts.

Bisbee District

The Bisbee or Warren district, in southern Cochise county, was the largest producer, with about 130,200,000 lb. of blister copper, as compared with 142,500,000 lb. in 1910. Production in the district began in 1880, since which time it has been a constant and increasingly important contributor to the output of copper. To the close of 1911 it had produced 1,415,200,000 lb. of copper, or 8.64% of the output of the United States and 40.3% of the Arizona production. In total and in present output it ranks third among the copper districts of the country.

In the early days the output of copper was entirely from oxidized ores, but in recent years the quantity derived from sulphide ores has rapidly increased, and at the present time probably equals that derived from oxidized ores. It is reported by the companies that additions of ore reserves in all the properties have fully equaled or exceeded extraction and in some cases important developments have been made. In the Oliver shaft new oxide orebodies were found on the 1050 and 1250-ft. levels, and new sulphide bodies on the 1250 and 1600-ft. levels. Large bodies of iron pyrite assaying from 2 to 4% copper have been developed in the Briggs shaft, together with smaller bodies of higher grade ore. An especially interesting development in the Copper Queen mine was the discovery, in the Spray division of the mine, of sulphide ore in the Abrigo limestone of Cambrian age. Previously ore had not been developed at so low a geological horizon. Another discovery that may prove of importance is the occurrence of disseminated chalcocite ores in the porphyry of Sacramento mountain. The Shattuck-Arizona company also reports the development of important orebodies.

The nature of the deposits of the district do not favor the blocking out of extensive ore reserves far in advance of immediate needs, since the cost of keeping the heavy ground open for a long period is prohibitive. The quantity of ore actually blocked out in proportion to the annual output of copper is probably as small for this district as for any large producing district in the country. Most of the ore occurs in irregular bodies without definite arrangement, so that the cost of prospecting is greater than in many other districts. Moreover, the soft heavy ground associated with the ore makes it necessary to employ the square-set method in mining, and the cost of timber adds materially to the cost of mining. Recently efforts have been made by both of the principal companies to modify their system of mining so as to use less timber. The cost of mining in the district, however, is likely to remain relatively high. Centralization and improvement in the hauling and hoisting systems of the mines has resulted in marked economy. The ores of the district continue to show a decrease in grade, but this is in part due to improvement in mining and metallurgical methods which permit the treatment of lower-grade material. It is the policy of most of the companies to mine as low-grade ore as can be treated at a reasonable profit. In the early days of mining in the district the oxidized ores yielded about 20% of copper. For 1911 the average recovery was about 5.9% copper, with 0.0308 oz. gold and 1.49 oz. silver per ton, an average precious-metal content of $1.42 per ton of ore.

MINES AT BISBEE, ARIZONA.

The Copper Queen mine produced a total of 619,132 tons of ore and precipitate, containing 74,489,728 lb. of copper, 16.895 oz. of gold, and 1,227,453 oz. of silver.

The Calumet & Arizona Mining Co. produced 21,476,739 lb. of copper, 216,987 oz. of silver, and 9329 oz. of gold. The average net cost per pound of refined copper produced was 8.33c. The following table shows the grade of ores.

Operations of the Calumet & Arizona Mining Co. in 1911:

	Dry Wt.
Tons ore mined (including fluxing ore)	244,067
Tons ore shipped (including fluxing ore)	244,772
Tons ore smelted (not including fluxing ore)	212,370
Tons fluxing ore smelted	38,831
Pounds copper recovered per ton ore	97.677
Pounds copper recovered per ton fluxing ore	13.400
Per cent copper recovered per ton ore	4.884

The Superior & Pittsburg Mining Co. produced 28,469,166 lb. of copper, 236,960 oz. of silver, and 8785 oz. of gold. The net cost per pound of refined copper produced was 6.60c. The grade of the ore is shown in the following table.

Operations of the Superior & Pittsburg Mining Co. in 1911:

	Dry Wt.
Tons of ore mined	205,603
Tons of ore shipped	205,675
Tons of ore smelted	206,234
Pounds of copper recovered per ton	138.348
Per cent of copper recovered	6.9174

*From an advance chapter, 'Mineral Resources of the United States, 1911.'

From August 1, 1910, to June 9, 1911, the Shattuck-Arizona Mining Co. shipped 32,029 tons of ore averaging 12.85% copper. Shipments were discontinued on June 9. At Douglas the smelting plants of the Copper Queen Consolidated Mining Co. and the Calumet & Arizona Co. were operated throughout the year. The Copper Queen Consolidated Mining Co. had in process the construction of an addition to the smelter to consist of a calcining and reverberatory plant to treat fine ores, concentrate, and flue-dust. It will consist of two reverberatory-furnaces and six calciners of the McDougall type, with the necessary concentrate-bins, dust-chamber flues, and stacks. These additions will be completed in 1912. In 1911, in addition to Copper Queen ores, the smelter treated the ore and concentrate of the Moctezuma Copper Co. of Mexico, and custom ores from Arizona and New Mexico. The Calumet & Arizona Mining Co. completed plans for and began construction of a new smelting plant, which it is expected will be ready for operation by August 1913. The plans contemplate a complete custom sampling mill; Cananea bedding system, 58,000 tons capacity; two 48-in. by 40-ft. blast-furnaces; dust-chamber 60 by 180 ft.; steel stack lined with acid-proof tiling 350 by 25 ft. in diameter; four 19 by 100-ft. reverberatories, with foundation and building for a fifth; twelve 21-ft. Herreshoff roasting-furnaces and suitable dust-chamber; and six Great Falls converters 12 ft. in diameter. The district is served by the El Paso & Southwestern railroad. Oil for fuel is used extensively in the production of power, which is generated in central plants and distributed to the points where needed. Early in 1911 a merger of the Calumet & Arizona and Superior & Pittsburg Mining companies was effected. The stock of the Calumet & Arizona Mining Co. was increased to 650,000 shares and an exchange made for the stock of the Superior & Pittsburg Mining Co. on the basis of 1 share of Calumet & Arizona for 3½ shares of Superior & Pittsburg.

Morenci-Metcalf District

The deposits of the Morenci-Metcalf district are at Morenci and Metcalf, in Greenlee county. During 1911 the district produced 71,500,000 lb. of blister copper, as compared with about 73,154,000 lb. in 1910. The district was one of the earliest copper producers in the state, the output beginning as early as 1873, and since 1880 it has been an important contributor to the copper output of the country. To the close of 1911 a total of 954,200,000 lb. of copper had been produced, or 5.82% of the output of the country since 1845, and 27.2% of the output of the state. In total production it ranks fourth among the copper districts of the country and second in the state; in the output for 1911 it ranks fifth in the country and second in the state.

The copper ores[1] of this district occur as contact deposits in Paleozoic limestones and shales which have been intruded by stocks and dikes of porphyry, as disseminated deposits mainly in the porphyry, and as deposits in fault fissures of the Coronado type. The original ores were pyrite and chalcopyrite of too low grade to be of economic importance. The workable bodies have resulted from the process of secondary enrichment. The orebodies in the limestone were formed in certain beds favorable to deposition, and this produced roughly tabular bodies nearly parallel to the stratification of the limestone. Alteration of these bodies has produced oxidized ores which formed most of the workable bodies in the limestone. These are now nearly exhausted. The disseminated ores occur in highly altered porphyry adjacent to fissure veins. The copper content of the upper portion of these deposits has been leached and deposited as chalcocite on the pyrite lower down. This has produced a zone of commercial ore varying in thickness, in general not extending below a depth of 400 ft. In the fault fissure or Coronado type of deposit commercial ore has been developed to much greater depth, and recent exploration of the principal faults in Copper mountain has shown that commercial ore occurs associated with these faults considerably below the general level of the ore-zone.

Of the 1911 copper output, 54,000,000 lb. was derived from concentrating ores and 17,500,000 lb. from smelting ores. The mines of the district produced 1,323,447 tons of concentrating ores, yielding 2.01% copper, and 222,551 tons of smelting ore yielding an average of 4% copper, the average yield for the 1,545,998 tons of ore produced in the district being 2.29%. The ores in general have a low gold and silver content, and as much of the copper is of sufficient purity for commercial purposes it is not refined electrolytically, and consequently the precious-metal content is not recovered. Until recently the square-set and fill system of mining which necessitated the use of large amounts of timber was very generally employed in the district. More lately modified systems of slicing and caving have been introduced and are being extended, so that at present a large percentage of the ore is extracted by these methods at a considerably reduced cost. The district contains large reserves of ores, and developments during 1911 have fully maintained the reserves and added to the possibilities of ore in both the Morenci and the Metcalf sections of the district. The Detroit Copper Co. reduced to bullion 517,087 tons of ore, yielding 22,704,398 lb. of copper, or an average of 45.9 lb. of copper per ton of ore treated. The following tables show the results of operations at the mill and smelter.

Concentrator operations of Detroit Copper Co. in 1911:

Ore concentrated, tons	500,000
Percentage of copper in ore	2.869
Concentrate produced, tons	66,012.14
Percentage of copper in concentrate	15.876
Saving	73.05
Tailing assay	0.848
Tons ore milled per ton of concentrate	7.57
Water used per ton ore milled, gallons	522.6

Statement of ores completely reduced to bullion during the year, the original assay, and the yield of same, by the Detroit Copper Mining Co., in 1911:

	Ore treated to bullion, short tons	Bullion produced, lb.	Copper assay of original ore, %	Copper bullion per ton of ore, %
Concentrating ore	500,379	19,429,038	2.866	1.941
Smelting ore	6,678.3	2,083,680	16.846	15.598
Silicious ores to converters	9,096	968,520	5.749	5.323
Total Detroit Copper M. Co. ores treated at Morenci	516,153.3	22,481,238	3.098	2.179
Purchased ores treated at Morenci	933.5	223,100	12.909	11.953
Grand total	517,086.8	22,704,398	3.116	2.195

During the fiscal year ended September 30, 1911, the Arizona Copper Co., Ltd., produced 34,584,000 lb. of copper. The company's mines produced 744,746 dry tons. The average yield in copper per ton of ore treated was 46.4 lb., or 2.32%. This compares with a yield of 2.13% for the preceding year. Of the total ore, 94% was concentrating ore and 6% smelting ore. Of the total copper production, 82% was derived from sulphide ores and 18%

[1]For detailed report of the Clifton-Morenci district see Lindgren, W., 'The Copper Deposits of the Clifton-Morenci District, Arizona,' *Prof. Paper* U. S. Geol. Surv. No. 43, 1905; Tovote, Wm. L., *Mining and Scientific Press*, Vol. 101, 1910, p. 770.

from oxidized ores. During the latter part of the year plans were made for beginning the construction of a new smelting plant to replace the present one, which has become out of date. For the fiscal year ended August 31, 1911, the smelter of the Shannon Copper Co. produced 14,944,933 lb. of copper from company ores and 223,169 lb. from custom ores. During the same period the mines of the company yielded 263,975 tons of ore, with an average extraction of 56.9 lb. per ton. The average cost per pound of copper for the year was 11.5c. The district is served by the line of the Arizona & New Mexico Railway Co. A narrow-gauge line extends from Morenci to connect with the Arizona & New Mexico railway at Coronado. Early in 1910 the Shannon Copper Co. completed a standard-gauge road connecting the mines at Metcalf with the concentrating and smelting works at Clifton.

Jerome District

The Jerome or Verde district of Yavapai county produced about 33,200,000 lb. of blister copper in 1911, as compared with about 38,660,000 lb. in 1910. The production of copper in the district began about 1883, though

ARIZONA.

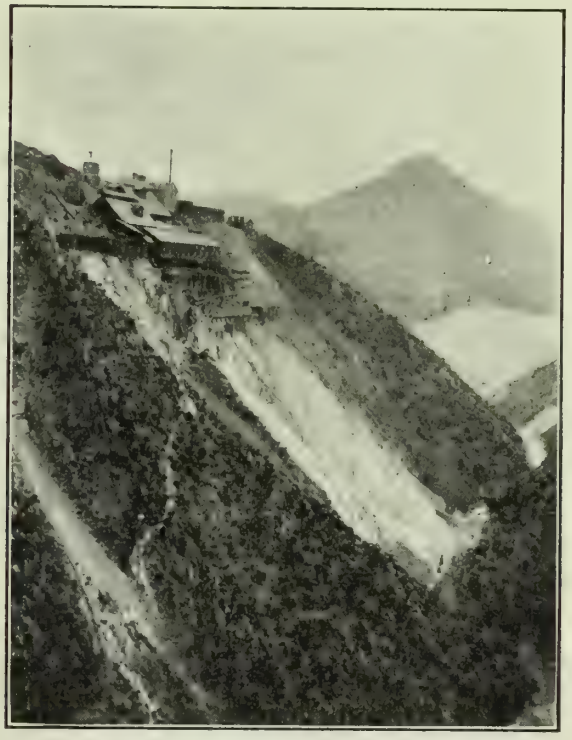
it had yielded gold and silver previous to that time. Since 1888 it has been a steady and important producer. To the close of 1911 it has yielded a total of 603,200,000 lb. of copper, or 3.68% of the total output of the country since 1845, and 17.2% of the total output of the state. In total output it stands fifth among the copper districts of the country and third in Arizona. In output for 1911 the district ranks eighth among those of the country and fourth in the state.

According to Graton[2] the orebody of the United Verde mine is an irregular lenticular mass, replacing a schistose rock that has resulted from the intense shearing of a rather basic porphyry. The ore minerals, mainly sulphides of iron, copper, and zinc, have partly or completely replaced the rock in some instances; in others, they occur as veins and stringers in the schist. The ores are of pre-Cambrian age. The ores differ from most of the large copper deposits of Arizona in carrying larger amounts of gold and silver. The copper content of the ore is also unusually high for this type of deposit. As little timber as possible is employed in mining on account of the danger from fire. Considerable copper is recovered from the mine-waters that have leached through the burning stopes by precipitation on scrap iron. Most of the ore is smelted at the United Verde Copper Co.'s plant. The ore high in sulphur is roasted and smelted in blast-furnaces. Some of the ore low in sulphur is smelted without roasting. The United Verde company has under construction a new smelting plant to replace the one now in use. According to published figures, the United Verde company, the only important producer of the district, made an output of 33,167,987 lb. of copper, 461,145 oz. of silver, and 15,239 oz. of gold in 1911. The precious-metal content was equivalent to about 1.6c. per pound of copper. Development was carried on by other companies in the district during the year, but no important production was made. The district is served by a narrow-gauge railroad owned by the United Verde Copper Co., which connects with the Santa Fé, Prescott & Phoenix railway.

[2]Graton, L. C., 'Mineral Resources U. S. for 1907,' Pt. I, 1908, p. 597.

Globe District

The Globe district of Gila county produced about 44,600,-



CONCENTRATOR CANYON, CLIFTON-MORENCI DISTRICT.

000 lb. of blister copper in 1911, as compared with about 27,600,000 lb. in 1910. The increase in production was largely due to the beginning of production by the Miami Copper Co. The mine production for the year considerably exceeded the smelter production, as much of this material had not been smelted at the close of the year. Production of copper began in the district about 1881; the district was well known as a silver producer before that date. For several years subsequent to 1881 the production was intermittent, but since 1888, and especially since 1898, when the railroad first reached Globe, the district has ranked among the important copper producers of the country. To the close of 1911 it has produced a total of 379,300,000 lb. of copper, or 2.31% of the output of the country, since 1845, and 10.8% of the output of the state. In total production the district ranks seventh in the country and third in the state. Important production began in the Miami section in 1911 and this section of the district will continue to grow in importance.

The ores in the Globe end of the district vary greatly in copper content, the grade to be treated at any given time depending largely on the possibility of profitable treatment. In general, ores of as low grade as can be handled with reasonable profit are mined. During 1911 the ores of the district yielded about 3.35% of copper, with about 24c. in gold and silver per ton. The mines of the dis-

trict produced 585,408 tons of concentrating ore yielding an average of 2.2% copper and 122,702 tons of smelting ore yielding an average of about 9% copper. The Old Dominion smelter was the only reduction plant operating in the district during the year. The district is served by the Gila Valley, Globe & Northern railway, a branch of the Southern Pacific. The Old Dominion and the United Globe mines were the largest producers during the year. The average grade of ore mined and treated by the Old Dominion company for the past two years is shown below. Grade of ore mined and treated by Old Dominion company, Arizona, in 1911:

	Percentage of copper.	
	1911.	1910.
Average smelting ore	7.75	7.85
Average concentrating ore	3.50	3.49
Average of ore mined and treated	5.84	5.70

The average cost of refined copper for the year was 9.15c. per pound. The United Globe mines produced 110,578 tons of ore, yielding 8,523,433 lb. of copper, 11,459 oz. of silver, and 875.9 oz. of gold.

In the Miami end of the district the Miami and Black Warrior mines were the only important producers. The Miami Copper Co. began production in 1911, the first unit of the mill going into operation March 15. At the close of the year five units were in operation, and the sixth was nearly equipped. The entire plant will have a capacity of about 3000 tons per day. The result of milling operations for the year are as below.

Milling operations of Miami Copper Co., Arizona, in 1911:	
Ore milled, tons	445,036
Percentage of copper in ore	2.48
Concentrate produced, tons	20,065
Percentage of copper in concentrate	40.36
Copper in concentrate, lb.	16,195,561
Copper recovered per ton of ore, lb.	36.39
Mill extraction, per cent	73.37

From the concentrate produced, the net returns of refined copper amounted to 15,385,783 lb. Based on the net production, the cost of copper in concentrate on board cars at Miami was as follows:

	Per ton of ore.	Per lb. of copper.
Mining	$1.2134	$0.03500
Milling	0.6274	0.01810
General	0.1706	0.00492
Total	$2.0114	$0.05802

The concentrate is shipped to Cananea, Mexico, for treatment. The main work of the year underground was confined to preparation for and extraction of ore, but little prospecting of unexplored territory was accomplished. At the close of the year ore reserves were estimated at 18,232,000 tons, averaging 2.58% copper. In 1912 the Inspiration Consolidated Copper Co. was formed as a merger of the Inspiration Copper Co. and the Live Oak Copper Co. It is reported that this company has about 45,000,000 tons of ore developed of an average grade of about 2% copper. Blocking out of the ore was continued through the year and plans were inaugurated for the construction of a mill to treat the ores. Development work was carried on by other companies in the district.

Mineral Creek or Ray District

The Mineral Creek or Ray district began important production during 1911. The output for the year was about 15,700,000 lb. This was the first important production of copper from this district. The disseminated deposits occur in crushed schist and granite. The original mineralization was pyrite and chalcopyrite, but the commercial ore has resulted from secondary enrichment of the deposits produced by the leaching of the copper minerals from the upper portion and redepositing them as chalcocite on the sulphides lower down. This has resulted in a blanket-like deposit of commercial ore covered by a relatively barren capping and underlain by a zone of original mineralization too low in copper content to be of commercial value.

The average thickness of the leached zone in the Ray Consolidated ground is 252 ft., and the average thickness of the ore 101 ft. Locally, especially associated with the diabase, native copper becomes of some importance. The district is served by the Arizona & Eastern railroad. The mines and reduction works are connected by the Ray & Gila Valley railroad, controlled by the Ray Consolidated Copper Co. The most extensive operations in the district were conducted by the Ray Consolidated Copper Co. The underground work of the year was largely confined to preparation for the mining and extraction of ore, little attention being given to prospecting undeveloped territory. At the close of the year the ore reserves were estimated as follows: Fully developed by churn-drilling, 64,700,000 tons, having an average grade of 2.16% copper; fully and partly developed, 77,314,470 tons, having an average grade of 2.17% copper. The shrinkage stope system of mining has been applied in two portions to the property and is reported to be entirely satisfactory.

The first unit of the concentrator at Hayden was put in operation in March, and at the close of the year five units had been completed. The plant is to consist of eight units with a nominal capacity of 8000 tons of ore per day. The total ore treated for the year was 681,519 tons, of an average grade of 1.83%, resulting in a gross output of copper contained in concentrate of 15,721,520 lb. and corresponding to an average extraction of 63.1%. In the latter part of the year the extraction was considerably above the average, being 67.38% for December. The average assay of concentrate produced was 22.4% copper. The average cost per pound of copper produced to the close of the year was 10¾c. This cost was much higher than will be normal. Early in 1912 the cost was reported at 9c. per pound, and the management estimates that when the plant is in full operation the cost will not exceed 8c. per pound. The concentrate was shipped to El Paso during 1911, but early in 1912 delivery to the Hayden plant of the American Smelting & Refining Co. was begun. Early in 1912 controlling interest in the Ray Central Copper Co. was acquired by the Ray Consolidated Copper Co., and the properties will be operated together.

Silverbell District

The Silverbell district of Pima county made practically no production of copper in 1911. It produced about 5,750,000 lb. of blister copper in 1910, as compared with about 10,500,000 lb. in 1909. Important copper production began in the district in 1904, though it had produced some silver and a little copper before that date. At the close of 1911 the district had yielded about 41,800,000 lb. of copper.

Paleozoic sediments have been intruded by an acid porphyry, the sedimentary formation for the most part being detached blocks entirely surrounded by porphyry. The copper deposits are of two types—contact deposits, in which the sulphides of iron and copper, together with contact silicates, garnet, epidote, etc., have replaced limestone; and disseminated deposits, in which the original ores consist of iron and copper sulphides as veinlets and small grains in the shattered porphyry. The commercial ores of the latter type in this district, as in most others, have resulted from the secondary enrichment of these deposits.

The ore mined to the present time has been principally that of the contact deposits. These ores are in general rather low-grade smelting ores. However, they are nearly or quite self-fluxing and can be treated cheaply. Development of disseminated ores has been in progress by several companies and encouraging results are reported, but there has been no important output from this type of ore. The ores of the district are treated at the plant of the Southern Arizona Smelting Co., at Sasco. This plant was closed down August 16, 1910, and has remained idle since. A branch of the Southern Pacific railroad extends from

Red Rock to the district. The Imperial Copper Co. has been the main producer in the district.

OTHER DISTRICTS

Shipments of ore were continued for the Turquoise district, Pinal county, the output for the year being about 3,300,000 lb. of copper. The Paleozoic sediments of the district have been extensively faulted and intruded by monzonitic porphyries. The copper deposits of the district may be grouped as follows:

(1) Oxidized blanket deposits connected with thrust faulting, exemplified by the orebodies of the Germania and Mary mines. (2) Pyrite deposits with some associated bodies of oxidized ore in the Cambrian dolomitic limestone and shale, exemplified by the Mame and Leadville mines. (3) Pyrite deposits with associated bodies of oxidized or enriched ore in Carboniferous limestone, exemplified by the Copper Belle and other mines near Gleeson.

The Big Bug district of Yavapai county also contributed considerably to the copper output.

Mine Rescue Work

The following outline of the conditions to be observed in the conduct of mine-rescue work was adopted at the National Mine Rescue Conference held at Pittsburg, September 25, 1912. The conference further resolved that in rescue work untrained men should not be permitted to use breathing apparatus except when it is the only possible chance to save life. In selecting untrained men, discipline is of equal importance to training.

OUTSIDE ORGANIZATION

1. All openings to be carefully guarded.
2. There should be a man in charge of outside arrangements to see that ventilating appliances are put in condition for operation, so as to be ready to operate when conditions require it.
3. See that good, competent men are placed at all openings to the mine and that they obey the orders given.
4. A competent person to be placed near the entrance to the mine to examine all safety lamps before they are allowed to be taken into the mine.
5. Some specified person to be placed at the entrance to check off all persons and make a record when they go into and come out of the mine.
6. Proper provisions to be made in the way of food and shelter to take care of persons engaged in rescue work.
7. A physician to be on hand while rescue parties are in the mine.
8. Safety lines to be established around all openings inside of which lines no open lights should be allowed.
9. A man in charge of the rescue squads to organize and have them ready to enter the mine when called upon.

INSIDE ORGANIZATION

1. A man to have full charge of the inside operations on each shift.
2. An advance squad under a competent leader to explore the workings in advance of the other squads who are advancing the ventilation, making repairs, and the stretcher squads.

The squads are to advance in the following order:

a. Breathing apparatus or advance squad.
b. Stretcher squads.
c. Temporary ventilation squad.
d. Material squad.
e. More permanent ventilation squad.

3. A station to be established at a point suitable as a base of operations from which to work, and with a competent person in charge who should re-examine all lights before they pass beyond him to the interior of the mine.
4. A telephone should be established at this station to communicate with the surface, and to be carried into the workings as fast as possible.
5. No person to go in advance of the ventilating current except the advance squad, which shall make an examination of the atmosphere for gas, and examine the return air-current frequently for indications of fire; also for any other dangers which are likely to exist.
6. A doctor should be stationed at this inside station with necessary supplies for his use.
7. While advancing into the mine all unexplored openings to be dangered off.
8. Strict discipline to be maintained at all times.

Gold-Mining in Kyushu

Gold-mining in the island of Kyushu, Japan, during 1911 showed a very fair increase (9600 oz. troy) over the output for the previous year, due to the general development of the mines with modern machinery. The Hasami gold mines in Nagasaki prefecture installed some modern machinery about two years ago and increased their output for 1911 (which amounted to $77,400) by about 50% over that of the preceding year. The Taiono gold mines in Oita prefecture produce about 2400 oz. per year, the Urushi mine in Kagoshima prefecture 1200 oz., the Okuchi and Ushio mines in Kagoshima each about 4800 oz. per year. The Yamagano gold mines in Kagoshima prefecture are the largest producers of this metal in Kyushu, their annual output averaging over 15,600 oz. The Serigano gold and silver mines, in the same prefecture, are also showing increased production, their output being over 6000 oz. per year. The Kushikino gold and silver mines, in Kagoshima prefecture, which were taken over and are being developed by the Mitsui Bussan Kaisha, are showing good results, and with the installation of modern machinery, which is being ordered from the United States, this group of mines will probably be one of the best gold producers in Japan, the estimated output being placed at 2400 oz. gold and 18,600 oz. silver per month. The first installment of machinery has been ordered from the Dorr Cyanide Machinery Co., the Allis-Chalmers Co., and the Moore Filter Co., and more will be ordered as the development work progresses. Considerable interest has lately been centred in a new gold-mining district in the north-central part of Kyushu, near Kitakawachi, Fukuoka-ken, where some prospecting has been done and samples yielding nearly 1 oz. per ton have been brought in.

Use of Sand

When a new sand is to be used in mortar or concrete work it is best to test it first in a sample block, and see the results, before using on a large scale. A mixture of coarse and fine sand with the coarse predominating is best, as it makes a denser and stronger concrete than a coarse-grained sand with the same amount of cement. This is because the small grains fill the voids made by the large ones. A sand with more than 45% voids should not be used, and it is always best to know the amounts of voids in the sand that is being used. This can easily be determined by taking the weight of a cubic foot of the sand and multiplying it by 100 and dividing by the product of the specific gravity into 62.5, the weight of one cubic foot of water. The result subtracted from 100 will give the percentage of voids.

$$\text{Percentage of voids} = 100 - \frac{100 \times \text{weight of cu. ft.}}{62.5 \times \text{sp. gr.}}$$

The less the percentage of voids the better the sand.

IMPORTS of pig iron into Japan from the new Tata iron furnaces in India have been very large, and to a certain extent have driven English pig iron from the market. The Mitsui Bussan Kaisha has been a large buyer, both for its own account and also for the government iron works at Wakamatsu. Although the quality of the Indian iron is very much inferior to that of the English, or even of the Chinese formerly imported from the Han-Yeh-P'ing works, importers have the advantage of $2.50 per ton in freight.

Discussion

Readers of the MINING AND SCIENTIFIC PRESS are invited to use this department for the discussion of technical and other matters pertaining to mining and metallurgy. The Editor welcomes the expression of views contrary to his own, believing that careful criticism is more valuable than casual compliment. Insertion of any contribution is determined by its probable interest to the readers of this journal.

Persistence of Ore in Depth

The Editor:

Sir—In a recent issue T. A. Rickard has crystallized current opinion on this subject in a stimulating article that will meet with general acceptance. Briefly stated, his conclusion is that after the oxidized zone and the zone of secondary sulphide enrichment are passed, ore deposits must be expected to become leaner with increasing depth. Generalizations are notoriously dangerous, and are never more so than when applied to the study of ore deposits; few sciences indeed have suffered more in this respect. Details that have been garnered from the study of a given metalliferous deposit, and that might have had a real value when applied to the construction of a sound theory of deposition for that metal alone, have been ruthlessly transferred to stay and brace the tottering structure built for another metal of possibly the slightest genetic affinities. When all the known facts concerning the deposition of any one metal have been collected, collated, and analyzed, then, and not until then, may analogies be made with the data of another metal, similarly treated. Meanwhile, further theorizing is as the cloud of dynamite smoke from an intermediate winze when already the distant plumb-line is with difficulty discernible through the telescope.

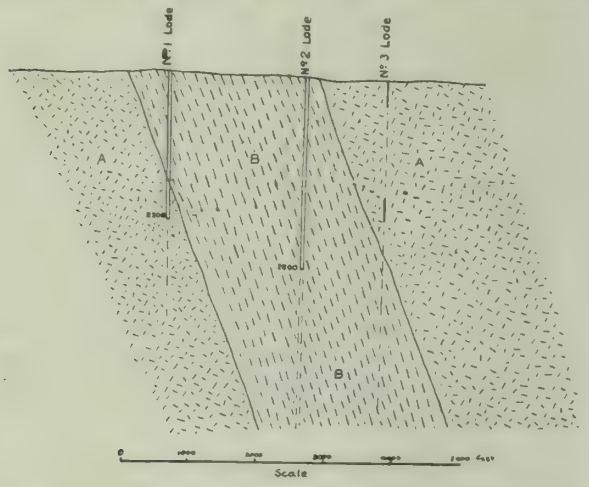


FIG. 1. A, UNFAVORABLE ROCK. B, FAVORABLE ROCK.

Frankly I regard Mr. Rickard's generalization that ore-channels must become leaner in depth as pernicious doctrine if universally applied; the more so, in that for most orebodies it contains a kernel of truth. It is indeed entirely true when its application is limited to a certain group of orebodies, namely, to those formed near the existing surface. This group includes, it must be noted, not only deposits formed in recent geological ages, but also some of Paleozoic and pre-Cambrian times. In the latter cases subsidence and burial beneath later deposits have protected the upper portions of these ore-channels against the erosion of ages. The auriferous conglomerate of the Witwatersrand may, with some reason, be regarded as a specific instance. In all these cases the general reason for ore deposition is probably the cooling of rising solutions on approach to the earth's surface; local modifications arise from variations in physical and geological structure.

But there are many deposits that cannot be ascribed to simple cooling. These occur chiefly in Archean and Paleozoic rocks, though, as in the Mother Lode-Alaska Treadwell belt, they may occur in Mesozoic strata. Lode-fissures in these rocks are normally very steep, while, from the vicissitudes they have undergone during a large portion of geological history, the strata are usually much disturbed. It is a fundamental axiom that in these older deposits the nature of the lode-wall exercises a vital influence on the richness and sometimes on the mineral character of the orebody. Hence it rarely happens that a great depth is reached before the lode, worked from the outcrop downward, has passed out of the favorable rock. Herein lies the kernel of truth in Mr. Rickard's generalization, but surely the fact should be stated in terms of geologic structure and not of depth.

The point is perhaps best illustrated by sections of actual occurrence obtained in the course of examinations made during the past few years. The sections and descriptions are admittedly generalized for a twofold reason: this note is written far away from notebooks and from the literature of the subject, and the reports from which the sections are taken are not yet freed for publication.

A generalized section of an area quoted by Mr. Rickard as affording satisfactory evidence in support of his proposition is shown in Fig. 1. The favorable rock (B) is inclined at 65°, the lodes are vertical and carry ore only when in the favorable rock. It is evident that the result of work on No. 1 lode has completely supported Mr. Rickard's argument; indeed, I suspect that it was on the evidence from this lode that his argument was based. But No. 2 lode has not appreciably diminished in value in depth. On the contrary, one of the best levels in the mine was below the 2000-ft. level; No. 3 lode (as yet explored only near the surface and proved to exist at 2000 ft.) was poor at the surface in unfavorable rock (A), but it is anticipated that it will materially improve at 2500 ft., when it will reach the favorable rock. Of course, it has yet to be shown that it will yield ore. It is, therefore, evident that the factor of depth postulated by Mr. Rickard is not the dominant factor in the area cited.

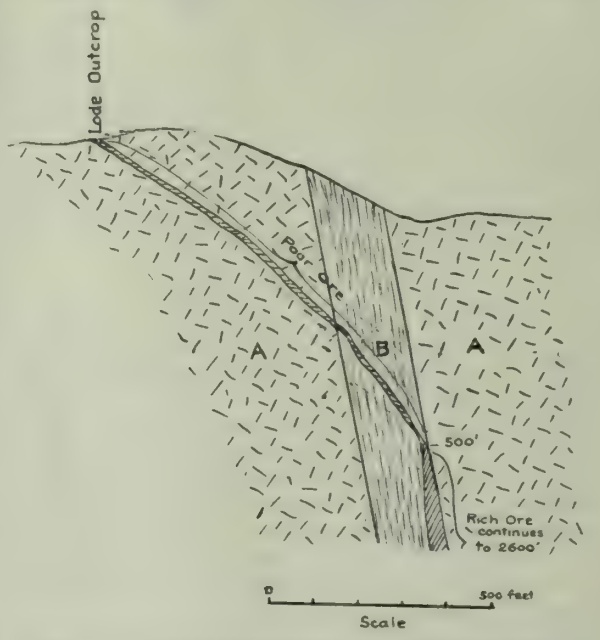


FIG. 2. A, UNFAVORABLE ROCK. B, FAVORABLE ROCK.

Two of the most famous instances of occurrence that confirmed miners of forty years ago in their belief that ore-channels might increase in value with depth are illustrated by Fig. 2 and 3. They are sufficiently self-explanatory. Fig. 2 is well known. Fig. 3 has, I believe, never before been published, yet the result, though not the reason, has been quoted by a generation of miners in favor of deeper sinking. Both these cases are covered by Mr. Rickard in his summary of the causes that lead to the belief in increasing richness in depth, and they are reproduced

here to show that the old miners merely fell into precisely the same error with regard to these deposits that Mr. Rickard himself has fallen into in regard to the area in Fig. 1; they assumed that depth and not geological change was the controlling factor that affected the richness (or poverty) of the orebody.

The famous Oroya 'shoot' or 'pipe' at Kalgoorlie 'petered out' in depth, but depth *per se* had nothing to do with its disappearance. It was deposited under a geologic cornice (for want of a better word) formed by lateral displacement along a fault-plane. Its foot-wall was another, generally parallel, fault-plane. But when these two came together, as they occasionally did, ore failed until they again separated. The Oroya pipe was the mainstay of the eastern side of Kalgoorlie, and its disappearance has had much to do with the falling yield of that goldfield. Instances could be multiplied indefinitely from these older rocks to show that the failure of ore is due to a change in the geologic conditions; I can, on the other hand, recall no instance in homogeneous country where failure of ore could unhesitatingly be ascribed to increase in depth. Mr. Rickard mentions the famous Champion Reef of Kolar, India, now working at a maximum depth of 3900 ft., in terms that show his scepticism of its persistence. But if it should fail at greater depths it will fail not on account of the depth, but because the fissure has passed from hornblende-schist into the granite, and so far as I know

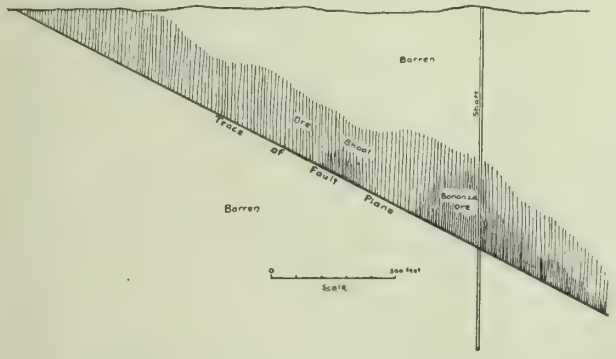


FIG. 3. LONGITUDINAL SECTION ALONG VEIN, SHOWING SHAFT SUNK 600 FT. IN THE VEIN BEFORE MEETING ORE. THE SHAFT WAS SUNK LONG BEFORE THE CONTINUITY OF THE ORE-SHOOT WAS ESTABLISHED. ORE OCCURS ONLY ABOVE THE FAULT-PLANE.

there is no evidence to indicate such a change is likely to take place. Naturally lodes of this character must always be few in number, because, as already pointed out, it can rarely happen that a fissure will remain in the same country rock to great depths. This is particularly so in Archean rocks. To the mining engineer, and even to the geologist unaided by the microscope, the majority of Archean rocks, especially in a differentiation series, look much alike. Yet in a metamorphosed and chloritized quartz-dolerite, I have known not one but many instances of ore failing in a strong lode when the only observable change in the rock in thin sections was an increase of hornblende from 5 to 15%. Lodes that have not depended on cooling for their filling are clearly peculiarly susceptible to the influence of the wall-rock. And if such a small change as the foregoing correlates poverty of ore, it is not wonderful that the passage in depth from, say, a quartz-diabase into a hornblende-porphyrite may betoken the complete disappearance of ore. Yet these two rocks may be so much alike in the Archean complex that no geologist could distinguish them in hand specimens. It is therefore not surprising that the mining engineer, failing to recognize the change, must of necessity ascribe the poverty of his bottom levels simply to increasing depth.

Putting the maximum depth of mining at 7000 to 8000 ft., not for reasons of ventilation or of hoisting, but for another that is never discussed in the press or with the man in the street, and among mining engineers is spoken of only with the greatest caution, I find myself prepared, when considering the depth to which these deeper-seated ore-channels may go, to subscribe to the words of W. P. Blake (quoted by Mr. Rickard) merely italicizing one word, "whatever view we may take of the source of the mineralization of lodes, we may conclude from the evidence that it is deep-seated; and in a *homogeneous* country rock may be expected to extend as far as we can ever reach downward in mining operations."

A characteristic feature of Archean or channels mentioned by Mr. Rickard, is a horizontal zoning in the orebody. There is no visible change in the rock and no pinching occurs in the lode to account for the peculiar distribution of the valuable ore. It is so marked in Kalgoorlie that in certain mines the driving of a level in poor ore causes the manager no perturbation. He knows that his leading stope, when broken out, will bring the whole to the run-of-mine grade. Despite, or perhaps because of, my initial disclaimer against theorizing, a vague speculation as to the origin of this zoning may be permitted. It always recalls the successively lower marks made by waves of the ebbing tide against a sea-wall. In this case it may also represent successive high-water levels of a flowing tide. To be associated with this phenomenon is a separate conclusion that metalliferous deposition in deep-seated regions is paroxysmal in character, comparable in many respects to volcanic outbursts at the earth's surface.

The question of the behavior of lodes in depth is one of vital importance to the miner of the future. Most mining engineers are aware of the immense amount of capital annually expended in the search for metal mines. From Spitzbergen to Tasmania, from Nikolaievsk to Puntas Arenas, the 'scout' is ubiquitous and the return for it all is lamentably small. H. C. Hoover has recently shown that the outlook for new goldfields is not cheering, and

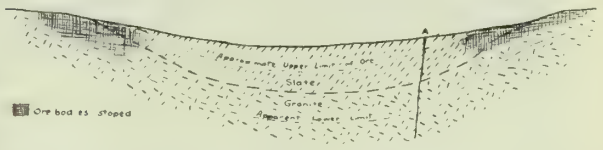


FIG. 4. LONGITUDINAL SECTION ALONG A BROAD ORE-CHANNEL, SHOWING A BARREN OUTCROP AT A, ON WHICH SINKING MIGHT REASONABLY BE ADVISED WITH THE EXPECTATION OF FINDING ORE IN DEPTH.

with his conclusions I find myself in complete agreement. The same conclusions may probably be reached for most of the baser metals. Despite the great price of tin and the increasing demand for it, occasioned by the oil and canning industries, no new tinfields of importance are known, nor is there any whisper of any. We are therefore forced back upon the old fields. The outcrop mines are there known, and either have been exhausted or are being worked. Future industry must more and more concern itself with concealed orebodies; it is here that a universal acceptance of Mr. Rickard's proposition would prove exceedingly harmful both to the mining engineering profession and to mining capital, already greatly restricted in its search for profitable investment. I have, for example, in mind an area shown in section in Fig. 4 in which it might be sound mining business to sink on a poor lode at A (if any such were known) with a reasonable expectation of an increase in the value of ore at depth. It is obvious that speculative search of this kind could only be advised after the most careful investigation and also when the financial interests had been fully acquainted with the character of the enterprise.

Finally, while I disagree with Mr. Rickard on the question of terms, it is clear that the result reached is much the same, namely, that it is a dangerous and often a fatal policy to regard the unexplored lower levels of mines as being likely to produce as much ore as the upper levels. There are notable exceptions, but they are few.

MALCOLM MACLAREN.

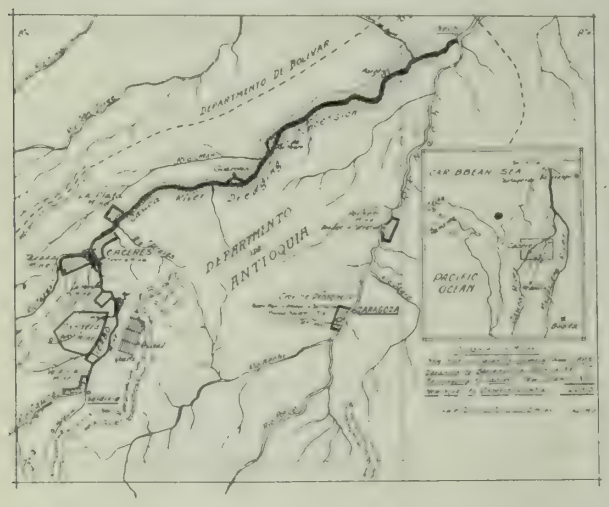
Liskeard, Cornwall, September 15.

Mining Conditions in Antioquia, Colombia

The Editor:

Sir—After traveling over the entire mining district of Antioquia, Colombia, South America, I find that the benches, bars, and high ground where water could be brought from a reasonable distance have all been worked by the Spaniards years ago, and worked over by the natives more recently. The entire country is plentifully sprinkled with old worked-out diggings. Most of the alluvial deposits are low and only suitable for elevating or dredging. Along the rivers the valleys are broad and very flat. This condition of the country makes it very difficult to bring water with sufficient pressure to work the ground, and necessitates long and expensive pipe-lines. A three to five-mile ditch is considered quite long, and owing to the softness of the soil and tropical rains, the expense of repair on a long ditch is tremendous.

Antioquia is undoubtedly a rich country in minerals. Most of the streams carry gold in quantity that in California would be considered profitable to work. The prin-



cipal work on *playas* is done during the dry season, for during the rains the rivers rise and flood the machinery, so that it is not only difficult but dangerous to work. In the dry season the rivers are very low, and the small creeks are almost dry, so it is necessary to have a substantial water right, which means long ditches before it is possible to work with a small plant. Owing to the thick jungle, rough country, and bad climate, prospecting is difficult, and transportation expensive. The richest mines are usually in districts where conditions are most unfavorable.

This is nothing compared to the trouble a foreigner encounters in trying to lease, buy, or even denounce a mine. The ignorance of the Antioquianos concerning mining valuations is ridiculous. They expect a foreigner to pay a fabulous price for a claim that has never been prospected or worked. Should you denounce a mine, equip it, and they see you are making money, they will immediately tie you up in a lawsuit and swear that some one or other of their relatives owned it years ago. Clear titles to property are almost impossible to secure. The natives ask you whatever price their fancy dictates for almost any property. All the mines are usually owned by several shareholders, and if you wish to buy or lease one, you will find it utterly impossible to get all these shareholders to agree to any reasonable proposal. The natives require several weeks to transact a small piece of business that any ordinary person could do in a day or so.

The cost of living is extremely high, and traveling costs a small fortune; for one must have saddle-horses, pack-mule, and a peon to attend them. The royalties for leasing a piece of property are high, being always from 20 to 30%, including very hard conditions. My advice to miners who wish to do any prospecting or investing, is to steer clear of Colombia and go to the North or Canada, where one can find a healthy climate and be protected by good laws. Almost every foreign prospector or miner on a small scale who has invested money in Colombian mines has failed to make a profit.

LOUIS A. MAIRE.

Visalia, California, October 15.

Placing Shaft-Sets

The Editor:

Sir—In a small—say a 2-compartment—shaft, I find that the quickest way to timber is to work, when possible, from the bottom upward, dispensing with hangers. Be careful to keep powder away from the walls, and keep them solid; a double jack is better than a pick for this. See that the 'muck' comes out of the bottom and not out of the sides. Any wall which sounds 'drummy' must be either taken down at once, or watched carefully every shift; use the same men as much as possible from start to finish. Any bumps or corners that are too close can be removed better by plugging with uppers when the bottom is down a few feet, and these plugs must be 'spit' before the bottom holes, so the fuses do not cut off. I cut all fuses the same length; with one man firing slowly, it is possible to tell which hole misses, if any. In a wet shaft cut the fuses different lengths and tie the ends together with wire in a bunch; hang them with a wire to a nail in a crack or wooden plug, and put a handful of oily waste in the centre; set fire to this and pull out. A sinking ladder is useful; although rarely used by the men, it gives confidence when shooting. An old ½-in. wire rope will do for the sides, and rail straps in pairs serve as rungs. One strap is bent over ⅜ in. on each end and the bolts tightened; to prevent slipping, drive a horse-shoe nail through the rope under each rung and double over. You thus have a ladder that lasts well, works fine, and costs little. Some drill holes in the side, put a few slivers of wood in them, then drive in old drills; these serve to steady the ladder. Often a pair of drills may serve in this way as a stirrup for a stull in an awkward place, saving a hitch, and will bear more weight than the stull will. If possible, go down 50 ft. without timber, then throw two stulls across the narrow way of the shaft, plumbing them carefully. These stulls can be two inches wider than the sets, giving a sill for the lagging. Then timber to connect with the last stulls. The working platform is carried up from set to set, and the bobs, being from the inside corners above and in the clear, make mistakes impossible. This is a fast way of timbering, and for repair work or taking out timbers later these stulls are invaluable and help to strengthen the timbering. A good way to hold up the 'shooting set' against the stulls and last set is to use short chains thrown around the set and the end link put through a link and held with a mule-shoe. Often, by being careful with the powder in sinking, much lagging can be dispensed with. A coat of whitewash in a dry shaft is helpful, as the candles give more light and there is less danger of fire, and it perhaps helps to preserve the timber. Also when lagging is not used, and the walls are whitewashed, you can tell at a glance where rock is loosening. Stations are also improved by this procedure. As to timber framing, when using round timber, which is often the only kind obtainable, square only the upper side and inside of the sets. A pair of sawhorses with a strap like a windlass brake to button down and keep the stull solid, is a good arrangement. Frame one end, then level it carefully; now, with the level, mark a working line on the other end and the twist is taken out of the timber. A good rip-saw works cleaner and faster than a chisel. Fit all sets on the surface and mark them. There is a swivel bucket-hook advertised which, it is claimed, keeps the bucket from turning when sinking with a crosshead; this must be a great help, as the crosshead is left at the end of the guides; the rope, running through a piece of pipe in the centre, will often cause trouble by making the bucket revolve, especially when the rope has been strained a little.

La Caridad, Nacozari, October 7. AN OLD MINER.

Special Correspondence

NEW YORK

THE METAL MARKET.—MEXICAN COMPANIES.—DIVIDENDS.

A severe break in the London metal market—£3 15s. per ton—as a result of the crisis in southeastern Europe, while it created a great deal of discussion, failed to have any effect upon the New York quotations for copper. The Balkan outbreak has, outwardly at least, rather stiffened the holders of copper in their attitude, and the claim is made that in the event of the larger nations of the Continent being drawn into conflict there would immediately arise a demand for copper that would take every available pound in the world's visible supply, and that without much regard to price. How far the demand which has made Germany so great a consumer during the past three years is due to preparation for war is not a matter of public knowledge, but there can be no doubt that this element was and is very important in Germany. While the copper market is being carefully watched and the outlook studied from every possible angle, business remains quiet. Eastern financial centres are nearly always waiting for something to come to pass, and at this time the stock markets seem to have settled down for the pre-election wait, and all matters that can be postponed until November 5 are going over until that time. The strike at Bingham is apparently no longer a factor in copper-metal prices, and it is only a question of a little time when production will again be normal.

The position in the lead market is interesting, as it is conceded that stocks are low, both in the hands of the producers and the consumers. The users of lead are doing an increased business. Paint manufacturers are all busy, and the recent abnormal activity in public utilities has given rise to an unprecedented call for lead-covered cables, miles of which are drawn through the underground pipes in those cities that have forced telegraph and telephone wires to be laid underground. The American Smelting & Refining Co. has, in a way, been 'holding the umbrella' for the lead producers. The whole situation is such that a sharp advance in price would be only natural and a squeeze as a consequence something more than a mere possibility.

It has been so long since the New York traders have had a chance to welcome a new, real copper promotion that any tidings in this direction are considered good. It is hoped that Thomas F. Cole's new organization, the Rainbow Development Co., will seek a market in New York rather than in Boston. There are some things which seem to conspire to keep the mining-share market in New York nearly down to the vanishing point. In the first place, some of the best issues, including practically all of the Guggenheim enterprises except Braden and the newest addition, the Alaska Gold Mines Co., have been taken from the Curb to the floor of the Stock Exchange, with the result that trading has dwindled rather than otherwise. Traditions of the Stock Exchange are obdurate toward all mining ventures. Of the remainder, the Cobalt shares have practically ceased all activity. Goldfield Consolidated has evidently almost reached the end of its productive career as a high-grade gold mine. The New York market for Tonopah stocks has long been a secondary one, the orders for the greater part originating in Philadelphia and Pittsburg, principally the former. The Heinze shares (Ohio, Davis-Daly, United Copper, and Stewart) have suffered on account of the troubles and doings of F. Augustus Heinze. Some of the companies, as in the case of Davis-Daly, have cast Heinze into the outer darkness. In the case of the Stewart the attempt was unsuccessfully made. In this property Heinze has found another opportunity to indulge in his favorite pastime of legal tangles. The Stewart is now involved with the Ontario in an apex fight, while the Bunker Hill & Sullivan is after the Stewart, with a claim for ore mined through the Stewart workings from the Saxon claim. There are people in Butte who will say that this is by no means the first time that such an accusation has been brought against F. A. Heinze.

The British Columbia Copper Co. is to emulate its larger neighbor, the Granby, in increasing its holdings. Some months ago the company took a working option on the Silver Dollar and the Ada B. claims in Copper Mountain, British Columbia. The exploratory work which has been done revealed a showing sufficiently favorable to justify making the first payments required. The remainder of the purchase price is spread over a long period of time and payments are to be made out of the earnings of the properties. The British Columbia also has options on the Voight holdings, which adjoin the newly acquired claims.

Notwithstanding conditions in Mexico, which apparently grow worse instead of better, mining operations are carried forward in El Oro without cessation. The El Oro Mining & Railway Co. reports operation of the mill for 29 days during September, treating 19,210 tons of ore and 15,910 tons of tailing, yielding bullion valued at $168,530. Operating expenses were $90,660, expended on development $24,130, total expenses $114,790, leaving a

BUNKER HILL & SULLIVAN MILL.

profit from mining operations of $53,740. The profit derived from the operation of the railway was $8140, making a total profit of $61,880, and $8000 was expended on permanent mine improvements. It has been many months since any effort has been made to enlist the public's capital in Mexican mining ventures. The Puebla Smelting & Refining Co., however, has just been listed on the New York Curb, and is to build and operate a smelter in the Magistral mining district in the state of Puebla. The claim is made that the company owns a large acreage of coal lands and fluxing material to operate a 500-ton custom smelter. It is stated that the machinery for the first half of the plant to be erected is already on the ground. The shares are now being traded in 'when, as, and if issued.'

Mining dividends continue to be the most interesting feature of the present situation. The Hollinger, which with the Dome divides the honors in Porcupine, has declared an initial dividend of 3%, payable November 2. This is the first money to come back out of mining operations in Porcupine and is but a drop in the bucket compared with the amounts that were sunk in claims at extravagant prices when the excitement was at its height. The Coniagas mine, at Cobalt, is to pay 12% on November 1. This is a regular 6% quarterly dividend, an extra dividend of 3%, and a further extra dividend of 3% which was to have been paid in May last, but distribution of which was temporarily deferred. It is a good indication when the investor begins to study the returns from such properties as the low-grade gold mines of Alaska, the Bunker Hill & Sullivan, and the Hecla in Idaho. Bunker Hill & Sullivan has paid more than two and a half millions in dividends, and is now paying 2½% per month regularly, with extra dividends at the end of each quarter. The Centennial-Eureka, which is owned by the United States Mining Co., has paid its second dividend of $1.50 per share for the current year. The Centennial-Eureka has

a capital of 100,000 shares, of which all but 136 shares are owned by the United States Mining Co., a subsidiary of the United States S. R. & M. Co. At the meeting of the Amalgamated Copper Co. held this week the board of directors acted as was anticipated and declared a quarterly dividend of 1½%, placing the stock on a 6% basis.

LONDON

Progress at the Geevor. Tin Mining Booming.—Development in Bolivia.

Last week I wrote about the boom in Cornish matters and mentioned that many well known American engineers have recently taken solid interests in the old county. Since then details have come to hand relating to the results at Geevor, a mine near Land's End having the Levant and Botallack mines as neighbors. This old mine has been reopened under the direction of another American engineer, R. Gilman Brown. The progress has been steady and sure, and the proportional distribution of work above and below ground has been well balanced. Operations were started in 1906 and exploration work was carefully conducted before any surface plant was provided. Subsequently 20 stamps and a dressing plant were erected. The later developments have been so satisfactory that the mill is to be extended so as to treat 100 tons per day, together with additional plant intended for the improvement of the extraction. Further capital will be required to complete the new outfit and to continue sinking and development. As a rule, Cornish managers do not commit themselves to any statement relating to ore reserves. Probably Edward S. King, now manager of Carn Brea & Tincroft, late of West Australia, was the first to say, though guardedly, what were the definite prospects for the future. Mr. Brown has gone farther, and states that 60,000 tons of ore has been proved at the Geevor above the fifth level, having a recoverable content of 30 to 35 lb. black tin per ton; also that on the fifth level the ore-shoot has been exposed for 1300 ft. During the past year the extraction has been about 23 lb. of black tin per ton, but the additional plant is calculated to improve upon this by 5 or 6 lb. per ton. Another interesting point in connection with the report is that a plan of the workings is given. This is another innovation and an example which other Cornish mines might well follow. The success at this mine is attracting considerable attention, and the results of reopening are in strong contrast to the misfortunes of its neighbor, Botallack. The other adjoining mine, the Levant, that has been worked continuously for a long time, is arriving at a crisis in its history. The landlords are demanding impossible terms for the renewal of the lease, and the shareholders, being mostly local residents, are utterly opposed to any modern idea connected with the technology or finance of mining. What the eventual upshot will be is more than I can say. It is remarkable how many people are now taking an interest in Cornwall. It appears as though many who have earned experience in Nigeria are desirous of not wasting it, and are therefore turning their attention to more hopeful lode-mining districts.

Tin is undoubtedly 'it' on the Stock Exchange at the present time. Bolivia is attracting attention as well as Cornwall, and, as a matter of fact, it is the only tin-producing country showing much promise. Bolivian ores are usually complex, silver, copper, tungsten, etc., being found in association with cassiterite. A company has been advertised this week, called the Porco Tin Mines, which has been formed with a capital of £125,000 for the purpose of developing the Porco mines in Bolivia. These have been worked in a small way for some years, especially for silver. The property is close to the branch line of the Antofagasta railway connecting with Potosi, and is 25 miles from that city. The original owner is Arturo Arana, of Sucre, and the introducers are José Richards and James Edwards, the latter being secretary of the Great Boulder Proprietary company, owning the mine at Kalgoorlie. The firm of Avelina Aramayo & Co. are the commercial agents. They are the owners of the Aramayo Francke mines at Chorloque, a hundred miles to the south toward Tupiza. Reports on the property have been made by José Richards, O. Gore Adams, the manager of the Llallagua tin mine near Oruro, and Bruce Marriott & Co. Richards' report is used as the basis of the prospectus. He estimates the ore reserve at the various workings at 45,000 tons, averaging 4.4% black tin. The cost of mining and concentrating is given as £32 per ton of metallic tin, and the cost of freight and smelters' charges in England as £28. There is a 10-stamp mill on the property, and it is first proposed to improve this and the accompanying dressing plant. A new mill of 20 stamps is to be erected with a capacity of 60 tons per day. The mine has been worked chiefly for silver in earlier days, and much tin ore has been left in the old stopes. The weak point of the prospectus is that the estimates of output and profit are based on the report made by Mr. Richards, who is admittedly interested in the sale of the property.

BLACK HILLS, SOUTH DAKOTA

Reliance Mill Starts.—Work at the Victoria.

The New Reliance mill has started. During the shutdown the plant was given a thorough overhauling and the slime department improved by the addition of a Portland filter, which will be employed as the final stage in the decantation and agitation slime system used at this mill. The mill contains thirty 1000-lb. stamps, giving a capacity of around 125 tons per day. F. C. Bowman, of Trojan, is manager. The Heidelberg group, belonging to John Treber and A. T. Roos, of Deadwood, is being systematically developed with a small crew, and gives indications of developing into a good mine. At the present time the owners are driving along the edge of an ore-shoot, and will shortly cross-cut it to determine the width. The ore is of good grade; the only question remaining to be settled is the quantity available.

The Hailstorm property, in the Two Bit district, has been leased to Louis Arpino and associates, who have commenced work and hope to be making smelter shipments at an early date. On neighboring ground, the Monarch, Nicoli brothers are taking out $80 to $100 ore and shipping regularly to smelters. Mr. Arpino believes he will open up some similar ore in an extension of the Monarch shoot. Lessees on the Wells Fargo, in Blacktail gulch, are making regular shipments, most of the ore going to the Golden Reward cyanide plant and some to smelters. A crew of men is employed at the Golden Gate property, in Blacktail gulch, in repairing the head-frame and timbering the 100-ft. shaft, preparatory to installing a small electric hoist and starting development at the bottom, which is on the quartzite. Work is under the direction of C. C. Todhunter, who represents E. J. Hoover.

The Victoria mill is running steadily, and 100 to 125 tons of ore per day is being treated. The plant has been running a little more than a month now, and is getting down to a good working basis. Rolls are used for crushing, and the screens have been changed so that practically all of the product will pass 20-mesh. The ore is extremely hard and yields a good proportion of its content by leaching. Mill solutions are 4 and 1½ lb. cyanide per ton, respectively. Consumption is 0.4 lb. per ton. Two pounds of lime per ton of ore is added at the rolls.

Eastern people largely interested in bonds of the Branch Mint company are investigating the property, and there is a probability that operations may be resumed before long. A request was made that the County Commissioners cancel a certain amount of taxes, and this has been taken under advisement. A large amount of taxes is due on the property, but as it has not been a producer for several years, it is believed the Commissioners will make a liberal reduction. F. L. Clemens, manager for the Gilt Edge Consolidated company, is making a careful examination of its property, with the idea of arranging for a resumption of milling at an early date. The property is at Galena.

JOHANNESBURG, TRANSVAAL

THREE GREAT PRODUCERS OF THE RAND.—DETAILS OF OPERATION.

The struggle for supremacy between the principal Rand gold-mining companies has been attended with varying results. Providing labor continues plentiful it is still difficult to predict whether the Crown or Randfontein will ultimately lay claim to supremacy. At the present time the outlook is all in favor of the Crown Mines, for not only does its ore yield a higher return per ton, but, on the whole, the yield is more uniform, while both underground and on the surface operations have been so concentrated and facilities so increased that little variation ought to take place from one month to another.

During the past three years the Crown Mines has spent over a million and a half sterling in equipping and developing the property, with the result that it has been found necessary to issue a million sterling debentures, the remainder being partly supplied by available working capital and partly by working profits. The result of this expenditure has been to increase the ore reserve from a total of four million to over ten million tons, the estimated value of the gold content of which is over fifteen millions sterling. New crushing stations have been built and the capacity of the mills increased from 150,000 tons to 230,000 tons per month, as follows: Crown Deep mill, 90,000 tons; Crown Reef mill, 75,000 tons; and Langlaagte Deep, 55,000 tons per month. Not only has the capacity of the milling equipment been increased, but the whole of the surface and underground equipment has been overhauled and so concentrated that the working cost is expected to be lower than any similarly placed property on the Rand. With regard to the life of the property, it may be pointed out that the Crown Mines owns an extensive area, but is intersected by a huge dike. Operations have so far been confined to the northern portion, about a third in area of the property, the veins below the dike not yet having been touched. It is estimated, however, to contain at least a hundred million tons of ore. Considering that there is every reason to expect the veins to continue beyond the confines of the present property, it is premature and futile to attempt to estimate its ultimate life, but at all events there ought, at present scale of working, be ample ore to last about fifty years.

The position on the Randfontein property also seems to be improving, but the mammoth mill of 600 stamps erected on the property is only half employed, and it is difficult to foresee the period when the policy of erecting such a huge mill will be fully justified. At the present time the tonnage crushed is about equal to the maximum capacity of the combined Crown mills, but the yield per ton is lower, and although the working costs are lower, the average working profit per ton milled is only half that of the Crown Mines. Then again, the official figures of the Randfontein Mines, despite the lower content per ton and higher stamp duty, show that the ore reserve is only about half that of the Crown Mines. There are good reasons to doubt whether the whole of the alleged reserve of developed ore is as available for mining as that of the Crown Mines, despite the lavish manner in which the Randfontein property is supplied with milling equipment. The scattered mines of the Randfontein are also a drawback. The northern section developments are not by any means encouraging, and such a huge and scattered concern is sure to be handicapped in times of labor scarcity. Affairs are improving at Randfontein, however, and with its huge reserve of milling capacity the property ought always to press the Crown Mines closely in the race for premier position.

The only other probable competitor for the leading position on the Rand is the East Rand Proprietary, whose doings during the first half of the present year show that this property constitutes a factor that the other large amalgamations cannot always afford to despise. In the face of the unduly pessimistic report of the superintending engineer the results of mining operations during the past six months are somewhat of a surprise, and clearly show that the despondent view taken by the new management was quite unnecessary, though as a policy perhaps justifiable. The tonnage treated fell considerably as compared with 1911, but the increase of the grade of ore milled from 25s. per ton to 32s. 9d. per ton, an improvement of nearly 2 dwt., gave rise to most surprise. But the costs advanced 5s. per ton, so that only 2s. 9d. per ton of the higher yield ranked as increased profit. The dip section of the East Rand Proprietary, represented by the whole present proved area of the Angelo Deep property east of the western shaft, as well as the Hercules property, is well known to be of very low grade. When worked, the ore will require considerable 'sweetening' from other areas. The question, therefore, naturally arises as to whether it is justifiable, with these future requirements staring the new management in the face, to sacrifice the richer portions by increasing the yield 7s. 9d. per ton, though only obtaining an increased

RANDFONTEIN MILL.

profit of 2s. 9d. per ton. The answer can only be supplied by those who control the future destinies of this huge property. During the last three months the grade of ore milled has shown a tendency to decline, and perhaps this may indicate that, as soon as possible, it is intended to abandon the forced selective mining policy of the past six months and proceed by crushing ore more in keeping with the average value of the ore reserves, looking for the maintenance of profits by lower working costs per ton and the treatment of an increased tonnage. It seems highly probable that the richer ore of these deep-level areas will be found beyond the water dike, where water troubles may naturally be expected, but with the installation of suitable pumps the water can be handled with ease. The development progress made during the past six months does not compare favorably with that for 1911, which the superintending engineer designated as utterly inadequate. When everything is taken into consideration it is clear that, despite the better results obtained during the past six months, the East Rand Proprietary is still a long way from being regarded as clear of all the difficulties and drawbacks which may sometimes give trouble.

Among the three principal Rand producers the Crown Mines promises to be the most consistent in the future, on account of its better and more uniform grade and the comparative ease with which not only the grade but also mining and ore reduction operations can be regulated, not to mention the huge reserves of ore. To bring the Crown Mines to this position has required a huge capital outlay, but there can be little doubt that in the long run this expenditure will be more than justified. It seems probable that the Crown Mines will usually be found at the head of the list of gold producers on the Rand and of the world. The Randfontein and East Rand Proprietary Mines will constitute good seconds and may occasionally be first; more especially Randfontein by virtue of its huge equipment, but there are so many difficulties to contend against underground in connection with both of these properties that they cannot be regarded as anything like as consistent producers as the Crown Mines.

KALGOORLIE, WESTERN AUSTRALIA

Fraser's Mine for Sale.—New Labor Agreement.—Black Range Improving.

Fraser's mine at Southern Cross, the first gold mine in this state to pay dividends, is for sale. The mine was floated in May 1889, four years before Bayley's Reward, at Coolgardie, was found; and paid its first dividend of $6250 in 1890. By May 1900, when work was stopped, the mine had produced $2,285,000 from 245,000 tons of ore, exclusive of residue, as the mine then had no cyanide plant. In 1901 the mine, with a 30-stamp mill and all accessories, was sold to the British and Foreign Development Syndicate for $2500. This syndicate did no development. They leased to tributers, who took out another 81,000 tons from the old workings for a return of $1,337,500, inclusive of gold from old and new residue. The whole of this gold was won from above the 300-ft. level, and taken from a payshoot 4000 ft. long. In January last the mill was shut down, and pumping was stopped; but tributers were allowed on the lease free of royalty, as the attorneys imagined that no ore could possibly have been left after tributers had been working the ground for 12 years. However, eight men began work, and their return during July was $5575 from 324 tons, or $17.20 per ton, a better average than had been previously obtained. Four years ago the Syndicate asked the Government to assist them to test the ground below 300 ft. by boring, and the Minister of Mines sent the government geologist, H. P. Woodward, to examine the mine. After an exhaustive inquiry, Mr. Woodward gave a favorable report. He pointed out that in addition to the lode worked, there were two other parallel lodes on the property, which had not been tested. The three would probably join in depth, when an enrichment might be anticipated. He closed his report as follows: "The only conclusion that can be drawn is that if boring is jointly undertaken by the Government and the company, it will be with every prospect of success." In spite of this nothing was done, and a mine which had produced $3,625,000 from 352,600 tons, worked to a depth of 300 ft. only, is now a derelict, and, if not sold will probably be abandoned. No wonder Western Australia is in the doldrums.

There is a prospect of the Great Boulder Proprietary buying the Great Victoria mine, at Nevoria. Backed by a Government subsidy of $5000, the owners, Delbidge & MacDonald, sunk a winze below the 300-ft. level, and continued the drift, which was then in 50 ft. After going another 50 ft., assays as high as $60 per ton were obtained, and at 100 to 125 ft. the average assay value was $13. A staff of samplers from the Great Boulder are thoroughly sampling the mine. Seven thousand five hundred tons of ore previously crushed showed the value for a width of 100 ft. to be $7, but there appears to be an enrichment at the 300-ft. level, while the lode seems to be wider than ever. Richard Hamilton, manager for the Great Boulder, is a very cautious individual, far too cautious, in fact, for the good of the country; if all operators gave prospectors so little encouragement prospecting would automatically cease. The price asked for the mine is $250,000, a mere bagatelle in most countries, but Western Australia has no capitalists.

The wages agreement at Kalgoorlie expires on September 30, and negotiations to extend the agreement for another period of three years are in progress. The five labor unions concerned have all held meetings to consider the ultimatum sent them by the Chamber of Mines. It is understood that the Chamber has offered to increase the pay of shovelers and trammers from $2.64 to $2.80, and to continue all other workers at the old rate. There will be a joint conference on September 1 to finally discuss the matter. Mining is at present so depressed that no general attempt to raise wages will, for a moment, be tolerated by the Chamber of Mines.

The Siberia Consols, at Waverley, was offered to Adelaide speculators for $50,000 cash and a quarter interest in shares. The vein on this property is 45 to 120 ft. wide, and has been proved by five shafts for a length of 600 ft. A total of 876½ tons treated from these shafts at the Government mill yielded $1,040,000, or over $118 per ton. This was picked ore, but the remaining 4000 tons on the dump is worth $6 or $7 per ton, so that the average of the whole lot is about $25 per ton.

The Black Range, which has paid regular dividends of $13,600 per month for years, is now opening out at a depth of 800 ft. This mine started with a cash working capital of $58,750, and has already paid $1,128,000 in dividends. The mine has produced $2,927,300 from 148,000 tons since 1905, a wonderful record for a property picked up for $25,000. This property was offered to most of the big firms of mining engineers, but they would not look at it, as the 35° dip was too flat to please them. Finally it was bought by Hans Irvine of Melbourne.

RHODESIA

Large July Output.—Tati Concessions.—Record of the Lonely Mine.

The gold output declared by the mines of Southern Rhodesia for the month of July is the third largest on record, and the production of other minerals is eminently satisfactory. The June and July productions are contrasted in the following table:

	June, 1912.	July, 1912.
Gold	£226,867	£240,514
Silver	1,826	2,017
Lead	928	916
Chrome iron	13,750	26,754
Coal	5,538	6,405
Totals	£248,909	£276,606

Apart from the substantial improvement shown in gold output, the large increase of chrome iron ore is especially worthy of remark. Clearly this is a branch of the mining industry in Rhodesia which is of growing importance. The properties of the Tati Concessions, Ltd., although not actually in Rhodesia, are always considered under the subject of Rhodesian mining. The Tati concession is really in the extreme northern portion of the Bechuanaland Protectorate and immediately adjoins southwestern Matabeleland. The quartz veins and the general working conditions are much the same as are found in the Matabeleland province. For years past the affairs of Tati Concessions have been in a languishing state, but recently the management endeavored to instill fresh life into the undertaking by introducing more generous mining regulations and in every way endeavoring to foster the prospector and tributer element in the territory. During the past few months prospectors have been arriving steadily, and good finds of gold, copper, and other minerals, are from time to time reported. The Durham Prospect Co. has possession of the New Zealand mine, and it is expected that crushing will be begun next month, after which monthly returns will be published. Arrangements are proceeding with responsible persons for the immediate development of the Monarch mine, and the Somerset, from which good results are stated to have been obtained. The Arab and the Giraffes claim have been let on tribute, and development is proceeding on the Charlie, Gloucester, Magdalen, Dollar Princess, Austria, Homeward Bound, and Piatra Reefs. A number of discovery claims have been registered, and apparently this hitherto much neglected district of small gold mines has attracted a number of prospectors and small capitalists from Rhodesia and the Transvaal.

The Lonely mine in the Bubi district was originally staked by two prospectors, who had considerable difficulty in raising £30 to register and protect their claims. Today the estimated profit is £518,000, there being 153,075 tons of ore developed, of an average assay-value of 23.26 dwt. per ton. This change has come about in a brief five years, and in the opinion of many the Lonely will continue to occupy an important place in the foreground of Rhodesian mining for a long while to come.

General Mining News

ALASKA

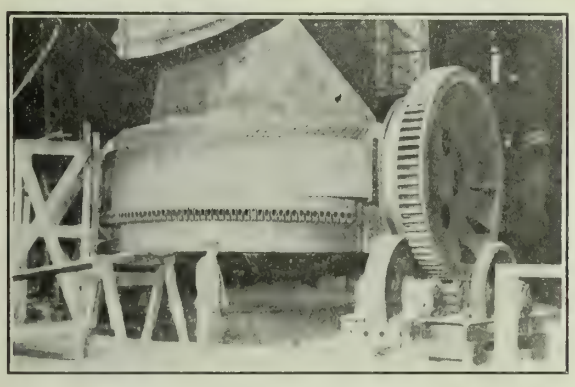
Fairbanks

On the right limit of 27 below Goldstream, three Russian miners have sunk 260 ft. and are still passing through gravel. This is one of the deepest workings in the country, nobody having any idea such a depth of gravel existed. It is all frozen. The deepest lode ever sunk in the placer workings of the district was on the Chatanika flats near the mouth of Sargent creek, where 310 ft. was sunk through frozen ground. During this work the prospectors used a shield to protect men in the shaft from falling pebbles. Rich ore has been found on the left limit of Goldstream, between Sheep and Nugget creeks, by O. Haines and Hudson brothers. Having worked out the ground opened for summer work on No. 17 Goldstream, the owners are sinking another shaft to be used in opening more gravel this winter. Peterson & Craig are sluicing night and day. No. 17 has already produced about $1,000,000 in gold.

ARIZONA

Cochise County

Rich silver ore has been cut in the Ormos mine, 18 miles east of Cumpas, on the second level at a distance of 582 ft. from the mouth of the adit; but its extent has not been determined so far. From a vein 12 in. wide about 5 tons of ore has been broken. This mine has already produced $70,000 from the upper workings. M. McWhorter and associates have taken up 30,000 acres of land for prospecting for oil, in the Lost Hills basin field, near Fairbank. On account of lack of funds, the Arizona Oil Co., which has a well down 1200 ft., has stopped



GREAT FALLS CONVERTER.

work; and the former people wish to pool their interests so that the well may be continued. The Minneapolis Copper Co. is resuming operations, and will continue the erection of its smelter, which was begun before Mexican rebels came on the property.

At the Copper Queen smelter, the first of the new Great Falls type of converters, which replaces two of the old barrel type, was blown in on October 18. Four more of these will be installed. In response to the wishes of a majority of its employees, the Copper Queen has decided to have pay-days twice a month.

Gila County

F. W. Hoar, manager for the Southwestern Miami Development Co., has taken an option on the Prospectors' group of 13 claims for $125,000. The prevailing formation is Pinal schist, much of it being mineralized, and it will be prospected by churn-drills. Shipments are being maintained from the Black Warrior mine to the Old Dominion smelter. The ore averages 7% copper. Surface equipment, and retimbering and enlarging the Copper Hill shaft at the Arizona Commercial is finished. The cross-cut on No. 16 level of the Old Dominion has passed through 8 ft. of chalcopyrite and bornite ore, averaging 12% copper.

Greenlee County

(Special Correspondence.)—N. L. Amster recently visited the Shannon at Metcalf, where they are opening ore 100 ft. lower than it has been mined before, and are taking out ore averaging 4 to 5% copper. The extension of the orebody has been proved to a point below the level of the Carter adit, which is a very important development. Production for September was below normal because of the freezing of one of the furnaces, and this months' output will also be smaller than usual, but is now increasing, and next month will show a decided increase. A considerable amount of development has been done during the past six or eight months, and from $7000 to $8000 per month is being spent for that purpose, all of which is included in the operating costs.

Clifton, October 17.

Mohave County

The Needles Mining & Smelting Co. is sinking the shaft of the Tennessee mine, at Chloride, to 800-ft. depth. On the 700-ft. level a good deal of ore has been opened. R. H. Cameron has taken a bond on the Loper and Carney mines, 8 miles east of Hackberry, in the Cottonwood mining district. The ore developed will average $20 per ton. The owners want $50,000 cash for the mines, which are near a railroad. Development is to be started at the Swope and Studley properties, in IXL basin. In cutting out a road on one of the claims, a vein of lead ore was opened. W. D. Grannis and F. B. Holcomb have been examining the mines of the Arizona Venture Corporation.

Pinal County

(Special Correspondence.)—It is stated unofficially that the American Smelting & Refining Co. has released its option on the Lake Superior & Arizona mine at Superior, after unwatering the mine and making an examination. The Calumet & Arizona company has a few men on the Newman-Thompson-Daggs group of 81 claims recently acquired under option at Superior, and is making arrangements to secure electric power from the Ray Consolidated mine, 14 miles distant.

Florence, October 17.

Santa Cruz County

(Special Correspondence.)—The former president of the old Arizona Commercial Copper Co., N. L. Amster, when speaking of the R. R. R. mine near Patagonia, said: "We have just cut a new orebody, parallel to the one on which we have been working, and 100 ft. from it, which is 23 ft. wide and averages 8 to 10% copper, and we are now driving on it. On the first orebody two stopes from 70 to 80 ft. long have been opened for a width of 40 ft., in ore which will average 10% copper. The winze is down 110 ft., and has 9% copper ore in the bottom. We are putting in a set of scales, and by October 20 will be shipping 100 tons of ore per day averaging from 8 to 10% copper, and this may later be increased to 150 tons per day. We are employing about 70 men." Engineers and others who have examined the mine say that it is the largest and richest body of copper ore ever opened in Arizona with such a small amount of work.

Nogales, October 17.

CALIFORNIA

Butte County

The Oroville Dredging Co. handled 95,349 cu. yd. of gravel, yielding gold worth $11,069, during the week ended August 31, and for the financial year to August 31, a total of 430,108 cu. yd. was dredged yielding $49,188.

Modoc County

(Special Correspondence.)—The sheriff of Modoc county has given official notice of the sale of the Ft. Bidwell Consolidated mines to satisfy a judgment for $12,164 in favor of James Williams. The date of sale is October 28. It is reported that representatives of the company plan

to buy it in. Failing to do this, the company has six months in which to redeem the mines. Considerable southern California capital is interested in the mine, while much stock is held by Detroit people. A number of companies are arranging to conduct operations in the Gold Basin portion of the High Grade field. This lies in the lower region, where the light snowfall does not seriously impede work.

Ft. Bidwell, October 18.

Nevada County

(Special Correspondence.)—The Gold Point mine, at Union Hill, near Grass Valley, is being worked in a small way by A. Onn, a Colorado miner, who lately came here. The mine is between the well known Idaho and Brunswick mines, and the operator states that he has found an extension of the recently discovered Brunswick vein. The shaft on the Gold Point has been deepened 50 ft. and development is yielding ore of high value. The new hoist, which is capable of hoisting from 1200-ft. depth, is ready for work. The main shaft has been timbered to 230 ft., and it is intended to sink 300 ft. farther. Some good ore has been taken out of the mine, and Grass Valley men are quite sanguine about future prospects.

Grass Valley, October 21.

The Grizzly Ridge Mining Co., which is operating the Oustomah mine on Wet hill, has made a contract with the Pacific Gas & Electric Co. to supply electric power, which will displace the present water-power, although this will be always available in case of emergency. E. C. Klinker is in charge of the property. The mine has been unwatered to the 500-ft. level, where a vein was exposed by collapse of the workings, and work is to be started on this vein on the 300 and 500-ft. levels. As soon as it has been opened enough, the 10-stamp mill will commence work. After the mine-water is out from the 1050-ft. level, sinking will proceed to 1500-ft. depth. The Oustomah was formerly known as the Pennsylvania and is one of the oldest quartz properties in the district. Preparations are being made for working the Flat Iron placer mine, above Camptonville, as soon as there is sufficient water for sluicing.

Plumas County

The California-Utah Gold & Copper Co. has seven claims, about 12 miles from Doyle, in this county, and during the past few weeks a hoist of 1000-ft. capacity has been purchased, bunk-houses built, and the property put in order for work on an extensive scale. When the Utah people took over the property, a shaft had been sunk 60 ft. in ore, and a cross-cut passed through 16 ft. of ore. On the surface a large lode can be traced for 2000 ft. It consists of a leached iron gossan, copper showing a few feet below the surface. The property is situated at an elevation of over 6000 ft., while there is plenty of timber and water available.

Sierra County

The owners of the Mountain House group of gravel claims have bonded them to San Francisco people. They consist of seven locations of 160 acres each, and there is plenty of timber for mining purposes. The work for the year will be done in an adit from McKenzie diggings.

Siskiyou County

For a considerable time past a large power-plant and dredging project has been spoken of, to be erected at the junction of the Klamath and Salmon rivers, 20 miles below Forks of Salmon. At this point is a mountain, and a tunnel will be bored from the Klamath river across to the Salmon, just above the base of the mountain. The power station is to be built at the Salmon end of the adit where a 50-ft. head will have been gained in passing through the two-mile tunnel. In the dry season the former river would be drained into the latter, and the electric power generated will be used on a dredge to be built to work that part of the Klamath river drained between the head of the tunnel and the junction. The company wants a 50-year franchise, and is prepared to spend $1,000,000 on the work. Besides dredging, it is intended to start other works, supplied by power from the plant.

Trinity County

The Globe Consolidated Mining Co. has completed its tunnel through Globe mountain. It is 1723 ft. long and 600 ft. below the summit, and was found necessary for the cheaper working of the Chloride, Bailey, and Globe mines. Below the tunnel on the west side, the Globe mill will be built. About 300 tons of machinery has been delivered at the property, including a 20-stamp mill and cyanide plant of 100 tons capacity. Over 100 men are employed.

Tuolumne County

Work has been started at the Wickham mine by the Mother Lode Syndicate, which has taken it under option. The Mangate mine is being unwatered preparatory to further development. The Santa Isabella group of claims is being examined by Los Angeles people.

COLORADO

Clear Creek County

(Special Correspondence.)—An 8-in. streak of silver-lead ore has been uncovered on the Rosebud property on Democrat mountain which yields 180 oz. silver and 34% lead. Stoping has been started. G. W. Teagarden is manager. T. W. Cunningham, leasing on the Gambetta mine, on Republican mountain, has found a 4-ft. body of zinc ore which assays 51% zinc and 36 oz. silver per ton. From three to four carloads are being shipped each month. Hurley & Co., leasing on the Harris mine, in East Argentine, made a shipment of five tons of second-class ore this week which returned 450 oz. silver per ton. These lessees are driving on a 14-in. vein. There is also showing a 2-in. vein of glance which carries 15,000 oz. silver per ton. Work has been resumed on the Gold Coin mine on Griffith mountain. L. Hoery, the owner, will start shipments of lead-zinc ore during the coming month, the product to be sent to the Mineral Chief mill for concentration. A rich shoot has been cut on an unknown lode, and from a shipment of two wagon-loads returns of 190 oz. silver per ton were realized. This lode was penetrated 800 ft. from the portal of the Silver Plume adit on McClellan mountain, and the shoot is showing for 300 ft. H. L. Roberts, of Idaho Springs, is manager. Work has been resumed on the Dewey property in East Argentine district. Oscar Johnson is owner. The Mineral Chief mill is finishing on an average two tons each of lead and zinc concentrate per day. A. L. Stephens states that he is treating about 100 tons of ore each week from the New Boston mine on Democrat mountain. The shipments from the Santiago mine in East Argentine average two carloads per week, the product being consigned to the Salida smelter. The average value of the ore is $90 per ton. D. H. Burlingame is manager. Shipments of high-grade ore have been started from the Kittie Ousley mine, in West Argentine. Operations are being carried on through the 200-ft. shaft, and stoping is in progress on a 10-in. vein.

Georgetown, October 16.

Lake County (Leadville)

It is generally known throughout the country the great benefit the Yak tunnel has been to this district, but few people know the area of ground which it has made possible to be profitably worked. Properties which had been idle for years on account of the heavy expense of coping with water, are today being worked on a large scale. Through this adit, mines on Carbonate, Iron, and Breece hills, and in Big Evans gulch, are being developed. There are 34 sets of lessees working along the adit on 21 claims, and several of these claims have as many as four sets of lessees working different blocks of ground. The average monthly shipments total 12,000 tons.

About 25 tons of ore is being sent daily to the smelter from the Sugar Loaf Consolidated, which shows improve-

ment of late. The Eagle Mining & Milling Co. is to enlarge its mill, and new roasting furnaces, tables, and magnetic separator will be installed, making the daily capacity 120 tons. The ore contains lead and zinc. Lessees at the Highland Chief, Breece hill, have opened 3 ft. of carbonate of zinc ore.

GILPIN COUNTY

The main shaft at the Ralls County mine is down 795 ft., and will be continued to 1000-ft. depth. The vein in the shaft at present is 8 ft. wide, showing copper ore. On the 500-ft. level the east drift shows 3½ ft. of ore worth 2.2 oz. of gold and 3.8 oz. of silver per ton. A good deal of development is being done at the Belden mines, on the Spencer, Ranney, and Black Quartz lodes. Seventy tons of ore has been sent to the mill by the Castle Rock in Chase gulch. The usual work is under way at the Wood, Gomer, and West Calhoun mines, while the East Centennial, Pratt, Ethen Allen, Elephant, and Togo lodes are being worked by local pools. The Golden Flint company has completed its aerial tramway from the mine to the mill, a distance of about one mile.

SAN MIGUEL COUNTY

During September the Tomboy mill worked 28 days and treated 10,000 tons of ore yielding bullion and concentrate worth $84,000. The net profit was $40,000, and $11,300 was spent on improvements.

TELLER COUNTY (CRIPPLE CREEK)

The sampler at the Colburn mill is finished, and the mill resumed treatment of ore on October 16. It has

COLBURN MILL, CRIPPLE CREEK.

now a capacity of 3000 tons per month in treating ores by the Clancy process. It is stated that the process used is cheap enough, but the mechanical arrangements have made high costs. Eastern people interested in the Midget-Bonanza property have made an inspection, and in all probability a mill will be erected. Ore is being mined on No. 8, 9, and 10 levels. The Trilby mine, on Bull hill, is shipping about 25 cars of ore monthly from the 1100-ft. level, while the Isabella has sent out 35 cars for the first two weeks of October. Work on the 1275-ft. level proceeds steadily. During the week ended October 14, the following shares were dealt in at Colorado Springs: El Paso, 300; Elkton, 5150; Isabella, 21,000; Mary McKinney, 5000; Portland, 600; and Vindicator, 2000. The employment bureau for the district has proved to be a great success.

IDAHO

SHOSHONE COUNTY

More timber will be cut in the Pine Creek district this year than before, and it is estimated that 5,000,000 ft. will go down the Coeur d'Alene river next spring. The Springston Lumber Co. has bought all the white pine lumber. The district is rapidly attracting the attention of miners, who will work through the winter. The Highland Surprise, Nabob, and Amy-Matchless will employ a good number of men.

The directors of the Caledonia Mining Co. are to defend title to their orebodies against the Bunker Hill & Sullivan company. Several experienced mining engineers have been engaged, and a thorough examination of the disputed ground will be made. Under the restraining order issued by the court, the former company can continue to mine ore as long as it is stored on the property. It will be prepared for shipment, as the court allows a nominal fee for mining while the case is pending, although the Bunker Hill establishes its claim to that part of the property.

Work has been resumed in the Bunker Hill portion of the Bunker Hill & Sullivan, and the first ore was shipped since the fire. The men are working on No. 10 and 11 levels and will soon be on No. 12. Pumps have been installed and No. 13 is being unwatered. Repairs at the shaft and hoist are nearly finished.

On October 16 the Stewart company was denied an injunction against the Ontario company. This decision is not final, and is subject to appeal. In the meantime the latter company can mine ore and is not compelled to account for the proceeds of its shipments. This is a case where the Stewart company claims the veins in the Ontario property by the law of the apex.

NEVADA

ESMERALDA COUNTY

At the Grizzly Bear claim of the Goldfield Consolidated a cross-cut is being extended south toward the Atlanta, at a depth of about 1350 ft. At 1330-ft. depth in the Merger a cross-cut is being driven at the rate of 15 ft. per day toward the western boundary of the St. Ives claim. It has been found that the dump at the Kabawgam claim, owned by the Begole Syndicate, is not waste as was supposed, but ore worth $22.79 per ton in gold, silver, and copper. This came from a depth of 370 ft. west of the Consolidated. Shipments have been resumed from the Florence Goldfield. Two leases have been recently granted at the Combination Fraction. The Blue Bull shaft is down 525 ft. and is in promising formation. A shipment of high-grade ore has been made from the company workings of the Black Butte.

HUMBOLDT COUNTY

An 18-in. vein has been cut on No. 10 level of the Seven Troughs Coalition mine, and assays over $100 per ton. A basalt dike has been entered on the sixth level, with veins of quartz showing. The cross-cut should enter the Jess-Bard vein within 100 ft. Lessees have part of the old workings of the property above No. 2 level. Old workings of the Industry group are being cleaned out preparatory to prospecting for rich silver and gold found there.

NYE COUNTY

During the week ended October 19 the mines at Tonopah produced 10,848 tons of ore valued at $271,200. The September tonnage was 43,530 from all mines. The Tonopah Mining Co. treated 14,806 tons, yielding 253,700 oz. of bullion worth $212,100, and shipped 56 tons of concentrate worth $32,800. The net profit for the month was $154,073. The Tonopah Belmont treated 12,405 tons, yielding 356,241 oz. of bullion worth $290,401, with a net profit of $170,496. On October 18 this company shipped 132,514 oz. of bullion valued at $109,000, the result of the first 10 days' work of the current month. Preparations for sinking the main shaft are still in progress, the concrete bulkhead in the sump is being set, and the pump station nearly finished. There is little fresh to report from the Tonopah Mining Co.'s property. A shipment of 48 tons of ore from the North Star last week returned about $106 per ton, and another car of similar ore has been sent out. This ore comes from the 850 and 1250-ft. levels. At the Merger, on the 980-ft. level, the west drift was extended 30 ft. in the ore-shoot, assays returning from $80 to $100 per ton. A good deal of improvement has been shown in the Jim Butler, and good ore is being mined on the 600-ft. level. The MacNamara company shipped last week bullion worth $12,000. Owing

to the breaking of the chain-drive belt on the 150-hp. motor driving the tube-mills, the West End mill was shut down for 22 hours. The diamond-drill at the East End is down 382 ft. in andesite rock. The Buckeye-Belmont shaft was down 1035 ft. on October 15, with a flow of water about 1300 gal. per day. The shaft is of two compartments, each 4 by 4 ft. in the clear. Costs of sinking per foot are as follows: April, $23.38; May, $23.49; June, $24.82; July, $31.39; August, $30.80; and September, $30.46 per foot.

Production of the White Caps mine, at Manhattan, from May 24, 1911, to October 1, 1912, has been published by the secretary of the company. There were 5718 tons treated valued at $169,948, of which 144,437 was recovered. The company received $15,506 in royalties, while the lessees got $85,596 net. A new orebody has been discovered in the old Bath lease, now worked by the Litigation Hill company. It is 6 ft. wide and averages over $20 per ton. On the Kendall-Douglas lease, at the Manhattan Consolidated, a rich vein 16 in. wide has been opened, parallel to the main lode of the property.

Storey County

Since the last assessment, No. 89, levied June 30, 1910, the Ophir company has produced 23,500 tons of ore yielding $821,880, and a net return of $724,941. Three dividends of 10c. each, equal to $60,480, have been paid. The Ophir has paid $202,706 to the Comstock Pumping Association. The new cyanide plant, which cost $36,000, is now treating the tailing near the Kinkead mill, in Virginia City, of a gross value of $120,000, of which $90,000 can be recovered. Since September 1903 the Ophir has paid 12 dividends totaling $282,240, and collected two assessments of $100,800.

The recent development on the 2500-ft. level of the Sierra Nevada has been the cause of much speculation, and many visitors have inspected the mine. On the hanging wall is a rich vein 8 in. wide, which assays from $175 to $504 per ton, while the remaining 24 in. of ore averages $20 per ton. During the week ended October 19 the Mexican mill treated 451 tons averaging $50.35, with 94% extraction. The north stope on the 2500-ft. level yielded 530 tons worth $71 and 83 tons worth $22.22 per ton came from the 2400-ft. level. The total mine production was 624 tons, worth $41,000. At the C. & C. shaft all pumps worked full time, and necessary shaft repairs were made. At the Ward shaft, pumps and other equipment are being removed from the 2100 and 2475-ft. stations. The Crown Point shipped 661 tons of ore to the Yellow Jacket mill.

White Pine County

(Special Correspondence.)—The Nevada Consolidated company started work at Copper Flat last week with 85 men, and gradually increased the number to 200 men. There will be no recognition of the Western Federation of Miners. When the strike was called the ordinary miner had no voice in the matter. Rule or ruin has been characteristic of the union methods from Coeur d'Alene to Cripple Creek, and they will not succeed at Ely or at Bingham. At the Boston-Ely, diamond-drilling was tried in the formation below the 1245-ft. level, that is, below water-level; but the ground caved. The manager is driving southwest from the Emma shaft to cut the old Matilda vein, which had a good gold and silver content at the surface. One vein 30 ft. wide, containing chalcopyrite, and assaying 7% copper and over $5 in gold has been opened. There is a large area of leached ground between the surface and bottom level.

Kimberly, October 15.

SOUTH DAKOTA

Lawrence County

The Homestake declared its regular monthly dividend of 50c. per share on October 17. The amount payable on October 25 is $109,000, and the total paid to date is $23,443,550.

UTAH

Beaver County

The Horn Silver claims are being surveyed, and considerable new work is planned. Ore assaying 61.7% lead, 20 oz. of silver, and a trace of gold has been cut on the 210-ft. level of the Noonday property.

Emery County

A. L. Canfield, of New York, is stated to have secured an option for purchase of the Oscar Beebe vanadium property for $20,000.

Juab County

The lease of the Galena King mine is proving satisfactory, and ore carrying lead, silver, and gold is being shipped, the last carload returning $1877. Zinc ore is being opened to some extent at the Yankee Consolidated mine, and six carloads per month are being shipped, the last lot of 95 tons yielding a net return of $2219. An explosion of powder in a temporary storage house at the Chief Consolidated resulted in damages costing $500. Owing to the Tooele smelter shutting down its copper furnaces on account of the Bingham strike, the Chief will send a limited supply of ore to the United States S. R. & M. Co.'s plant. The electric pumps at the 2200-ft. level of the Centennial Eureka are being removed, and this part of the mine will fill with water. A site for the new mill for the Knight mines has been selected on the Boston & Tintic property. The process will include roasting and chlorination. About 180 ft. above the 500-ft. level of the Iron Blossom mine an orebody over 10 ft. wide and assaying from 40 to 70 oz. silver and 25 to 30% lead has been opened. The Opohongo has paid a dividend of 2c. per share, amounting to $20,000. Ore shipments from the Tintic district during the past week totaled 170 cars, of which the Centennial sent out 40 and the Chief 23 cars.

Salt Lake County

There has been little trouble at Bingham during the past week, and about 1000 men are at work at the mines. Strike-breakers are arriving, and the strikers have made sundry demonstrations. Four steam-shovels are at work; and 5000 tons of ore has been sent to the Arthur and Magma mills. None of the millmen joined the strikers. The smelter at Garfield is still working. Various statements have been made by both sides, but the management apparently has the best of the argument.

The Intermountain Transportation Co., with a capital of $300,000, has been formed in Salt Lake City to maintain a modern haulage system throughout Idaho, Utah, and Nevada. The company is to use motor trucks in the various mining districts for carrying freight, and will have four at work within 60 days. A large tonnage has already been contracted for. It is argued that many mining districts would now be active if there were cheap methods of transport. Directors of the Michigan-Utah company visited the mine last week. All the ore mined is to come from the City Rocks side of the range, and a hoist is being installed at the winze connecting the old City Rocks and Solitude adits. The latter was driven into the mountain by the old Utah Mines Coalition Company.

Utah County

A draft for the sum of $1,800,000 has been drawn by Jesse Knight, as president of the Knight Power Co., on the Electric Bond & Share Co. of New York, who bought the power-plants. The proceeds will be used in settling the affairs of the power company. A committee will attend to the dissolution and handing over the properties to the new Utah Power Co. The final dividend to the shareholders will be $140 per share.

WASHINGTON

Ferry County

The Imperator-Quilp company, of Spokane, which has been working the Quilp mine in the Republic district, under option to purchase, has commenced suit against the Quilp company and its secretary for $410,000 damages, on the

ground that fraudulent maps of the property were supplied. The option price was $250,000, of which $15,000 was to be paid on or before September 24, 1910, and $5000 every 90 days thereafter until the purchase price was paid, provided this was done by March 9, 1913. At the time of the contract, the Quilp mine had estimated ore reserves of $200,000, which were marked on plans supplied to the purchasers; also, that part of the mine which the plans showed to contain ore was under water, and the purchasers had to rely on representations of the Quilp people; and also it was found that the orebody was in another claim adjoining this mine.

Stevens County

In an adit 700 ft. long and at a depth of 325 ft., the Aurora Mining Co. has opened 25 ft. of high-grade copper ore, and as soon as bins are built shipments will be made. Near the portal of the adit a large vein was opened last spring. Shipments of gray copper ore are to be sent from the Superior mine, near Brown's lake, in the Chewelah district.

CANADA

British Columbia

During the first nine months of the current year, mines in the Slocan district have shipped 4725 tons of zinc and concentrate, to which the Lucky Jim contributed 1106 tons of ore averaging 50% zinc; Van Roi, 1981; Standard, 1504; Hewitt. 100; and Noble Five, 34 tons. The Rambler-Cariboo is expected to join the list of shippers shortly.

Cobalt

Since 1904, the production of this district has been 140,230,383 oz. of silver, worth $72,263,952, while $35,242,318 has been paid in dividends. The Beaver Consolidated mill is to be increased to treat 120 tons per day, due to the favorable nature of development at the 530 and 600-ft. levels. During the past week the Nipissing company sent 154,273 oz. of silver, valued at $99,521, to London, England. Timiskaming dividend amounts to $75,000. The company has cash in bank totaling $255,650, while there is $65,803 owed by the smelters, and ore worth $34,261 is on hand. The Coniagas dividend of 12% is payable on November 1, making the total to date 107%, equal to $4,280,000.

Dawson

In September the Yukon Gold Co.'s dredges handled 944,300 cu. yd. of gravel averaging 54c. per yard, with a total yield of $515,000, against 727,948 cu. yd., 69c. per yard, and $506,577 in September 1911. For the season to September 30, gold recovered has totaled $2,917,700, against $2,172,582 for the previous season.

Porcupine

The Hollinger company has declared a dividend of 3%, payable November 2. In future dividends are to be paid every four weeks, this being equivalent to 39% per year. The Dome Lake company, which holds three claims in this camp, is to be reorganized, and the capital reduced from $2,500,000 to $500,000. Mine development has been satisfactory of late, and the stamp-mill will be ready in a few weeks. The main shaft of the McEneany is down 400 ft. On the 200-ft. level about 600 ft. of work has been done on the lode, with 7 ft. exposed at the face of the drift. All concrete foundations at the Dome Lake mill are finished. In the mine three levels are being driven on No. 3 vein, where the average width is about 3 ft. of high-grade ore. At the Dome Extension most of the development is being done on the 200-ft. level.

MEXICO

Chihuahua

(Special Correspondence.)—On the morning of October 2 a band of rebels numbering 150, under de la Torr, unexpectedly visited the Concheno property and demanded ₱10,000 and a supply of food and clothes. As October 1 was pay-day there was only ₱500 on hand. The rebels then helped themselves to ₱10,000 worth of goods at the company's store, giving receipts for money and articles commandeered. They also took several horses and gear, and searched the houses of Americans and Mexicans for money, arms, and jewelry. No violence was attempted, and no resistance made, but two Americans were fined ₱200 each for having weapons hidden. The rebels were disappointed and threatened to kidnap two Americans to hold for ransom. They were armed with Mausers, but had little ammunition, and appeared nervous. Detachments of Federals from Dolores, Ocampo, and Guerrero were trying to surround them. The migration of rebel bands to the south is what the mines have to fear.

Concheno, October 5.

After a shut-down for two months caused by rebels infesting the district, the Yoquivo Development Co. has resumed work at its mine and mill. The district is free from trouble now, and the manager, C. Qualey, hopes to continue operations. Rebels have also disappeared from the Ocampo district, and the La Princesa, in Cusihuiriachic, has been shipping ore to the Chihuahua smelter for some time. The Rio Plata Mining Co., of the Arteaga district, is operating its mine and mill full time. No uneasiness for the future of the Parral district is felt by mining and business men, and lately several mines resumed operation. The railroad is busy carrying ore to the smelters at Chihuahua, Mapimi, and Torreon. Business generally is gradually improving, and a fair number of prospectors have gone into the hills. Despite the rebellion of the past four months, the Cusi Mining Co. has maintained ore shipments to the smelters. More machinery is to be installed, and a new mill may be erected early next year. C. R. Watson is manager. Owing to the stoppage of railroad communication, shipments of copper from the Rio Tinto could not be made, but now that conditions have improved, it is being sent daily to El Paso. During the shut-down all machinery was overhauled.

MAP OF MEXICO.

PERU

The Inambari Gold Dredging Concessions, Ltd., of London, has raised the necessary capital to continue its work with the large dredge completed this year. The Huinac Consolidated Copper Co., Ltd., was formed in London in July, with a capital of $2,000,000, and absorbed the mines of the Huinac Copper Mines, Ltd., in liquidation. The mines are in the province of Huarez. T. H. Foulkes, with 10 miners and mechanics, has sailed for Salaverry, on the way to the mines of the Compania Minera Ophir, Ltd., at Salpo. They will lay the new track and install an air-compressor in the working adit, from which it is proposed to begin development of this important group of mines.

Personal

Professional men are invited to send news of their engagements and travels. Such news is interesting to friends.

W. F. Wood is in San Francisco.

H. Foster Bain is at Cleveland.

James A. Pollock is at Alta, Utah.

Murray C. Godbe is in the Northwest.

J. P. Keene has gone to Mono county.

John B. Farish is at the St. Francis.

C. H. Bailey was here during the week.

M. S. Milward is here from Chihuahua.

Charles E. Virden is at the St. Francis.

R. H. Chapman has returned to Montana.

Charles G. Patrick is here from Goldfield.

R. L. Hussey, of Los Angeles, is at the Palace.

W. H. Lattimer was in San Francisco recently.

Edmund Juessen has gone to Kingman, Arizona.

William Burnett, of Cobalt, is in San Francisco.

Clarence Bamberger was at Ely, Nevada, recently.

George H. Hayes was here from Los Angeles last week.

C. G. Rothschild is now at 43 Leonard street, New York.

J. M. Callow has returned from the East to Salt Lake City.

E. J. Collins was in Tonopah last week on professional business.

John H. Miles was in San Francisco and has returned to Idaho.

E. F. Burchard was in San Francisco and has returned to Washington.

Percy E. Barbour has returned to North Carolina from New York City.

Kingdon Gould has been inspecting his coal properties in southern Illinois.

Barry Searle has gone to Nicaragua to spend a month at the Lone Star mine.

A. D. Lemaire, of Valley Mountain, Nevada, has been visiting San Francisco.

Walter F. Stevens, manager for the Ferrobamba mines, has returned to Arequipa.

Noel Cunningham is now mill superintendent for the Hollinger Gold Mines, Limited.

Marshall S. Walker is now at the United States Assay Office, 23 Pine street, New York.

J. A. Holmes was in town during the week and expects to sail for Panama on November 2.

Henry B. Kaeding is making an extended trip to the copper mines of the Lake Superior region.

Richard B. Stanford has left New Orleans for a few weeks trip to the Topaz mine in Nicaragua.

F. J. Coleman, assistant mine superintendent for the Detroit Copper Co. for many years, has resigned.

E. C. Vigeon, assistant general manager for the Spassky Copper Co., left London for Russia on October 4.

C. W. Purington passed through San Francisco on his return from Alaska and is now at Brookline, Massachusetts.

R. B. Lamb is making a professional trip to the Gowganda silver district and will go to the goldfields of northern Ontario.

Obituary

Charles R. H. Blyth died of typhoid fever at Aranzaru, Zacatecas, Mexico, on September 19. Mr. Blyth, who was a graduate of Freiberg, was an engineer of prominence, and his death at the age of 28 is generally regretted.

Thomas Price died at his home in San Francisco, October 13, at the age of 77, from heart failure. He was born in Wales and became professor of chemistry in the Normal College at Swansea, but came to San Francisco in 1862, where he assisted in the organization of the Cooper Medical College. The later years of his life were spent in consulting work, in which he attained enviable distinction.

Market Reports

LOCAL METAL PRICES

San Francisco October 24.

Antimony	11—11½c	Quicksilver (flask)	41.50
Electrolytic Copper	18—18¼c	Tin	62—63½c
Pig Lead	5.35—6.30c	Spelter	8¼—8½c

Zinc dust, 1400 lb. casks, per 100 lb., small lots $9.50—9.75; large $7.50—8.50

METAL PRICES

(By wire from New York.)

NEW YORK, October 24.—Copper is easier because of European sales. Lead is easier on account of Western sales. Spelter is steady, but the business done is small. Average daily prices for the past week, in cents per pound, based on wholesale transactions, standard brands, are given below.

Date.	Electrolytic Copper.	Lead.	Spelter.	Silver, per oz.
Oct. 17	17.35	5.08	7.28	63¼
" 18	17.35	5.08	7.28	63⅛
" 19	17.30	5.08	7.28	63¼
" 20	Sunday.	No market.		
" 21	17.30	5.06	7.28	63¼
" 22	17.25	5.06	7.28	63
" 23	17.25	5.06	7.28	63¼

LONDON QUOTATIONS

(By cable, through the courtesy of C. S. Burton & Co., New York.)

	October 24.
Camp Bird Ltd	$ 6½
El Oro	3½
Esperanza	9¾
Oroville Dredging	1½
Santa Gertrudis	6⅜
Tomboy	6⅜

COPPER SHARES—BOSTON

(By courtesy of J. C. Wilson, Mills Building.)

	Closing prices, October 24.		Closing Prices October 24.
Adventure	$ 6¼	Mohawk	$ 61
Allouez	40	North Butte	35½
Calumet & Arizona	76¾	Old Dominion	59½
Calumet & Hecla	550	Osceola	106
Centennial	19½	Quincy	81½
Copper Range	54	Shannon	14½
Daly West	3⅛	Superior & Boston	1½
Franklin	10	Tamarack	41
Granby	61	Trinity	4½
Greene Cananea, ctf.	9⅞	Utah Con	12
Isle-Royale	33	Victoria	2½
La Salle	4⅜	Winona	4½
Mass Copper	6¼	Wolverine	71

NEVADA STOCKS

(By courtesy of San Francisco Stock Exchange.)

San Francisco, October 24.

Atlanta	$ .20	Montana-Tonopah	$2.12
Belcher	.28	Nevada Hills	1.62
Belmont	9.40	North Star	.35
Big Four	.41	Ophir	.43
Con. Virginia	.37	Pittsburg Silver Peak	.84
Crown Point	.40	Round Mountain	.36
Florence	.78	Savage	.11
Goldfield Con.	2.65	Sierra Nevada	.41
Halifax	1.70	Tonopah Extension	2.75
Jim Butler	.69	Tonopah Merger	1.12
Jumbo Extension	.33	Tonopah of Nevada	6.37
MacNamara	.22	Union	.58
Mexican	2.52	Vernal	.11
Midway	.48	West End	1.67

MINING STOCK QUOTATIONS—NEW YORK

(By wire from C. S. Burton & Co., New York.)

	Closing Prices. October 24.		Closing Prices. October 24.
Amalgamated Copper	$ 91⅞	Miami Copper	$ 27⅜
A. S. & R. Co.	83⅜	Mines Co. of America	2⅜
Braden Copper	6¼	Nevada Con	21⅞
B. C. Copper Co.	4½	Nipissing	8¼
Chino	47⅞	Ohio Copper	1⅜
First National	1⅞	Ray Con	21
Giroux	4¾	Tenn. Copper	42
Goldfield Con.	2½	Tonopah Belmont	9⅜
Greene-Cananea	9⅞	Tonopah Ex.	2⅜
Hollinger	14½	Tonopah Mining	6½
Inspiration	19⅞	Trinity	6
Kerr Lake	2⅜	Tuolumne Copper	2⅞
La Rose	2⅜	Utah Copper	63
Mason Valley	12¾	West End	1⅜
McKinley-Darragh	1⅞	Yukon Gold	3½

James Lewis & Son's Copper Report

Standard copper fell from £79 7s. 6d. for cash on September 2 to £78 2s. 6d. on the 13th, gradually recovering to £79 1s. 3d. on the 23rd, with sales since between £78 16s. 3d. and £79, until September 30, when £79 5s. was paid. Closing prices are £78 17s. 6d. for cash, and £79 15s. for three months prompt. Sales totaled nearly 35,000 tons.

A large business, estimated to be about 25,000 tons, has recently been transacted in electrolytic copper for English consumption, and also for export to Europe at 17¾c. per pound for the former and £81 15s. per ton for the latter, by American refiners, who have now raised their selling price to £82 per ton, at which some business has been done. Against their purchases of refined copper, European dealers have freely sold standard, with three months prompt, at £79 10s. to £80 per ton.

The future price depends upon whether the present large consumption in Europe and the United States will be fully provided for by the greatly increased and increasing production of American and other mines, stimulated by the large profit consequent on the advance of 40% in the value of copper, as compared with the average price of last year.

The enlarged equipment of the Hampden Cloncurry mines, in Queensland, will enable an output of 650 tons of copper per month, while the Mt. Elliott mine, also in this state of Australia, produces about 700 tons per month.

American shipments from northern ports for the past month are advised as 25,572 tons. European stocks decreased 1262 tons, and the visible supply 2387 tons during the month. Imports are 2569, and deliveries 7576 tons less than the same period last year. Total arrivals in England and France for the month were 14,394, and deliveries 14,697 tons fine. Arrivals in England from Chile were 1949, and deliveries 2228 tons; and from other countries 9653 and 9375 tons, respectively. Liverpool and Swansea received from the United States 2050 tons of bars and 695 tons of plates, equal to about 2734 tons fine copper; in London 759 and in France 2332 tons. Chile charters for the month are advised as 2700 tons, including 1225 tons for the United States.

STOCKS OF COPPER (TONS FINE)

	1912.			
	Jan. 1.	Aug. 1.	Sept. 2.	Oct. 1.
Chilean in—				
Liverpool and Swansea..	4,225	5,671	5,558	5,279
France	714	1,005	981	987
American in—				
Liverpool and Swansea..	12,939	3,531	2,450	1,887
France	4,033	5,848	6,356	5,975
Sundries in—				
Liverpool and Swansea..	786	722	1,202	1,065
London and Newcastle...	6,462	3,918	3,840	4,439
Birmingham	346	515	470	
France	507	623	549	622
English in—				
Liverpool and S. Wales..	17,346	14,263	16,030	16,879
Total in England and France	47,358	36,096	37,436	37,133
Sundries in—				
Germany and Holland...	13,400	5,578	4,696	3,737
Total European stocks.	60,758	41,674	42,132	40,870
Afloat (advised by cable and mail)—				
From Chile	1,575	2,900	2,600	1,825
From Australia.....	8,350	6,000	5,600	5,250
Total visible supply...	70,863	50,574	50,332	47,945

Company Reports

SOUTH AMERICAN COPPER SYNDICATE

This company was formed in 1907 to reopen the Oroa group of copper mines in Venezuela, ancient mines that between 1887 and 1894 were worked by the Quebrada company, an English concern. The capital of the company is £15,000, of which £9983 has been paid up. During the year ended June 30, 1911, the ore mined and shipped to Europe realized £75,447 at an operating expense of £47,803, yielding a profit of £27,644. Dividends totaling £32,358 have been paid, corresponding to 250% on the paid-up capital. W. A. Heywood has been sent to study the metallurgical problems involved.

DE LAMAR COMPANY, LTD.

This company was originally formed in 1891 to acquire from Henry Bratnober 415 acres of mining property in Owyhee county, Idaho, which had been worked for gold and silver by J. R. De Lamar. The original company, the De Lamar Mining Co., Ltd., made good profits for a time and paid dividends totaling 107½% of the original capital of £400,000. After 1896 profits decreased, and since that time have only totaled 40%. In 1901 the capital was decreased to £80,000. During the year ended March 31, 1912, 43,629 tons of ore, averaging $10.50 per ton, was produced and, together with 4967 tons of coarse tailing, was cyanided. The value of the bullion produced was £91,811, and the operating cost £91,132. The cost per ton for mining and development is $6, as there are no ore reserves, the output being gleaned from old stopes, fillings, and stringers. The company has £38,978 of unexpended capital.

KYSHTIM CORPORATION, LTD.

This company was organized in 1908 to acquire the shares of a Russian company, the Kyshtim Mining Works Co., which owns and operates copper, iron, and gold mines in the Perm district of the southern Urals. The capital is £1,000,000, and £650,000 debentures. The company has made loans of £761,152 to the Russian company for the purpose of reorganizing the work at the mines and smelters. During 1911 the Koniukloff, Smirnoff, and Tissoff mines produced 247,102 tons of ore averaging 3.19% copper. At the new smelting plant at Karabash 218,310 tons of ore was treated, and the production of blister from this plant and the old works was 5020 tons. Of this, 4033 tons was electrolytically refined, producing gold and silver amounting to £55,321, or £13 14s. per ton of copper. The total cost of operation was 15s. per ton of ore, or £34⅓ per ton of blister copper. The ore reserve is estimated to contain 1,699,000 tons of 3% copper ore carrying 2 dwt. gold and 1 oz. silver per ton. A third blast-furnace was started in May at the Karabash plant and a second reverberatory at the old plant to treat flue-dust and fine ore. It is expected that the output of copper in 1912 will reach 7000 or 7500 tons. The Russian company in 1911 made a profit of £172,394 on copper production, £23,439 on the iron works, £29,651 from timber, and £4919 from the sale of pyrite for sulphuric acid manufacture. For expenses £119,135 was paid, £30,033 written off, and £65,200 was paid to the English company. The holders of ordinary shares have as yet received no return on their investment.

BROKEN HILL PROPRIETARY CO., LTD.

In an editorial of the *Mining and Scientific Press* of August 17, the various works controlled by this company, and its intention to manufacture iron and steel on a large scale at Newcastle, New South Wales, were commented on. The fifty-fourth half-yearly report shows nothing of special note; but general progress has been sound, and the future is bright. Besides mining its own ore, the company is a large purchaser of lead-zinc-silver ores and concentrate, which are smelted at its large plant at Port

Pirie, in South Australia. Some of the zinc concentrate is shipped to Europe, but spelter is being produced at its own refinery. At one time the concentrating mills used to treat about 300,000 tons of ore every six months, but during the term under review only 109,619 tons was dealt with, with the following results:

	Tons.
Lead concentrate produced	22,406
" " " from 111,733 tons of old tailing	3,512
Zinc " " from 9455 tons of slime	3,209
" " " " 168,309 tons of residue	46,005

The sintering of slime has been abondoned, and a flotation process perfected for this product. In all, the flotation plants treated 177,764 tons of old residue and slime. Three smelters worked continuously and dealt with 15,952 tons of oxidized ores, and 62,006 tons of concentrate, etc. Inclusive of purchased ores, the refinery produced the following:

	Tons.
Soft lead	37,513
Antimonial lead	291
Spelter	895
Blue powder	72
	Ounces.
Silver	1,823,539
Gold	794

Two of the Ropp roasters were dismantled to make room for Dwight-Lloyd machines, and when this plant is completed the fourth smelter will be blown in. The bag-house for catching lead fume has proved a success. The Mathieson-Hegeler furnace is producing a first-class roasted zinc ore. Six furnaces were in operation at the zinc distillation plant. The balance-sheet shows the following details:

Receipts	$4,300,000
Expenditure	3,285,000
Written off	84,000
Net profit	934,000
Dividends	600,000
Added to reserves	334,000
Surplus of liquid assets over liabilities	3,220,000

Not much information is published in the report with regard to mining operations.

BROKEN HILL SOUTH SILVER MINING COMPANY

This is one of the most important companies operating at Broken Hill. It mines and concentrates its ore, but sells concentrate and old tailing to other companies. During the half-year ended June 30, only 2682 ft. of development was done in the mine, mostly at the 1070-ft. level. Driving south was done on the bottom level, 1170 ft. from No. 2 shaft. The Central mine, an adjoining property, intersected an orebody 15 ft. wide close to the South company's southwest corner, at 500-ft. depth. At the 1200-ft. level of the Central, equal to 1225 ft. in the South, the lode increased to a width of 86 ft., within 20 ft. of the South boundary, and is pitching south, making it of importance to this company. The ore reserves in the South mine are about 3,000,000 tons. The following table shows details of the half-year's work:

	Tons.	Containing—	
Ore treated	165,532	Silver, oz.	617,378
Concentrate produced	26,630	Lead, tons	18,652

	Tons.
Delivery of zinc tailing to Amalgamated Zinc plant	145,465
Delivery of zinc tailing to Zinc Corporation	17,585

Costs per ton of ore treated:

Mining	$3.10	Concentrating	0.90
Filling stopes	0.36		
Development	0.38	Total	$4.74

Receipts	$1,615,000	To reserve fund	74,000
Expenditure	850,000	Surplus of liquid assets over liabilities	880,000
Written off	28,000		
Net profit	750,000		
Dividends	600,000		

Recent Publications

ENGLISH. MISCELLANEOUS FAULTY EXPRESSIONS. By V. C. Alderson. 20 pp. Golden, Colorado, 1912.

ELECTRICAL SYMBOLS FOR MINE MAPS. By H. H. Clark. Bureau of Mines Technical Paper 22. 11 pp., ill. Washington, 1912.

PROGRESS OF THE MINERAL INDUSTRY OF TASMANIA, QUARTER ENDED JUNE 30. By W. H. Wallace. 15 pp. Hobart, August 1912.

ANALES DE INGENIERIA. Organo de la Sociedad Colombiana de Ingenieros. Volume 20. 79 pp. Bogota, Colombia, October 1912.

PHYSICAL TESTING OF ROCK FOR ROAD BUILDING. Including Methods Used and the Results Obtained. 96 pp., 20 fig. Bull. 44, Office of Public Roads. Washington, D. C.

ANNUAL REPORT OF THE CHIEF OF BUREAU OF MANUFACTURES TO THE SECRETARY OF COMMERCE AND LABOR, FOR THE YEAR ENDED JUNE 30, 1912. 11 pp. Washington, 1912.

DAYS OF OLD, AND DAYS OF GOLD IN BRITISH COLUMBIA. Kamloops Centenary Celebration. A few reminiscences of the early mining days. 15 pp., ill. Victoria, September 1912.

ZIRCONIFEROUS SANDSTONE NEAR ASHLAND, VIRGINIA. By T. L. Watson and F. L. Hess. Bulletin of the Philosophical Society. 27 pp., ill. University of Virginia, Charlottesville, 1912.

THE CEMENT INDUSTRY IN THE UNITED STATES IN 1911. By E. F. Burchard. Advance chapter from 'Mineral Resources of the United States, 1911.' 37 pp., map. Washington, 1912.

PHILIPPINE JOURNAL OF SCIENCE. Memorial number. In Memoriam of Paul Caspar Freer, Director of the Bureau of Science of the Philippine government. 41 pp., ill. Manila, 1912.

THE NEOCENE SECTION AT KIRKER PASS, ON THE NORTH SIDE OF MT. DIABLO. By B. L. Clark. University of California publication. Department of Geology. 13 pp., map. Berkeley, October 1912.

METHODS OF DETERMINING THE SULPHUR CONTENT OF FUELS, ESPECIALLY PETROLEUM PRODUCTS. By I. C. Allen and I. W. Robertson. Bureau of Mines Technical Paper 26. 13 pp., ill. Washington, 1912.

CONTRIBUTIONS TO AVIAN PALEONTOLOGY FROM THE PACIFIC COAST OF NORTH AMERICA. By L. H. Miller. University of California publication. Department of Geology. 54 pp. Berkeley, October 1912.

STATISTICS OF THE CLAY-WORKING INDUSTRIES IN THE UNITED STATES IN 1911. By J. Middleton. Advance chapter from 'Mineral Resources of the United States, 1911.' 66 pp., tables. Washington, 1912.

GAZETTEER OF SURFACE WATERS OF CALIFORNIA. Part II. San Joaquin River Basin. By B. D. Wood, under direction of J. C. Hoyt. U. S. Geol. Surv. Water-Supply Paper 296. 102 pp. Washington, 1912.

RESULTS OF SPIRIT LEVELING IN NEW YORK, 1906 TO 1911, INCLUSIVE. By R. B. Marshall. U. S. Geol. Surv. Bull. 514. Work done in coöperation with the state of New York. 139 pp., ill., index. Washington, 1912.

RESULTS OF SPIRIT LEVELING IN TENNESSEE, 1910 AND 1911. By R. B. Marshall. U. S. Geol. Surv. Bull. 519. Work done in coöperation with the state of Tennessee Geol. Surv. G. H. Ashley, state geologist. 45 pp., ill., index. Washington, 1912.

SURFACE WATER SUPPLY OF THE UNITED STATES. Part XI. Pacific Coast in California. Prepared under direction of M. O. Leighton by W. B. Clapp, F. F. Henshaw, and H. D. McGlashan. U. S. Geol. Surv. Water-Supply Paper 291. 218 pp., ill., index. Washington, 1912.

Concentrates

Most of these are in reply to questions received by mail. Our readers are invited to ask questions and give information dealing with the practice of mining, milling, and smelting.

HORSE-POWER totaling 4,699,910 was used by the mining industry of the United States, of which 4,483,807 was owned in 1909 by mine operators, and 216,103 hp., all electric, was rented.

VANADIUM added to steel imparts great resistance to shock and the 'fatigue' caused by constant bending. High-carbon vanadium steels make much better tools, such as saws, cutters, and riveting dies. Its use in cast iron is also said to be beneficial. Metavanadic acid has been used to some extent as a substitute for gold bronze in paint. Vanadium chloride is used in fabric printing; and vanadium trioxide in dyeing.

PRODUCER-GAS is the gas formed by partial combustion of fuel in a suitable apparatus. The term 'partial combustion,' when used in connection with producer work, may be defined as the incomplete oxidation of the combustible components of the fuel resulting in its complete gasification; and, since some of the combustible components of the gas evolved are not fully oxidized, while others are not oxidized at all, the oxidation of the gases may be carried to completion by burning in a gas-engine or furnace. Gases produced form a mixture in varying proportions of CO, H, O, CO_2, N, and C_2H_4, the combustible components being CO, H, and C_2H_4.

DIRECTORS of the Victoria Falls Power Co., of South Africa, report "a period of sustained progress during the year 1911, and down to the present time." The total share and debenture capital of the company stands at £7,000,000. The year's business resulted in a profit of £323,000, which, with the balance at credit, makes a total of £360,943. Interest on debentures, and income tax for 1911, absorbed £124,736, and depreciation £61,264, leaving a balance of £174,943. Out of this a 6% dividend was paid, absorbing £129,198, leaving £45,744 to be carried forward. The company has received applications for 52,000 hp., and the Rand Mines Power Supply Co. for electric supply of 67,000 hp. and compressed air of 66,000 hp., making an expected demand of 185,000 hp. When all extensions to stations are completed, the two concerns will have a capacity of 232,000 horse-power.

COPPER amounting to 15,035 tons of copper was exported from Chile in 1911, against 17,898 tons for 1910, according to a consular report. Much development was done, and more American capital was invested in Chilean mining interests. The Braden Copper Co. plant of 3000-ton capacity is nearly finished. There are 200 Americans and 2500 native workmen on its payroll. Some rich gold finds were reported from Talca, but nothing definite has been done. The nitrate production amounted to 53,237,315 Chilean quintals, against 50,781,331 in 1910, with the prospect of a greater increase for the current year. There are several new nitrate works, with an annual capacity of 18,000,000 quintals, nearly completed. In 1911, 11,331,904 quintals went to the United States; 19,503,205 to England; 12,216,637 to Germany; 1,762,189 to Belgium; 1,875,327 to the Netherlands; 1,787,501 to France; 824,781 to Mediterranean ports; and 510,530 to Japan. For the first ten weeks of 1912 the exports of nitrate totaled 14,619,132 quintals, against 12,523,931 for that period of last year. Chilean coal imports for 1911 totaled 1,294,118 tons, of which 705,762 tons came from England; and 526,643 from Australia. Only 51,861 tons has been imported from the United States in six years. A number of nitrate works are building oil-burning plants, and the coal imports are therefore likely to decrease. The Chilean Government continued its work of prospecting for new coal and oil deposits with fair results, the oil discovery in the south promising well. Coal prices were as follows: Cardiff, $8.76 to $8.88 per ton; West Hartley, $7.05 to $7.54; and Australian, $6.56 to $7.54 on board steamer at port of delivery.

CONVEYOR-BELTS made of rubber and canvas, with an extra thickness of the former in the centre, last much longer in carrying rough ore than those made of canvas and balata, even when the latter type is sewn with copper. Even the extra first cost of the rubber belt far more than covers the difference between the two makes. For transmission of power the balata belt leaves nothing to be desired, although in driving machinery in hot places, a woven belt is preferable. Leather or rawhide belts should not be used in wet places, as they get too soft and slippery. They are satisfactory when used for driving centrifugal pumps, or when working from a motor. A 3-in. rawhide belt has been known to travel a distance of 3,000,000 miles, in driving a centrifugal pump, before being worn out. In dry or wet elevators, for fine ore or pulp, rubber belts are most satisfactory. A little castor oil is as good a dressing for belts as can be found among the many dressings made. Being a vegetable oil, it does not rot a belt as does mineral oil, and it gives plenty of grip to the surface. Joining belts is done in many ways; the Bristol & Jackson fasteners being secure and are quickly fitted, while rawhide laces last a long time and make good joints, but take a little extra time in lacing.

Decisions Relating to Mining

Specially reported for the MINING AND SCIENTIFIC PRESS.

FOREST RESERVES NOT TO BE CREATED BY EXECUTIVE WITHDRAWALS

By an Act of Congress approved August 24, 1912, the President of the United States is prohibited from creating new forest reserves or making additions to existing reserves in the state of California except by authority of an Act of Congress.

Act approved August 24, 1912. (Not yet published.)

NOTE.—This act amends the Act of June 25, 1910, by adding California to the list of states where this inhibition is in force.

INTERFERENCE WITH OPERATIONS—A QUESTION OF FACT

Where suit was brought by the lessee of a mine against his lessors who were working a block of ground immediately above the lessee's ground, causing his stopes to cave in and making operation impossible, and the evidence was in conflict as to whether such caving was a necessary result of the reasonable and miner-like working of the lessor's ground, the lower court was held in error for directing a verdict for the defendant instead of submitting the questions to the discretion of the jury.

Peterson *v.* Bullion Beck & Champion Mining Co. (Utah), 126 Pacific, 310. July 30, 1912.

MINING OPTIONS—RIGHT TO EXERCISE DENIED

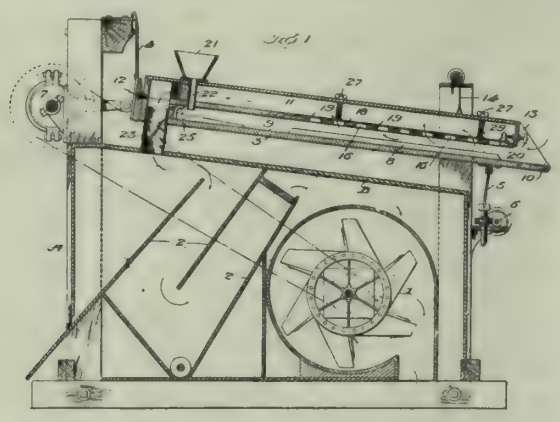
Where the Silver Peak Mines, by judgment of a court of law, had terminated options with certain parties and made other arrangements for the development of their properties, which were subsequently consummated, involving the expenditure of vast sums of money and the development of immensely valuable mines, and where many years have elapsed, other persons, claiming to have been in partnership with the original optionees, but who were not made parties to the suits terminating those options, will not be allowed to exercise those options at this late date, particularly where they have failed to show either fraud on the part of the mining company or good faith, ability, and readiness on their own part to perform their contract during the intervening years.

Gamble *v.* Hanchett (Nevada), 126 Pacific, 111. May 4, 1912.

A New Dry Concentrator

The accompanying illustration shows in detail the new dry concentrator designed and manufactured by the International Concentrator Co. of 149 Broadway, New York. It is claimed by this company that reference to the article by F. J. H. Merrill, in the July 13 issue of the *Mining and Scientific Press,* and to other papers on the same subject, will show that the faults of other dry concentrators have been overcome by the peculiar and original design of this new table. While it is at present impossible for the company to point to concentrators in use under many varying conditions, experiments at its works in Orange, New Jersey, have demonstrated this concentrator to be successful in the separation of many classes of ore.

The principle of construction is based upon what may be termed a double vacuum, as the construction requires two vacuum chambers (the upper and the lower) having separate but related functions. The operation of the table itself will be readily understood by study of the drawing. Among the many superior features claimed for the concentrator are the following: Constant control of the air force; perfect stratification of the granulated ore on an



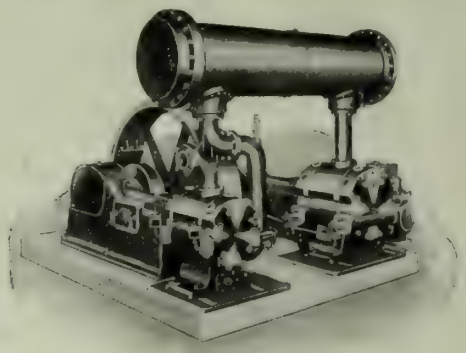
unperforated reciprocating table; tailing in process of separation cannot fall again to the table, after once parted from the mineral, as usual in single compartment machines before mentioned; obviation of all unfavorable conditions involved in variation of feed, air force, or speed, peculiar to other machines; definite, uninterrupted, and continuous action permits heavier volume of feed and corresponding increased capacity; operation is dustless, sanitary, and can be conducted by unskilled labor.

The table itself is made of steel, this being thought to be superior to the usual wood construction. Each table weighs, complete, about 1200 lb., and can be shipped set up, or if intended for a destination remote from a railroad, may be shipped knocked down, and ready for mule-back transportation, the heaviest section weighing less than 200 lb. All parts are interchangeable.

Enclosed Type Air-Compressor

Below is illustrated a new enclosed type, self-oiling, belt-driven air-compressor, the smallest size of a new line being put on the market by the Chicago Pneumatic Tool Co. This compressor furnished the air for operating all air apparatus at the recent annual convention and exhibition of the American Master Mechanics and Master Car Builders Associations held at Atlantic City, New Jersey, June 12 to 22. This is known as the 'Chicago Pneumatic' Class M-CB, having two-stage air-cylinders, 10 and 16 in. diameter, with 12-in. stroke. At its rated speed of 210 revolutions it has a displacement of 576 cu. ft. per minute. Mechanical inlet air-valves of the semi-rotary Corliss type are used, actuated by eccentrics on compressor shaft. Discharge valves are of the Chicago pneumatic air-cushioned poppet type, placed radially in the heads.

This combination insures high volumetric efficiency and the elimination of valve troubles, as the valves are interchangeable and most accessible for adjustment and renewal. Heads and cylinder walls are completely water-jacketed, and arranged with independent water supply, per-



mitting the use of solid gaskets between heads and cylinders. Frames are full tangye type with bored cross-head guides completely enclosing cross-head bearings. Cranks and eccentrics are enclosed with substantial planished iron casing, enabling complete flood lubrication of main bearings, cross-head, and moving parts by means of automatic gravity lubrication. Inlet valves and pistons are lubricated by large glass sight-feed lubricators on caps of inlet valves; and all valve-gear bearings have extra large compression grease cups. The intercooler is of the steel-shell marine condenser type mounted overhead, provided with composition tubes, baffle plates, and separator drip pockets. Air-cylinders are bolted directly to the tangye frames, and in addition extend down to large sole plates with drip guards all around. Cranks are of the balanced-disc type, pressed and keyed to shaft. The driving pulley is split-keyed to shaft and machined true on its face and edges. It is of unusually heavy design to give the necessary fly-wheel effect. Control is effected by an improved throttling intake controller operated by receiver pressure, capable of close regulation and adjusting the load to meet the air demands, so that the power consumption is reduced to a minimum.

This particular installation also includes a Westinghouse type 'HF' slip-ring induction motor, and a Cutler-Hammer controller with diaphragm attachment arranged to shut down or start up the motor in accordance with the air demands. The combination represents the latest developments in high efficiency air-power practice, and owing to the type of valves is noiseless is operation. The same type is furnished in capacities up to 4000 cu. ft. per minute. Equivalent sizes and capacities can be furnished in short belt drive and motor drive with motor mounted directly on compressor shaft. Further information can be obtained from main offices of the Chicago Pneumatic Tool Co., Chicago, New York, or any branch office.

Catalogues Received

Standard Spiral Pipe Works, 25 N. Dearborn St., Chicago. Price list of Reinforced Spiral Pipe.

W. S. Rockwell Co., New York. 'Rotary Annealing and Hardening Furnaces.' 15 pages. Illustrated. 8½ by 11 inches.

Hayward Co., New York. Pamphlet No. 594, 'Hayward Buckets and Digging Machinery.' 8 pages. Illustrated. 6 by 9 inches.

Mine & Smelter Supply Co., Denver, Colorado. Bulletin No. 25, 'The No. 6 Wilfley Concentrator.' 19 pages. Illustrated. 7 by 10 inches.

Power & Mining Machinery Co., Milwaukee, Wisconsin. Special catalogue in Spanish, 'Milling Machinery.' 112 pages. Illustrated. 6 by 9 inches.

Hyatt Roller Bearing Co., Newark, New Jersey. 'The Hyatt Way.' Monthly publication of this company, dealing with the Hyatt roller bearing. 8 pages. Illustrated. 6 by 9 inches.

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EDITORIAL

ANNOUNCEMENT of a paper on 'Electric Hoists in Headgears,' to be read before a South African Technical Society gives rise to speculation as to whether this might not be worse than a bee in one's bonnet.

DECREASE of the supply of gas from the Kansas and Oklahoma districts is causing much concern in the adjacent regions. The companies are finding it necessary to increase the price from its present level of 25 cents per thousand to domestic consumers, and many operators are beginning to return to the use of coal. The capital expenditure required in making the change will be a tax on industry that might have been met by a sinking fund set aside from the increased profits derived from the use of the cheaper fuel.

CALIFORNIANS will be surprised to learn from the report of Mr. B. S. Butler that, with the exception of Alaska, their state has the record for the highest average content of copper ore smelted, with an average for 1911 of 3.7 per cent of copper. How completely this has become the day of the low-grade producer is well evidenced by the figures for Arizona, 3.57 per cent, and for Montana, 3.13 per cent. Alaska is easily first, with an average content of 19.77 per cent, due to the shipments of high-grade ore from the Bonanza mine.

EUROPEAN bankers are reported to hope for Turkish success in the Balkan war, but the cables from the battlefield as yet give little promise of such a conclusion. The victories of the allies are popularly received with joy, since Turkey has never held a high place in popular esteem. The zeal of the allies is indicated by the great numbers of Greek, Bulgarian, and Montenegrin laborers who have already left America to enlist in the armies of their native countries, and the possibility of the principal European powers becoming involved is far from remote.

JAPAN is not a large producer of the precious metals, though a small steady production has been maintained since early times. More recently, with the introduction of modern machinery and the cyanide process, increase in production has been rapid, the value of the gold output now being double that of a decade ago, while silver production has also increased. The total is still small, $3,000,000 in gold and $2,380,000 in silver in 1911, but the wide distribution of the small mines throughout the Empire make them important factors in the economic scheme of a country where wages and living costs are still low, though rapidly increasing.

POLITICALLY this is a peculiar year in that even during the week before election there is general uncertainty as to what the outcome will be on Tuesday. In every presidential election of recent years it has been possible to prophesy the result of the election several weeks before it was held, but this year no one except national committeemen are rash enough to make assertions. The disappointed candidates may draw some comfort from the

recent report that Mr. W. J. Bryan, who has established a lasting reputation as a 'runner-up,' is to build a $100,000 home on his Texas farm. Evidently defeat has its compensations.

DECISION of Mr. E. S. Farrington, justice of the Nevada District Court of the United States, in the suit of the National Mines Company against the Charleston Hill National Mining Syndicate, of which the technical features were described in the issue of July 13, establishes the ruling that the fault and the vein are parts of one and the same fissure and awards the decision to the National Mines Company. The value of the ore involved in the suit is large, and the case was especially notable for the array of well known geologists and engineers who served as expert witnesses. A suit for an accouting of the profits derived from ore mined by the Charleston company from the National ground will probably follow.

TIMBER scarcity in the heart of a forest seems anomalous, but is actually reasonable. The engineer who is accustomed to an ample supply of soft wood for construction and operation purposes is free from the troubles of his colleague in a district where only hardwood timber is available. In Australia as well as in the Philippines the supply of soft wood for building construction is almost entirely derived from the United States, and a house with a galvanized iron roof is regarded as entirely acceptable. Japan and China both take large quantities of Oregon timber annually, and the development of the use of concrete in building construction is a welcome relief to the pressure on the soft-wood supply, since for certain uses, such as the manufacture of doors and window-sash, no general substitute seems likely to be developed.

RESUMPTION of work at the copper mines at Bingham and Ely brings to an end an ill-advised strike with nothing gained for the workman other than what might have been obtained by peaceable means, and indicates the futility of syndicalism. There was no complaint that workmen of these companies were not well paid, the demand for higher wages being based upon the increased profits of the companies derived from the high price of copper. To many minds this will present a degree of reasonableness, while on the other hand it may as reasonably be held that men who are already receiving as much or greater compensation for their labor than is usually paid for the same class of work elsewhere can not expect to receive more pay merely because their employers are making greater profits. If such a principle as this is to be admitted, then the way is open for corresponding reduction of wages when profits are small, and the net result will be to the disadvantage of the laborer who has been striving for decades to shift the accidents and uncertainties of his employment upon the industry rather than upon the individual. The line of progress of industrial development is steadily toward the stabilizing of conditions for the worker, who is less able to bear reverses than is the aggregation of capital which employs him. Any program of betterment for the wage-earner which overlooks this fundamental principle can not lead to ultimate success. The management of the properties concerned is to be congratulated on the effective way in which they have handled a difficult situation.

Development of Converter Practice

Less than a half century ago all the copper produced from sulphide ores was converted from sulphide into metal by a tedious and expensive series of repetitions of roasting and smelting processes. Now the use of the so-called 'bessemer' converter is universal and the successful development of an upright converter, 20 feet in diameter, at the Great Falls smelting plant of the Anaconda company, as described in earlier issues, affords an opportunity for a review of the development of converter practice. The primitive ancestor of the conversion of matte into copper through oxidizing the sulphur by means of a blast of air was the *mabuki* method, practised in Japan from early times. This method had no influence on progress, however, and it was not until after Japanese metallurgists had adopted the modern type of converter that the similarity of its principle of action to that of the *mabuki* method was pointed out. Development had its inception in the pointing out by Henry Bessemer that the removal of the carbon in pig iron could be accomplished by blowing air through the molten mass, as the heat of oxidation of the carbon and silicon would be sufficient to keep the mass molten until the completion of the operation. The analogy with the sulphur in copper-iron sulphides soon suggested itself to metallurgists, and experiments were made by Kupelweisse in 1868 and by Jossa and Lalitin in 1871, with the idea of producing copper from matte in the bessemer steel converter. But, as pointed out by Mr. James Douglas, in his review of converter development, these experiments were dropped when it was found that the copper chilled as it formed and choked the tuyeres, this unexpected result giving rise to the too hasty assumption that the method was impracticable. A few years later John Hollway made a series of experiments and later presented several good papers before the London Society of Arts, describing the results obtained. Elsewhere in this issue we reprint the more significant parts of the first paper, a fuller presentation of which the limitations of our space unfortunately serves to prevent. Hollway so clearly mapped out the general field that his work deserves to be better known by metallurgists, to whom the *Proceedings* of the Society of Arts is comparatively inaccessible, and we accordingly republish it for the benefit of our readers. Hollway points out that the heat generated by the oxidation of the iron and sulphur is sufficient to maintain the mass in a molten state during operation, and that the difficulties are lessened when the active mass is greater; the latter a factor of which the full force has only recently been realized. He further pointed out that the SiO_2 required to form a slag can either be derived from the silicious lining of the converter or from silicious material thrown into the converter during the progress of the operation, and suggests that in this way quantities of silicious gold and silver ores may be smelted. But Hollway was more impressed with the possibilities of his method as applied to the production of a rich matte from low-grade sulphide ores, having directed his experiments to that end, and after remarking that the ordinary form of bessemer converter is not altogether suitable for this work, proposes the use of pyrite smelting in a modified form of blast furnace. Having blocked out the essential features both of the converting of matte and of pyrite smelting, Hollway was not equally successful in the development of the necessary apparatus. The many accidents of converter operation, now so familiar, served to effectually deter his financial backers, and this brilliant series of experiments came to an untimely end. Shortly afterward, M. Manhes attempted the making of copper from matte in the bessemer converter at his rolling mill at Vedenes, and, having hit on the expedient of placing the tuyeres at such a height that the blast would not chill the metallic copper as it formed, he met with such success that he proceeded to erect a full-sized plant at Aiguilles, about 50 miles north of Marseilles. Here two 3-ton bessemer con-

verters were used, in one of which the matte was concentrated to 60 per cent copper, then transferred and blown to blister copper in the second. It is truly remarkable that so important an advance in the art of copper smelting should be made in a country of so little importance as a source of copper that it does not ordinarily appear in the list of producers, and at a place so obscure. The honors may fairly be divided between Manhes and Hollway. Hollway made a scientific study of a general problem with commendable thoroughness, but unfortunately he slighted the most important possibility of his results, and his experimental work was inconclusive. Manhes, on the other hand, concentrated his attention upon the making of copper from matte, and being able to experiment at his own plant, quickly attained success.

Development of the method now transferred itself to this country. Franklin Farrel followed the lead of Manhes at the Parrot works at Butte, with the assistance of some of Manhes' pupils, so successfully that six converters were soon at work, the scheme of keeping the tuyeres free from copper by systematic punching, initiated at the Parrot, being a material aid to success in operation. By 1890 the advantages of the new method were generally recognized and converters were in use or under construction at Anaconda, Great Falls, Butte, and Ashio, Japan. All these plants used some modification of the upright type of converter, and it was not until later that the horizontal type of converter was first employed in America at the Vivian plant at Sudbury, Ontario. The management of the Copper Queen company had studied the operation of small converters of this type at an Italian smelter at Leghorn and 5-ton converters were constructed for experimental purposes. The purpose of the design of the horizontal or 'Bisbee' type, as it afterward came to be known, is to obviate trouble from the chilling of the copper at the tuyeres by placing them in a horizontal row on one side so that by tilting the converter the tuyeres may be kept above the level of the accumulated copper. For a variety of reasons this type of construction strongly appealed to metallurgists, and its use became so general that it was not long before only a few plants retained the upright construction. Among these was the smelting plant at Great Falls, where the staff not only adhered to the type, but developed it from 7 feet in diameter to 20 feet in diameter, and have earned the right to attach the name of Great Falls to this form of construction, originally known as the Parrot type. Meanwhile the changing flux of conditions had led, through a series of experiments which would require too much space for mention, to a general use of Hollway's method of throwing in silicious material through the mouth of the converter, and it was found useful to observe his suggestion that the difficulties of operation are less when the mass of material treated is greater. Messrs. Pierce and Smith accordingly devised a large horizontal converter with a basic lining which could be successfully used and was generally adopted at the plants of the American Smelting & Refining Company. The original form of this converter was mechanically imperfect, and exhibited in exaggerated form the drawbacks of the Bisbee type. The shape of the lining in the horizontal type is structurally imperfect to resist the strains resulting from changes of temperature and the effects of mechanical abrasion. The shape of the lining in the upright type, a vertical cylinder, is mechanically good, and as a result this type of construction is being adopted at the Cananea, Copper Queen, Calumet & Arizona, and Arizona Copper Company plants, and at the El Paso and Hayden plants of the American Smelting & Refining Company as well. The use of large upright converters with basic lining decreases the cost of converting nearly to the irreducible minimum of the power cost for air, and the minimum of labor for charging, pouring, and punching of tuyeres, and it seems improbable that any further great advance will be made, though metallurgists will continue, as in the past, to constantly improve their practice within the limits of the basal definition of metallurgy as the art of making money out of ore. Meanwhile Messrs. C. W. Goodale, H. A. Wheeler, and the staff of the Great Falls plant have the satisfaction of knowing that 'sticking to the job,' in the words of Mr. E. P. Mathewson, does bring gratifying results.

Progress in Institute Affairs

Admirable progress is being made in the readjustment of the affairs of the American Institute of Mining Engineers. The committee, consisting of Messrs. J. W. Richards, Charles Kirchhoff, and C. F. Rand, appointed at the New York meeting on October 7, to formulate a plan for the future government of the Institute by one body instead of by a council and board of directors as at present, have prepared a draft which was submitted for discussion at the meeting at Cleveland on Wednesday, but no report of the conclusions attained had reached us at the time of going to press. In the main, however, the report of the committee follows the line of the generally excellent set of amendments submitted by Messrs. C. R. Corning and G. C. Stone at the New York meeting, and published in our issue of October 19, but provides for a Board of Directors, consisting of 24 members, to control all the activities of the Institute. An amendment to the articles of incorporation provides that the nine Directors who hold office in February 1913 shall, together with the 15 senior members of the Council, constitute the new board, and suitable provision is made for retirement until 8 members of the board can be regularly elected each year. The board shall elect from its members an executive commmittee of five, of whom three shall constitute a quorum to transact business with limited powers between regular meetings of the board. Thus the advantage of geographical representation on the board of management will be secured without making it too difficult to carry on the ordinary business of the Institute, since eight members constitute a quorum of the Directors. This will apparently be a distinct gain to the Institute, for the relationship of its governing bodies and officers is thus made commendably clear and should result in much more effective interest in Institute affairs. The general features of the amendments already published are followed in the substitution of letter ballots for the present system of voting by proxy, the appointment of a business manager, the appointment of a committee on publications, and the provisions for the formation of local sections. Amendments to the by-laws are hereafter to be made by the Board of Directors. A proposal to create a new class of membership, to be known as Fellows of the Institute, who may as a body discuss and by a majority vote express their opinion upon pending legislation affecting the mining and metallurgical industries was to be submitted for discussion at the Cleveland meeting, and comment upon it is therefore delayed. The meeting at Cleveland was well attended, interesting papers were presented, and a good discussion followed. It is evident that the fears entertained for the future of the Institute were groundless, and the same is true of the impression that has prevailed in some quarters that the differences existing between those taking part in the reorganization were other than the ordinary differences of earnest men striving for a common purpose. We are glad that the future looks so bright for the continued success of the organization.

Compressed-Air Hoisting at Butte

By Thomas T. Read

The substitution of compressed air for steam in operating the hoists at the numerous shafts of the Anaconda Copper Mining Co. at Butte, Montana, is perhaps the most interesting event of recent years in power-plant engineering. The relative advantages of compressed air and electric power for this work have been vigorously discussed by mechanical and electrical engineers. But differential equations defining the relations of volumes, pressures, and temperatures are matters concerning which the average engineer knows little and cares less, and I propose in the following paragraphs to present merely a general description of this interesting and important power-plant, avoiding so far as possible all points of dispute, and hoping thereby to avoid being drawn into a controversy with which I have no concern.

The hoisting shafts of the Anaconda Copper Mining Co. are scattered over the hills north of the town of Butte, and are at elevations of 5600 to 6200 ft. above sea-level. The new central power-house is at an elevation of 6080 ft. The relative position of the different shafts is shown in Fig. 1, and the circle, drawn with a radius of ½ mile and with the new power-house as a centre, serves to indicate the distances involved. At these shafts steam-driven hoists, rated at 3000 hp., and hoisting 5-ton skip-loads of ore at the rate of 2800 ft. per minute, have been in operation. Each shaft is also provided with a smaller hoist, locally known as a 'chippy,' for handling timber and general supplies for work underground. Hoists are operated on both shifts, the actual time which the main hoist is in motion being, according to B. V. Nordberg, about 5 hours out of the 24. Each shaft was provided with a boiler-plant, with its necessary labor, and coal, costing $4.50 per ton, was distributed to the shafts. The advantages of operation from a central power-station which could counterbalance the fluctuations in the power requirements of the individual hoists is evident. The recent growth of hydro-electric power development in Montana has made available at the mines an ample supply of electric energy, generated at the plant of the Great Falls Power Co., near the town of that name, on the Missouri river. This is transmitted 130 miles from Great Falls to Butte, at 100,000 volts, and is transformed to 2400 volts for use at the mines. The cost of electric power is $35 per horse-power-year, and when the full supply of electric energy became available about two years ago, it was at once decided to use it in place of coal, as a source of power supply. The question remaining to be decided was what medium of transmission of this energy could be employed to the greatest advantage.

Several methods of doing this were feasible. Electric hoists might have been placed at the shafts, this making the Great Falls plant the central station. But so simple an arrangement as this would have caused fluctuations in the power transmitted through the long transmission line that would have resulted in peak-loads of prohibitive magnitude, and to equalize the consumption of electric power some

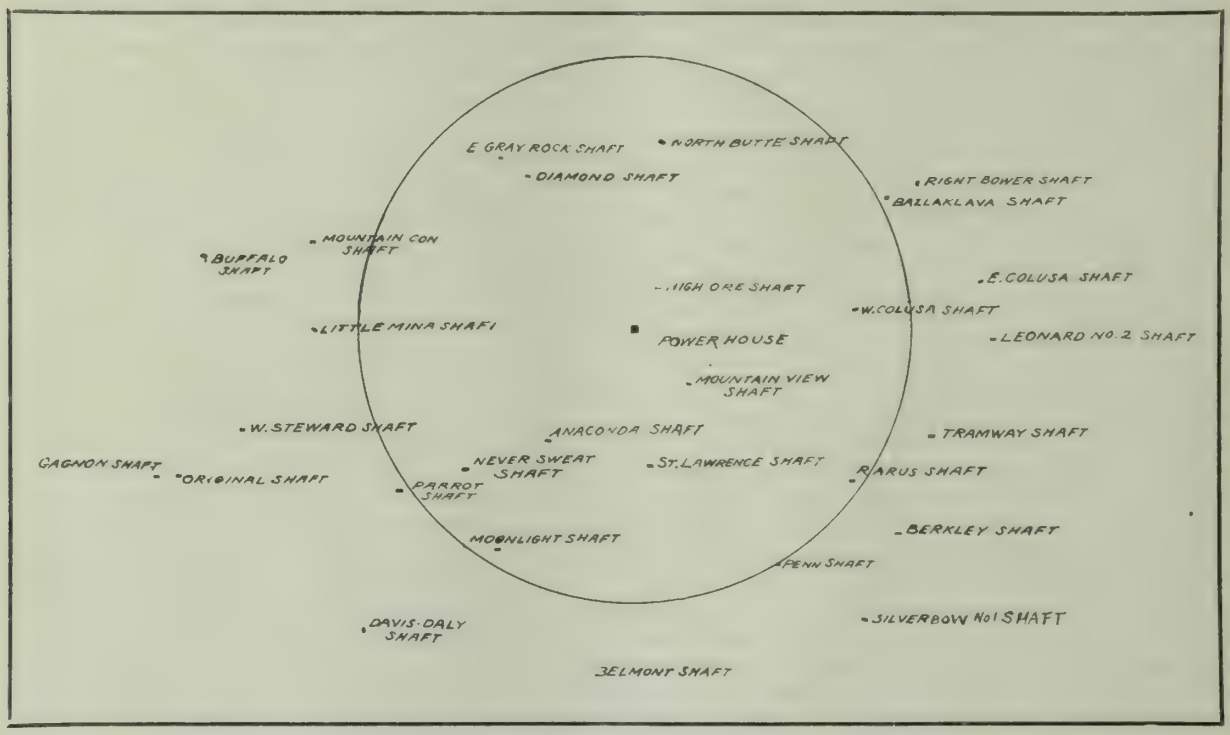


Fig. 1. Hoisting shafts of the Anaconda Company, Butte. The circle has a radius of ½ mile.

form of compensating device would therefore have been necessary. Storage batteries are not satisfactory for mine work; the loss of energy in converting electric energy into chemical energy and the latter to electric energy again, the cost of construction and maintenance, and their constant deterioration has led to a discontinuance of their use for this kind of work. The Ilgner transformer has given good results in Germany and elsewhere when employed for hoists which are in nearly continuous operation, but cannot be utilized to advantage on hoists which are idle a large part of the time. It was therefore decided to use the electric energy to drive air-compressors at the central station, the air being stored in a system of receivers and air-lines which distribute it to the hoists. It is then reheated and used in the re-built cylinders of the old steam-hoists. I will first describe the power-plant, as its advantages can then more easily be indicated. The plant is still under construction, but for the sake of clearness and convenience I will describe it in the form it will have when the construction work now under way is completed.

The electric energy from Great Falls is delivered at the transformer house, seen in Fig. 2, and transformed to 2400 volts. Six Westinghouse A. C. synchronous motors, of

1200 hp. each, drive 6 Nordberg cross-compound air-compressors having 30 and 50-in. diameter cylinders, each compressor being rated at 7500 cu. ft. per minute. Three of these compressors are fitted with variable-capacity valve-gear and the other three are of uniform capacity. The air is compressed to 23 lb. in the low-pressure cylinder, passes through the intercooler, and is compressed to 90 lb. pressors will serve to meet all the ordinary requirements of work. Since construction work was started, the daily output of the mines has been increased from 12,000 to 15,000 tons per day; the load on the power-house is therefore somewhat dependent upon the market price of copper.

The air from the compressors is delivered to a battery of 18 vertical cylindrical receivers 10 by 30 ft. and of a ca-

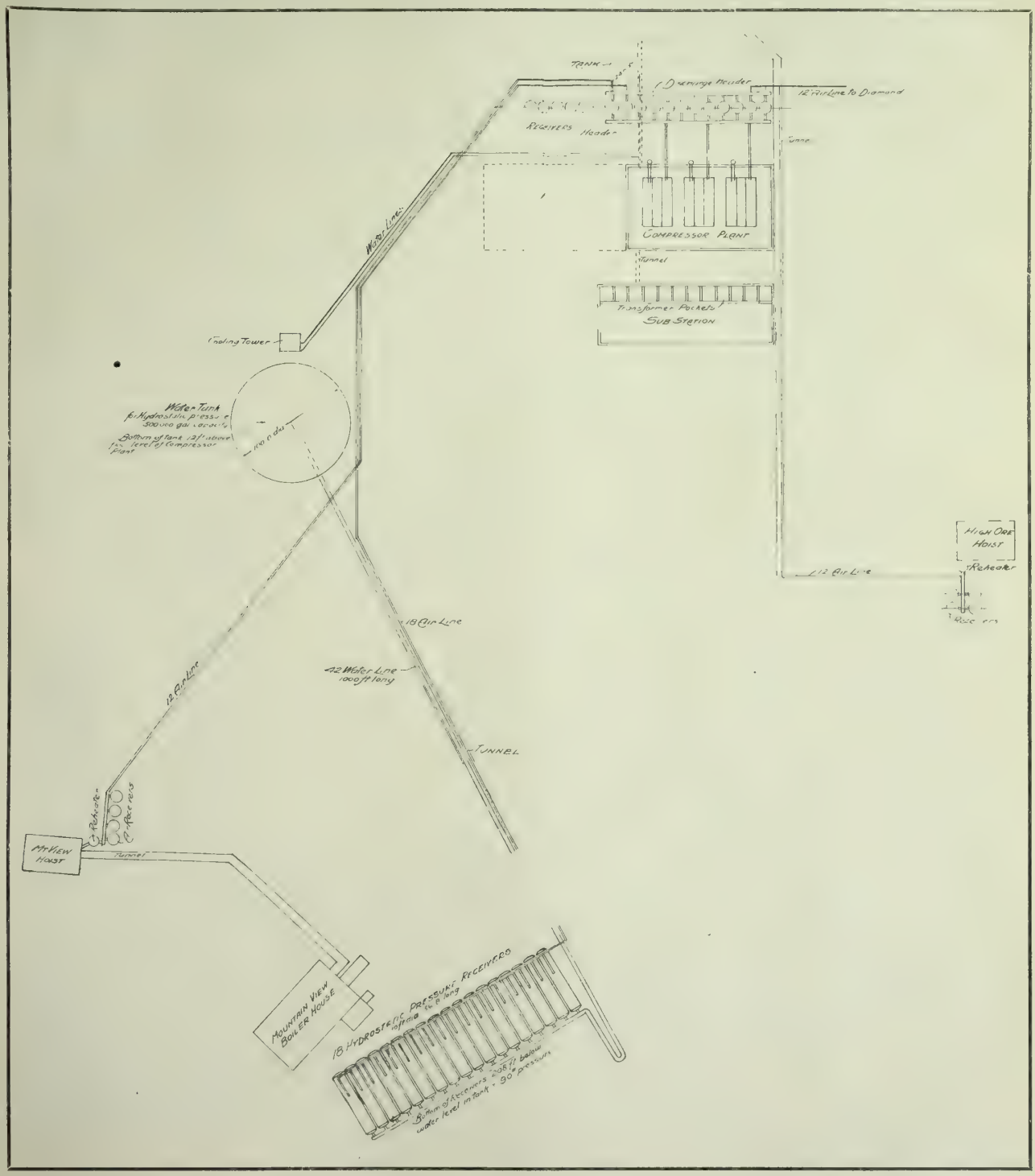


FIG. 2. CENTRAL POWER PLANT AND AIR-STORAGE SYSTEM.

This pressure was chosen so that any excess air above the requirements of the hoists can escape through a safety-valve into the mine system and be used to supply the rock-drills, thus relieving the compressors now used for that purpose. The load on the motors is thus kept absolutely uniform during the 24 hours of the day. The method of supplying air for excessive demands will be described in a moment. In starting an air-compressor air is introduced from the receivers for that purpose, so that one may be started and another stopped without causing any variation in the electric power-load. It is expected that five compacity of 360,000 cu. ft. of free air, when compressed to 90 lb. As these receivers are 50 or 60 ft. distant from the compressors a small receiver is placed above each high-pressure cylinder. These receivers are connected by air-lines with the receivers placed at the hoists; four receivers of the same size as those just mentioned being placed at each hoist. They are also connected with the storage equilibrium system, seen in Fig. 2, which is an essential feature of the design. The receivers just mentioned are connected by an 18-in. air-line with 16 horizontal receivers, each 10 ft. in diameter, and 56 ft. 8 in. long, placed on the hillside a

short distance above the Leonard shaft. These receivers are connected by a 42-in. water-line (having a 25-ft. loop at the bottom for safety) with a 500,000-gal. water-tank on top of the hill a short distance south of the power-house. When the water in the tank is 8½ ft. deep it stands 208 ft. above the receivers, thus giving a pressure of 90 lb. per square inch. When the air consumption by the hoists exceeds the supply from the compressors the water flows down into the lower receivers, displacing the 66,840 cu. ft. of compressed air which they contain (equivalent to 568,000 cu. ft. of free air). This storage system not only serves as an equalizer of the load upon the central power-house, but in the event of the total failure of the electric power, the stored air will serve to operate each hoist for twenty minutes, thus making it possible to hoist out the men at work underground. It should be noted that this reserve remains available indefinitely until it is used up; whereas with an Ilgner transformer it would be necessary to utilize the power of the transformer at once, perhaps before it would be possible to collect all the men at the stations.

Four air receivers are provided at each hoist. The air on its way to the hoist passes through a sectional surface heater of special design, 50 in. diameter and 25 ft. high. The heat is furnished by a 50-hp. return tubular boiler, giving steam at 200 lb. pressure and serving to reheat the air to 300°F. The coal used for reheating the air amounts to ⅓ lb. per horse-power hour. As the steam hoisting-engines were operated at from 120 to 150 lb. steam pressure and the air is at 90 lb., the hoists have been altered by removing the old steam cylinders and replacing them with larger ones, this being the only change necessary. The valve-gearing of these cylinders is so constructed that the full power can be turned on to secure the necessary acceleration, and when the skip begins to approach the top the speed of engine is checked by compressing air in the cylinders, which is accomplished by means of a compression lever operated by the engineer and by which means the exhaust valves are made to cut off at any desired part of the stroke, thus compressing the air in the cylinders and delivering it back into the main system. The speed of engine can also be checked by reversing the valve gear and compressing air in the cylinders, which is drawn in through the exhaust pipe and delivered into the main system as before. The energy which would ordinarily be wasted in useless friction on the brake shoes is thus returned to the storage system to be utilized on the next trip. The valve mechanism required for this purpose is extremely simple, and the hoist men are stated to prefer to operate the air hoists rather than the steam-driven ones. It will be noted that this system required the minimum amount of change in the present equipment. In the steam hoists, many of them of the flat-rope type and large enough to operate to a considerably increased depth, no further changes were necessary than the replacing of the cylinders. If electric hoists had been employed it would not only have been necessary to discard the steam hoists, but the surface plant would have required reconstruction, since the floor space required for an electric hoist greatly exceeds that of a flat-rope hoist.

Many of the advantages of the compressed air system in meeting the governing conditions at Butte are evident from the description. It must not rashly be inferred that compressed air, like a patent medicine, is good for all hoisting troubles. In this case, however, where a large number of hoists are to be operated from a central power plant, compressed air forms a useful means of power transmission because it is elastic and can be stored. In this way the occurrence of high peak loads can be automatically and mechanically prevented. This is aided, of course, by arranging the regular hours for hoisting at the various shafts so as to distribute it throughout the day, as far as possible. The hoists at the Mountain View, Diamond, High Ore, West Gray Rock, Leonard, Tramway, and Pennsylvania shafts have already been converted to the use of compressed air and 7000 tons per day is now being hoisted by the compressed-air hoists. The other hoists will be converted one at a time, as it is necessary to interfere as little as possible with the regular output of ore. The theoretical efficiency of the plant is stated as follows: motor efficiency, 95%; mechanical efficiency of compressors, 90%; efficiency of air compression, 83%; efficiency of hoist, 50%; total efficiency without reheating, 35.48%; efficiency after reheating, 53%. Thus 1.88 hp. of the compressor motor is equivalent to 1 hp. at the hoist. In closing, I wish to express my obligation to John Gillie, C. W. Goodale, B. H. Dunshee, and W. J. Lilly for the facilities which they so kindly accorded for observation of the plant and securing data regarding it.

Record-Breaking Output of Copper

The year 1911 was one of prosperity for the copper industry, both smelter and refinery outputs being the largest in its history, according to a report by B. S. Butler, just issued by the United States Geological Survey as an advance chapter from Mineral Resources of the United States for that year. The average price of copper for 1911 was 12.5c. per pound, slightly below the price of 1910, but near the close of the year the price advanced, the averagge for December being 13.71c. per pound. Metal-market conditions continued to improve until the average price had risen, in July 1912, above 17c. per pound, the highest price since the panic of 1907.

The smelter production of copper in the United States in 1911 was 1,097,232,749 lb., or 56% of the world's production, but while the production surpassed that of 1910 by 8,995,317 lb., the value of the 1911 output was but $137,154,092, compared with $137,180,257 for 1910. The following table shows the mine and smelter output of 9 leading copper-producing states and Alaska for 1911:

PRODUCTION OF COPPER IN LEADING STATES IN 1911, IN POUNDS

State.	Smelter returns.	Mine returns.
Arizona	303,202,532	306,141,538
Montana	271,814,491	272,847,705
Michigan	218,185,236	291,840,201
Utah	142,340,215	146,960,827
Nevada	65,561,015	67,377,518
California	35,835,651	36,316,136
Alaska	22,314,889	27,267,878
Tennessee	18,965,143	18,850,276
Colorado	9,791,861	8,024,488
Idaho	4,514,116	5,152,937

In 1911 twenty-one states and territories contributed to the copper production, but the three leading states (Arizona, Montana, and Michigan) produced 72% of the total output. Arizona produced more than 27% of the output for the year, Montana slightly less than 25%, and Michigan nearly 20%. Utah took fourth place, with an output of 13% of the 1911 production. The six leading states in 1911 (Arizona, Montana, Michigan, Utah, Nevada, and California) produced 94.4% of the output for that year, and the same states have produced 95% of the total output since 1845. Alaska produced the highest-grade ore in 1911, the average yield being 19.77% of copper; California was second, with 3.67%; Arizona was third, with 3.57%; and Montana was fourth, with 3.13 per cent.

SIEVE tests made on the pulp from ore crushed at the Lane mill works, Cue, Western Australia, from the Chunderloo gold mine, Yalonginda, W. A., showed the following result: Sand passing 40-mesh, 99%; 60-mesh, 97; 80-mesh, 94; 100-mesh, 90; 150-mesh, 81; and 200-mesh, 67%. The height of the overflow used on the Lane mill to obtain this extremely fine product was 7 in. above the mill track. It seems marvelous that such a fine pulp could be obtained in one operation. The ore as it comes from the mine is crushed to about 1¼ in. and thence passes through the Lane mill. This fineness was obtained when grinding at the rate of 36 tons per 24 hours. The ore contains 2% of copper.

Treating Sulphides in the Bessemer Converter

By John Hollway

*When metals are extracted from their ores by fusion, the necessary heat is always obtained by the burning of coal, coke, or other form of carbon. But sulphides can be made to burn in air, and the metallic sulphides, consequently, are natural combustible minerals. My object is to prove that they can be utilized as sources of heat in certain metallurgical operations. The most important of the mineral sulphides is pyrite, with which are frequently associated sulphides of copper and arsenic; silver and gold are usually present in larger or smaller quantities. When pyrite is roasted in the open air, an increase of temperature takes place in its mass, so that the oxidation continues without the application of external heat. This operation is carried on in Spain and other countries, where vast quantities of cupriferous pyrite are exposed in heaps for several months to a slow process of combustion, which gradually converts the sulphide of iron into ferric oxide. A similar combustion is effected in the pyrite burners of the sulphuric acid manufacturers, the solid product of the operation being the so-called 'burned ore,' an impure peroxide of iron. Other important sulphides are those of lead, zinc, and antimony. Sulphide ores of copper, lead, and zinc are usually roasted to render them reducible in the furnace and to make their non-valuable constituents capable of combining with the fluxes used, the requisite heat being always obtained by the combustion of coal or similar material of organic origin. This process of roasting extends over a considerable space of time, and the heat evolved by the oxidation of the sulphides is never very manifest at any period of the operation. The sulphur and metals frequently burn to waste, because the utilization of the heat resulting from their burning has not hitherto been considered a subject of much importance. If, however, a rapid current of air is forced through molten sulphides, the maximum temperature of the combustion is attained, because all the oxygen of the air driven in is then utilized for oxidation, and the operation is concentrated into the space of a few minutes instead of occupying many weeks, or in the case of cupriferous pyrite, many months.

By calculation the comparative temperatures produced by the oxidation of the principal sulphides can be found. The data thus obtained indicated to me that the oxidation of sulphides could produce sufficient heat to render their smelting a self-supporting operation, and in consequence several experiments were made by forcing a current of oxygen from a gas cylinder into molten sulphide of iron contained in a fire-clay crucible. The tuyeres used were porcelain tubes and the stems of common clay pipes. When the current of gas was directed upon the surface of the mass, an intense incandescence with a violet light was observable, showing the high temperature resulting from the oxidation. Upon dipping the tuyere into the sulphide the temperature visibly increased, and the oxide of iron formed acted energetically upon the silica of the fire-clay; but the contents of the crucible soon became viscous in consequence of the absence of sufficient silica to form a fusible slag.

The experiments were continued on April 22, 1878, and larger crucibles used; the sulphide of iron was acted upon by a current of air, sand being added during the oxidation. Matte and slag were obtained. The sulphide of iron was made by fusing cupriferous pyrite in a steel melting-furnace, the fire of which was allowed to burn down as soon as the oxidation commenced. When the blast of air was turned on, the tuyere was dipped into the contents of the crucible, and the blowing was continued for over 30 minutes. Although the whole of the oxygen was probably consumed, yet the oxidation had not proceeded far enough to concentrate the matte to any extent. About half the iron was removed as ferrous silicate, in which was found 0.104% of copper, and the separation of the matte from the superincumbent slag was very distinct. It was evident that to enable the oxidation to take place with sufficient energy, it would be necessary to introduce the air very rapidly, and, after some further experiments, made also with crucibles, which showed that pyrite could be melted by the heat evolved by its own oxidation, a trial was projected with a bessemer converter, because a rapid transmission of air could be thus obtained, and several experiments were accordingly made during July 1878.

The plant employed consisted of an ordinary cupola, 4 ft. diameter at the tuyeres, and 5 ft. above, having eight tuyeres, four being 3 in. diameter and the remaining four 4 in. diameter. A ladle for conveying the molten metal to the bessemer converter; and a bessemer converter, capable of treating 6 tons of crude iron at a time, lined, as usual, with gannister, and supplied with cold blast. The engines for supplying the blast were two cylinders of 42-in. diameter and 4-ft. stroke, working at about 45 r.p.m., at an average pressure of steam in the boilers of 73 lb. per square inch. The pyrite was put into the cupola with coke and treated like pig iron. When at each operation the cupola was tapped, the molten protosulphide was run into a ladle and thence into the converter.

In the first of these experiments, which took place July 10 and 11, 1878, about five tons of molten sulphide was blown for half an hour in the same manner as a charge of bessemer iron. After thirty minutes' blow the contents, consisting of silicate of iron and matte, were turned out of the vessel. No sand had been thrown into the converter, therefore the gannister lining was energetically attacked by the oxide of iron. The product was quite liquid when run from the vessel, the slag crystallizing on cooling in splendid crystals of ferrous orthosilicate. In the next experiment, sulphides containing 3.4% of copper yielded, after a quarter of an hour's blow, a matte containing 46% of copper, and the destructive action upon the gannister lining was greatly mitigated by throwing sand into the converter.

Six experiments were made on July 17 and 18. The pyrite used contained 2 to 3% of copper, 1.5 oz. of silver, and 3 gr. of gold per ton. Owing to the small quantity of sulphide employed in each of these experiments, the blowing had to be of very short duration, and great care was also necessary to avoid overblowing. To obviate this the blowing had to be arrested earlier than would be necessary to produce a matte containing the desired percentage of copper; but in operating with larger quantities of sulphide there would not be the same difficulty. The spectroscopic phenomena were observed through a six-prism spectroscope. The six experiments were all arranged and the duration of each blow in the bessemer previously settled; and the first, second, and third experiments were so carried out; the fourth was intentionally overblown, in order to observe the changes in the spectrum, and the result of these observations was that in the fifth and sixth experiments the blow was arrested at the moment indicated by the disappearance of certain lines in the spectrum.

The increments in the temperature of the gases at the mouth of the converter were measured by means of one of Siemens' differential pyrometers. The pyrometer was 8 ft. long, with platinum leading wires from the platinum spiral to the terminals. The end exposed to the gases was protected for 1 ft. 6 in. of its length by a porcelain tube 2 ft. long, and the next 2 ft. by loam placed around the iron tube of the pyrometer. The indicated temperature was

*Extracts from a paper entitled 'A New Application of a Process of Rapid Oxidation by Which Sulphides Are Utilized as Fuel,' presented before the Society of Arts (London), February 14, 1879.

always below that actually obtained, as the fire-clay coating protecting the exposed stem of the pyrometer retarded the transmission of heat.

The gases were sampled by means of a fire-clay bell, connected with ½-in. iron tubing, protected by clay from the hot sulphur vapor. The iron tube, at a distance of about 20 ft. from the converter, had inserted in it two pieces of brass pipe, to which were connected, by india-rubber tubing, two glass tubes for taking the gases. The free ends of the gas tubes were connected through a T-piece with a powerful aspirator holding 20 gal. of water. By turning a tap and shutting off the water-cock of the aspirator, both tubes could be filled with identical samples of gas evolved from the converter at any given moment. The sublimate appeared in the glass tubes about three seconds after turning the taps. To avoid any interruption in the experiments, two converters were fitted with similar appliances, both pyrometers being connected with the same instrument, but only one converter was used.

In the first experiment the blow occupied 17 minutes, during which period 14 cwt. of red sand was added. The amount of sulphide introduced into the vessel could not be exactly ascertained. The mean pressure of blast was 20 lb. per square inch. The phenomena at the mouth of the converter were remarkable. At the beginning dense white fume issued from the mouth of the converter, colored in varying tints by the volatile metals present in the incandescent state, affording a brilliant spectrum containing a great number of bright lines. When the temperature rose and the lead was in great part expelled, the flame showed less 'body' and was of a bluish-green color, possibly from the presence of minute quantities of zinc and copper. The blown product of the experiment was emptied into ingot molds and allowed to cool. When cold it was found to consist of three zones, the upper one being the slag proper, the central zone a mixed product of slag and matte, and the lowest a matte free from silica. The specific gravity of the matte was about 4.8 and the slag about 4.1. The products of the experiments gave, upon analysis, the following results: Slag, FeO 53.30%, Fe_2O_3 3.00%, copper combined with sulphur 0.16%, sulphur 3.39%, silica 29.90%. Matte, iron 57.10%, copper 15.85%, sulphur 21.96 per cent.

The second experiment was similar to the first, but about 30 cwt. of fused sulphide was used. The sand added was about 14 cwt., which was thrown in, as in the first experiment, and there was, as before, an intermediate matte. The slag was dense, black, and very crystalline; it showed a peculiar radiated structure at the edge near the iron molds, caused by the sudden chill. The zones were not horizontal, but were more or less conical, as owing to the sudden refrigeration of the mass the denser particles had subsided last in the central portion which remained fluid longest. The analyses of the slag and matte obtained are as follows: Slag, FeO 54.62%, Fe_2O_3 3.71%, copper combined with sulphur 0.22%, silica 30.05%. Matte, iron 56.05%, copper 16.59%, sulphur 23.47 per cent.

In the third experiment the charge was more fully blown. The sulphide used was about 25 cwt. and the sand added about 14 cwt. The blast pressure was 20 lb. per square inch, and the blow occupied 17 minutes, which was somewhat too long. The separation of the slag from the rich matte immediately beneath it was very distinct. The analyses of products in this experiment are as follows: Matte, sulphur 22.22%, iron 12.56%, copper 62.36%. Average of the slag, metallic iron 49.30%, metallic copper 1.55%, silica 29.55 per cent.

In the fourth experiment the charge was overblown by about six minutes. No sand was added in this blow; about 1 to 1¼ tons of fused sulphide was used. The product was apparently homogeneous in composition and gave on analysis: Silica 34.34%, FeO 25.10%, Fe_2O_3 33.83% (= 43.27% metallic iron), copper oxide 2.39% (= 1.91% copper). This slag is less basic and far less crystalline than those ordinarily produced, and the copper exists principally as oxide. As soon as the sub-sulphide of copper began to burn, a splendid emerald-green flame suddenly appeared, lasting about a minute, and all the lines except those of copper and sodium left the spectrum. During the last few minutes of the blow the mouth of the converter was dull and without flame.

The sixth and last experiment of this series was made upon about 20 cwt. of the fused sulphide; about 11 cwt. of sand was thrown in with a shovel during the blow, which lasted 11 minutes. A central zone of mixed matte and slag was obtained, as in the first experiments of the series, and its composition was somewhat similar. It is of interest to observe that this contained neither silver nor gold, which were concentrated in the rich well-separated matte. Slag, copper 0.42%, FeO 67.52%, silica 26.22%, sulphur 2.06%. Matte, copper combined with sulphur 59.71%, iron 13.16%, sulphur 21.94 per cent.

During the preliminary melting of the pyrite in the cupola, the flame seen at the charging door of the cupola exhibited brilliant colors, continually changing in tint. This flame brightly illuminated the visible spectrum. The greater part of the lead was volatilized during this preliminary melting. Indications were, besides, obtained of the volatilization of sodium, lithium, and thallium. The flame of sulphur and that of carbonic oxide give no distinctive lines, neither does arsenic volatilized as arsenic trioxide; hence no indication of the presence of these substances was to be expected, and zinc was probably not present in this flame in the form of vapor. The spectrum flame from the bessemer converter during the blow was a brilliant one. The lines of sodium, lithium, and thallium were recognizable, but the majority of the lines are of (as yet) unknown origin, though they are the most important, since the changes furnish indications of the progress of the chemical changes taking place in the vessel. Some of these unknown lines are those which were employed as test lines. No lines of lead were observed, nor of copper, except in the fourth experiment, in which all the lines except those of sodium disappeared about six minutes before the 'turn-down.' The charge took longer to melt in the cupola than a corresponding weight of pig iron under the same circumstances, but, when once molten, the sulphides formed a mobile limpid liquid.

Whenever during the experiments the converter was tipped forward the SO_2 poured out into the pit and made itself apparent by its strong odor. When the converter was in position, however, and the blast on, the smell was scarcely perceptible in the close vicinity of the flame in consequence, doubtless, of the rapid convection of the hot gas. The lining of the converter, after the six blows, was found to be not very materially acted upon, and therefore the reserve converter was not required. The products of the experiment which remained for examination consisted only of slag and matte and a few samples of the gases evolved. The sulphur and sublimates were principally lost in the cupola, which, as before mentioned, was only used for convenience. In practice, the volatilized substances would be collected in flues.

Further experiments were made on November 1 and 2, also with a bessemer converter. To start the oxidation, about two tons of fused sulphide was run into the vessel, which was then brought into position and the charge was blown for about five minutes without any addition. As the heat of mass increased, four tons of cold pyrite was thrown into the converter, gradually, in large lumps, together with 9 cwt. of sand containing over 16% of moisture. Although a large quantity of heat was expended in expelling the sulphur from the cold pyrite and in the expulsion of the water from the sand, yet the contents of the converter were maintained perfectly liquid by the heat of oxidation. After blowing some time, half the charge was tipped into the ladle, and, after the converter had been again placed in position, 18 cwt. more of pyrite was added, in lumps, and 3 cwt. more sand. After a short time the blowing was discontinued and the contents run out into the ladle.

During the experiment sulphur vapor burned at the mouth of the converter and phenomena were observed simi-

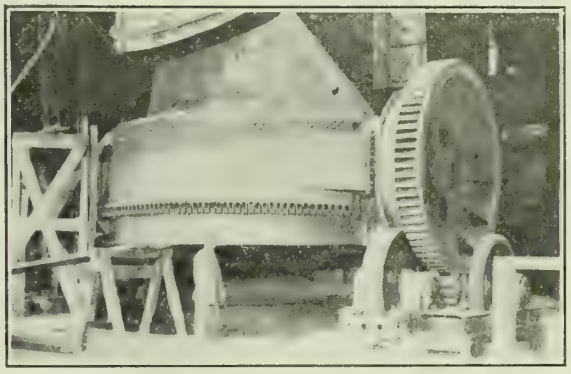
lar to those previously cited. It was proved to those present that the smelting of pyrite can be made a self-supporting operation, and that copper matte, silicate of iron slag, volatile sublimates, and SO_2 can be obtained without the employment of any extraneous fuel other than that employed in producing the blast. Another experiment of a similar nature had been previously attempted, but the addition of cold and wet raw material too early in the operation caused too great a reduction in the temperature, and the chilled contents of the converter had to be extracted by melting with coal. This refrigeration will be readily understood when the heat rendered latent by the fusion of the bisulphide of iron is taken into account, besides which large quantities of gas left the liquid mass at a red heat, and were not utilized to heat or to drive off sulphur from the raw material.

These experiments were carried out with an ordinary bessemer plant, but, for many reasons a bessemer converter is not suitable for the reduction of cold pyrite to matte, nor has it any arrangements for allowing the matte to accumulate out of the reach of the blast. Upon running the molten mass from the ladle into one of the ingot molds, the slag ran in a thick cylindrical stream of perfect continuity, falling without noise a distance of some feet into the liquid portion below. This lasted five minutes, and resembled the effect produced by illuminating a continuous column of liquid by a ray of light passed along its axis.

Further experiments with a bessemer plant were made on February 5, at which Prof. Roscoe and other friends were present. The first experiment was accidentally overblown, besides being chilled by the addition of more than the calculated quantity of sandstone. In attempting to continue the operation by the addition of lumps of pyrite, the strong current of air traversing the silicate of iron chilled it, and caused the mass to set in the vessel. It was partly extracted by the aid of coal, and partly by means of rods. About 2 cwt. of coal was now thrown into the empty vessel, and lumps of cold pyrite were added. The blowing being resumed, liquid sulphides accumulated on the tuyere hearth of the vessel, and pyrite and sand were continuously introduced during eight hours. While the operation was in progress a steam-pipe burst, and the blowing was discontinued for 20 minutes. The contents of the vessel, however, remained fused, and the operation was continued without any difficulty. During the 8 hours the blow lasted, a continuous jet of sulphur vapor burned at the mouth of the converter, where it came in contact with the external air. Round the edges, particularly at the base, the flame was of the well known blue color of burning sulphur; but the body of the flame appeared of a greenish tint. This was due to the yellowish brown color of the unburnt incandescent vapor of sulphur and the blue color of the sulphur flame; viewed through a small direct-vision spectroscope, many absorption bands were seen occurring at apparently regular intervals, from the red to the violet. Dr. Watts believes the spectrum to be principally due to the sulphur. Over 8 tons of sulphur vapor was probably burned in the eight hours, and about 18 tons of raw pyrite was treated.

The slag formed in the experiments principally consisted of a silicate of protoxide of iron, but contained some sulphur as sulphide of iron. If, after the matte has been separated from the slag, the latter is further bessemerized, and thus partly converted into silicate of peroxide of iron, the sulphide of iron will be entirely oxidized, and the slag consequently will contain no sulphur. The oxidation of FeO to Fe_2O_3 would produce the heat necessary to maintain the slag molten during this operation.

It is probable that the form of furnace eventually adopted will be a modification of the ordinary blast-furnace, fitted with a tuyere hearth. Such a furnace, built on pillars, with bosh and hearth of some substance not rapidly acted upon by the slag formed during the burning of the sulphides would, working continuously, treat a large quantity of material. Being built on pillars, the crucible hearth and tuyere bottom could be replaced when necessary without disturbing the remainder of the structure, and as these would be the only parts in contact with the fused materials, the furnace from the bosh upward should not experience much wear and tear. When a gannister lining similar to the ordinary bessemer lining is employed for the bosh and hearth, the corrosive action of the FeO would be neutralized and avoided by introducing with the pyrite sufficient silicious material to produce a slag containing at least as large a proportion of silica as compared with the bases, as the formula $2RO.SiO_2$. If, however, a basic lining is employed, the slag should contain less silica, and in no case more than the proportion equivalent to the formula $2RO.SiO_2$. Under such circumstances the blowing would be continuous, the hot charge coming down to a fusion zone, the height of which over the tuyeres would be determined by the amount of air blown in, and the frequency with which the blown products are withdrawn, varying likewise with the composition of the charge. The products could be withdrawn by tapping, as with a common blast-furnace, the matte being run off from a reservoir below the tuyeres, where it would collect. Being thus unacted upon and undisturbed by the blast, rich matte, or even metallic copper,



20-FT. UPRIGHT CONVERTER, GREAT FALLS SMELTER.

could be produced. By continuing the oxidation and producing Cu_2S, and some metallic copper, the gold and silver would be found with the metallic copper. It is well known that small quantities of silver and gold are far more completely extracted from minerals which contain them by smelting, or treatment with fluid metal or metallic matte, than by any wet process. The fact that by such methods practically the whole of these metals present are collected and concentrated, is the fundamental principle of the analytical assay, and is proved by the accuracy of determinations made in this manner. A large side flue, at the top of the furnace, would carry off the gases and sublimates after their temperature had been reduced in heating the charge introduced above through a self-closing hopper. It is calculated that such a furnace, 30 or 40 ft. high, with a hearth capacity of 1 cubic metre, would be capable of treating annually 50,000 tons of pyrite, and a similar quantity of silicious flux, working 200 days in the year.

The theory of smelting sulphides with a blast-furnace is as follows: The operation is started by placing the tuyere hearth in its place, and throwing in hot coke at the top of the furnace. The blast is now turned on, and the coke develops a high temperature by its rapid combustion. The ordinary working charge of sulphide and flux is now introduced at the top hopper, and as the sulphides melt the coke burns away. As soon as a layer of molten sulphide lies over the tuyeres, the blast is increased and also the burden of the furnace. The charge above the fusion zone as it descends is gradually heated, losing much of its sulphur by volatilization before it becomes molten. On fusion, a considerable amount of lead sulphide will distill over, accompanied by the remainder of the arsenic as sulphide in the strong current of nitrogen and sulphurous acid. These gases, as they pass upward in the furnace, will be greatly reduced in temperature by the volatilization of the sulphur and moisture from the crude materials.

There is some reason to believe that more than half of the sulphur in pyrite is volatilized in the free state by this operation. The sublimed oxides, sulphides, and sulphur would be collected in the wide chambers with which the side flue is connected. Below in the hearth the oxygen of the air forced in acts upon the sulphides of iron and zinc contained in the charge, and as long as a constant supply of these substances arrives at the hearth no other constituents present will be appreciably oxidized. A tap-hole near the top of the hearth allows the slag to be withdrawn. The blowing would be continuous day and night so long as the tuyere hearth lasted, and the heat from the gases after they leave such a furnace could be utilized so as to heat the blast or to produce steam-power for the blowing engines. The product of about six tons of material would be tapped every half-hour, so that in seven days' work 1000 tons of sulphide would be treated. If desired, the products could be run direct into suitable reverberatory furnaces, when, after the matte had settled, the slag could be run off while yet in a molten state, and in which the oxidation of the matte could be completed. It is difficult to see how the charge could be overblown, but if it were, the product could be worked up again by adding it to a subsequent charge of sulphides introduced at the top.

The SO_2 evolved could be oxidized into sulphuric acid in chambers, or reduced to sulphur by H_2S. The latter decomposition might be accomplished by driving superheated steam into the furnace where the sulphides are oxidized. The SO_2 could also be utilized by Hargreaves' process, and there are other possible methods of treatment, such as dissolving it in water by spray jets in towers, or by condensing the gas to the liquid state. I am indebted to A. H. Allen for indicating to me a means by which large quantities of liquid anhydrous SO_2 can be produced, from which sulphuric acid free from arsenic could be made. This plan appears to me simple, and offers many advantages. "The gases, freed from impurities mechanically carried over with them, are first cooled and then led into towers, or other suitable vessels, filled with charcoal, which will absorb and retain the SO_2 and allow the nitrogen to escape. The SO_2 is afterward obtained from the absorbent by exhaustion or heat, and, being thus practically free from the nitrogen, can more readily be liquefied by compression than is possible in the presence of a large quantity of that gas. The SO_2 having been extracted, the charcoal will be ready for another operation, and may thus be used many times in succession."

I have thus endeavored either to prove by experimental data, or to logically demonstrate:*

1. That the whole of the oxygen of the air driven into a thin stratum of protosulphide of iron (FeS), is utilized for oxidation.

2. That by the heat evolved in the rapid oxidation of sulphides and without the use of extraneous fuel other than that employed in producing the blast:

(a) About one-half of the sulphur contained in iron pyrite (FeS_2), is expelled in the free state.

(b) The remainder of the sulphur, excepting that left with the matte, is principally evolved as SO_2.

(c) Although only about 20% of sulphur is oxidized, the proportion of SO_2 to nitrogen by the new process is 14.9%, which is a larger proportion of SO_2 than is obtained by copper smelters who manufacture sulphuric acid. In the ordinary method of burning pyrite, where 45% of sulphur is oxidized, the ratio of SO_2 to nitrogen is only 16 per cent.

(d) The volatile metallic sulphides, such as arsenic sulphide and lead sulphide, are distilled off with sulphur.

(e) Iron being more oxidizable than copper, silver, gold, nickel, and certain other metals, these latter will be all concentrated in the matte, provided an excess of sulphide of iron is always present.

(f) The FeO thus formed is converted into slag by the addition of the silica introduced with the pyrite.

(g) The more perfect fusion of the slag thus obtained prevents loss of copper by entanglement with imperfectly fused material.

(h) About 16 to 20 cwt. of incombustible material, having a specific heat of 0.15 to 0.25, can be added per top of pyrite when a cold blast is employed, assuming that 1000°C. is the temperature necessary for the operation.

(i) The quantity of similar incombustible material can be increased to 30 to 34 cwt. to each ton of pyrite operated on, when a hot blast of 500°C. is employed, assuming that 1000°C. is the temperature necessary for the operation.

(j) Such incombustible material may contain larger or smaller quantities of valuable metals as oxides which will pass into the matte or be volatilized as sulphides, after double decomposition with FeS present in the molten bath. Thus silicates of nickel or copper would be converted into sulphide of nickel or copper, and be concentrated in the matte.

3. That when employing a silicious lining for the furnace the corrosive action of the FeO formed is greatly mitigated, if not practically avoided, by the addition of sufficient silica with the charge of pyrite to produce a slag containing more silica than is required by the formula $2(MO)SiC^2$ (M representing an atom of divalent metal).

4. That the quantity of coal necessary to produce the blast, calculated on the oxygen requisite for the oxidation which takes place, is 1⅓ cwt. per ton of pyrite.

5. That to heat the blast to 500°C. an additional amount of less than 1 cwt. of coal per ton of pyrite is sufficient.

6. That the new process would materially avoid the destruction of vegetation now so bitterly complained of in Spain, and, at the same time, would greatly increase the profits of the pyrite companies that now employ the cementation process.

7. That the new process could be advantageously employed by the copper smelters for treating rich copper ores on account of the great economy there would be in labor and fuel.

8. That the cost of plant is small, compared not only with the quantity of material it would treat, but also on account of the additional profits derivable from the new process.

*Much of the experimental data given in the original paper has, from considerations of space, been omitted.

New South Wales Mineral Output

The production of minerals last year proved highly satisfactory, the output having been exceeded only in 1907. The value of the mineral output was $47,423,909, an increase of $4,872,821 over 1910. Coal, silver-lead, and copper mines were the principal factors in the increase. The value of the product of the silver-lead mines, including zinc concentrate, was $19,770,000, an increase of $3,245,150 over 1910. Underground work in the Broken Hill Proprietary was resumed in February 1912, after suspension for the whole of the previous year. A large orebody was found in the British mine. An indication of the progress made in the recovery of the zinc content from the accumulated heaps of tailing and from the ore hoisted is given by the fact that the export of zinc concentrate for the year totaled 516,378 tons, valued at $6,876,803, exceeding in value that for 1910 by $609,182. The output of copper was valued at $2,871,731, an increase of $505,371 over 1910. The output from Cobar, which is the chief centre of the copper-mining industry, shows a substantial increase. Tin and tin ore produced amounted to $1,494,449, an increase of $384,128 over 1910.

MANGANESE ore amounting to 162,272 tons, valued at $758,017, was exported from India between April and July of the current year, which is a large decrease from 236,056 tons, valued at $1,123,730, for the same period of 1911. The exports to the United States were 47,179 tons, worth $186,465, as against 32,424 tons, worth $140,870, during the periods stated.

The Bishop Creek Mill

By Algernon Del Mar

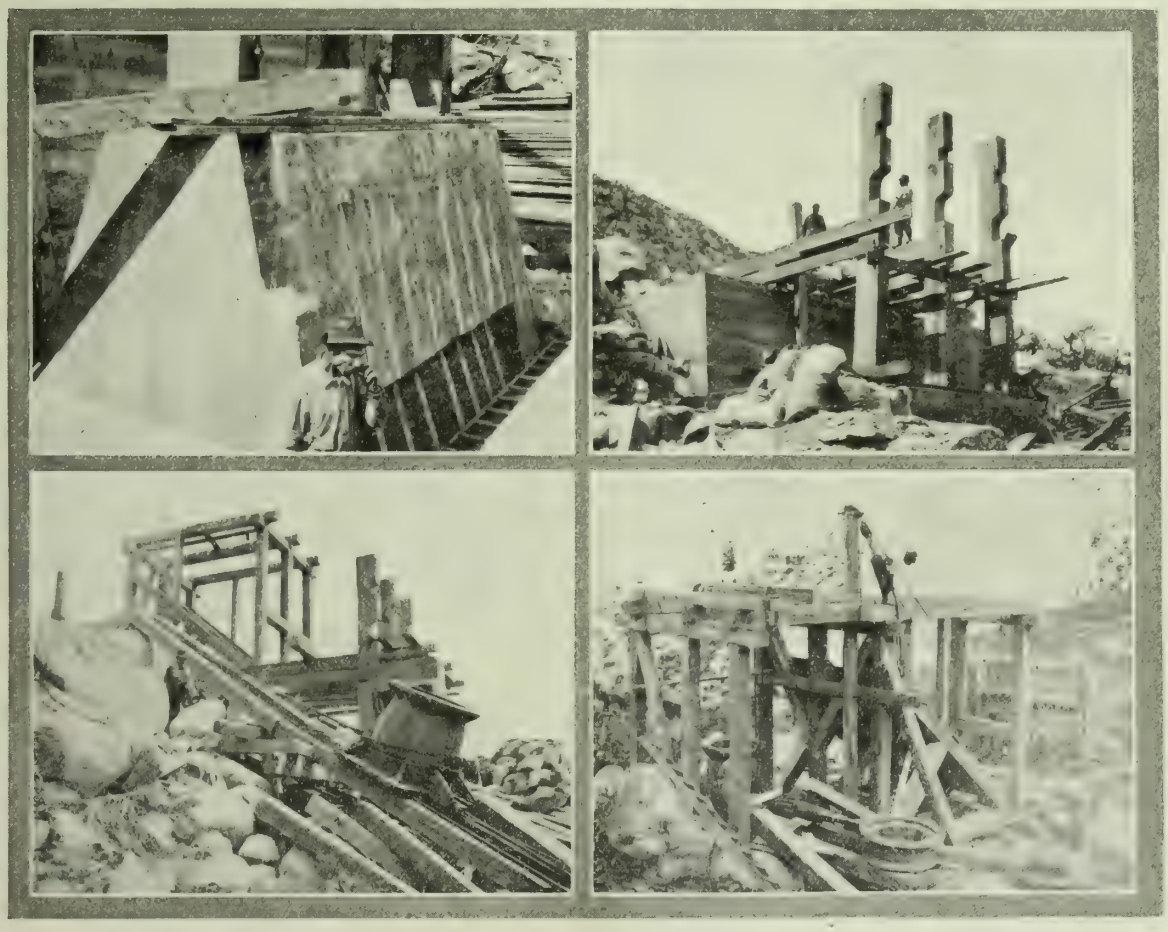
The Bishop Creek mine, or Wilshire's Bishop Creek mine, as it is more commonly designated, is in Inyo county, California, about eighteen miles from Bishop, on the headwaters of Bishop creek, at an elevation of 8400 ft. As this description is of the mill, the mine only requires passing mention as having been developed to such a stage that it was considered the conditions justified the erection of a unit of ten stamps, with provision for the addition of another unit of ten stamps with only the expense of the extra machinery. Not every one recognizes that the critical point in the history of a mine is when the mill is erected. It may be put up before there is sufficient ore developed in the mine to justify the expense, or it may be put up when the company is short of funds. In either case, no matter how good the mine, the result is a failure.

The mountain-side at the mine shaft is precipitous and subject to snowslides. This is the sufficient reason why the mill was placed 700 ft. from the mine, at the only point in the canyon near the mine that is not subject to slides of rock or snow. The mill is 50 ft. higher than the mine shaft. As it required a tramway to transport the ore 700 ft., an elevation of 50 ft. makes little difference in the amount of power required to transport the ore, the 50-ft. rise only requiring 3 hp. This elevation enabled the mill to be placed on solid granite bedrock, with a fall of 110 ft. from the ore-bin to a flat near the creek bottom, thus insuring a gravity system in the handling of the ore. Granite bedrock is not a necessity for light-weight stamps, but for stamps weighing 1250 lb. or over the foundation is of prime importance.

The mill, as mentioned, is about 110 ft. above a flat. A road was built connecting this flat with the main road. The problem then was how to land all the material on this hillside without carrying it up by hand, for it was out of the question to try to build a wagon-road to the millsite. This was solved by constructing an inclined track from the flat to the millsite. For power, an engine formerly used on a Sullivan diamond-drill was employed, using air from the compressor.

The surface of the ground when the mortar-block excavation was started was covered with loose boulders. The retaining wall for the ore-bin was built of rock, and will later be faced with two feet of concrete. When bedrock was reached a water Leyner drill was used to smooth it. The illustration shows the main portion of the gyratory crusher being hauled up the incline on greased tracks. The upper right-hand illustration shows the ore-bin retaining wall faced with concrete and the starting of the ore-bin foundations. The left-hand illustration shows the concrete mortar block for the ten stamps, each weighing 1250 lb. This is the form of mortar block used at the City Deep mill in South Africa. The mixture used in making the concrete was 1:3:3. The battery posts, 12 by 24 in., are held down with cast iron shoes. The hold-down bolts for the post are replaceable. I believe a post 12 by 30 would have been better for this weight of stamp. The back-knee sills are 12 by 16-in. lodge-pole pine; in fact, all the woodwork of the mill is made of this same wood, native to the country, hewn or hauled to the company's sawmill and there cut as required. The ore-bin timbers are all 12 by 12 in., making a solid substantial foundation for the aerial tramway which enters the top of the mill.

The designers of the mill planned to put the crusher, weighing nearly 12 tons, on top of the ore-bin, the tramway dumping directly into the crusher. This appeared to me to be a poor plan. The mine ore being wet, the fine



CONCRETE MORTAR BLOCK.
HAULING CRUSHER UP INCLINE.

ORE-BIN RETAINING WALL AND BATTERY POSTS.
ORE-BIN TIMBERS.

would clog, and, secondly, putting the crusher on the ore-bin, above this a grizzly, and then the tramway, would make a very high building with a small base and would require excessive timbering to insure stability. The plan I adopted was to place the crusher on a level with and behind the ore-bin, with a separate bin for the coarse rock and an elevator at the crusher to put the ore at any place in the ore-bin that may be required. The tramway then is immediately on the solid ore-bin, dumping on a grizzly, the fine ore going to the stamps and the coarse ore to the crusher ore-bin. In the construction of the ore-bin provision was made for at least two feet of ore to always remain on the inclined surface of the bin. This protects the flooring and stores a small quantity of ore as a reserve that can be easily shoveled down the incline. The stamps are fitted with Pacific guides, these being, in my opinion, the type that requires the least repairs. The ore-feeders are the Traylor make of Challenge feeder with cam grip feed. The mortars are the high back, narrow discharge, El Oro type, weighing about 9000 pounds.

Copper Production of California

By B. S. Butler

*California was among the earliest of the Western states to make an important output of copper. Production began in the 'Foothill' belt about 1862 and for several years was an important industry, California being second only to Michigan in its copper production. In a few years, however, the industry declined, and California did not take important rank as a copper producer until 1897, when production from the Shasta county district began. Since that time there has been a steady and important output from the state. The production for the early years has been ascertained from the best sources available, and adding to this the known production since 1882, it is found that to the close of 1911 California has produced about 480,970,000 lb. of copper, or 2.90% of the output of the country since 1845. In 1911 the output was 3.27% of the total production of the United States. In total output the state ranks fifth among the copper producers, and for 1911 it ranked sixth. Five plants in the state treated copper ores in 1911, though several of these were operated for only a short period. The main production has come from two districts, though numerous other districts have made small outputs, and copper minerals are widely distributed over the state. The largest producer has been the Shasta county district, and the next most important the 'Foothill' district. In 1911 California produced 35,853,651 lb. of blister copper, as compared with 45,760,200 lb. in 1910. The reduction in output for the state was due to the necessity for eliminating from the smelter fume the constituents injurious to vegetation. This resulted in the shutting down of all but one of the smelters in the Shasta county district.

Shasta District

The Shasta county copper belt is in the Klamath mountains, at the head of the Sacramento valley, a few miles north of the town of Redding. Sacramento river crosses the belt, separating it into an eastern portion containing the Bully Hill and the Afterthought districts; and a western portion containing the Iron Mountain and the Little Backbone districts. Placer mining was carried on in the district in the early days of mining in the state, and later considerable silver was produced from the gossan outcrop of the copper deposits. Although copper minerals have been long known from the district, it was not until 1897, when the Mountain Copper Co. (Ltd.), began production at Iron Mountain, that it became an important contributor of copper. In 1911 the district produced about 29,900,000 lb. of copper, as compared with about 36,000,000 lb. in 1910. The total production to the close of 1911 has been about 365,900,000 lb. or about 2.23% of the total output of the country. In 1911 the district produced about 2.72% of the total output. In total output the district ranks eighth, and in production for 1911 it ranked ninth among the copper districts of the country.

The enclosing rock[1] of most of the orebodies is an alaskite-porphyry intrusive of Mesozoic age. The ore minerals have replaced this rock along zones of shearing. In the western district the ores thus far developed are large, flat lying, more or less tabular bodies of no great vertical extent. In the eastern district they have more the character of veins and, locally, form deposits in the adjoining sediments. The ore in the western district is pyrite, with a small percentage of chalcopyrite and varying amounts of sphalerite. In the eastern district sphalerite becomes one of the important constituents. Rich secondary sulphide ores were found underlying the gossan at Iron Mountain and Bully Hill, but these have been exhausted. The ores carry precious metals, those of the eastern district being rich in them. The average metal content of the copper ores from the district for 1911 was 3.7% of copper, with $1.80 per ton precious metals.

The producing companies in 1911 were the Mountain Copper, the Balaklala, and the Mammoth. All of the ore is smelted in the same district, except that of the Mountain Copper Co., which during 1911 was treated at its Martinez plant on San Francisco bay. In addition to local ores the smelters treated a variety of ores from Nevada, Idaho, and Oregon, and ore and matte from other districts of the state. A large tonnage of the low-grade gold quartz ores of the districts was used by the smelters to flux their ores. Pyritic smelting is practised successfully in the district. Two smelters were operated in the district in 1911. The Mammoth smelter at Kennett operated throughout the year. It is reported that the bag-house has proved effective in eliminating the injurious substances from the smelter fume, and it is expected that a considerable revenue will eventually result from the materials collected in the bag-house, though a satisfactory process for the treatment of these materials has not yet been developed.

It is reported that the tonnage of ore developed nearly equaled that extracted. The extraction was 270,331 tons. The grade of the newly developed ore is reported as somewhat higher than the average of the old reserves. A new haulage adit, known as No. 5, has been driven 105 ft. below the No. 3 haulage adit. The adit is of sufficient size for the operation of 26-ton electric locomotives and the ordinary narrow-gauge railway cars. The Balaklala smelter at Coram was closed in July by order of the Federal court, on the ground that the fume was injuring vegetation. During the first half of 1911 the company produced 5,026,344 lb. copper, 177,821 oz. silver, and 4005 oz. gold.

The ores of the Mountain Copper Co. were treated at the Martinez plant on San Francisco bay. The company reports the following ore reserves: Iron Mountain mine, 27,979 tons; Iron Mountain mine (in store at Keswick) 37,341 tons—the whole estimated as carrying 3.75% of copper; No. 8 mine, 220,000 tons, of an average content of 4.45%. In addition to this there is the large body of ore developed in the Hornet mine which is low grade in copper, but salable for its high sulphur content. The Bully Hill and Afterthought districts made no production during 1911. The smelter at Bully Hill was closed in 1910 on account of smelter fume difficulties. Electric power is used almost exclusively at both mines and smelters. The district is served by the Southern Pacific railroad, short branches extending to the smelters. The Iron Mountain district is connected with the main line by a narrow-gauge railroad operated by the Mountain Copper Co., and the mines of the Mammoth company are connected with the smelter by a

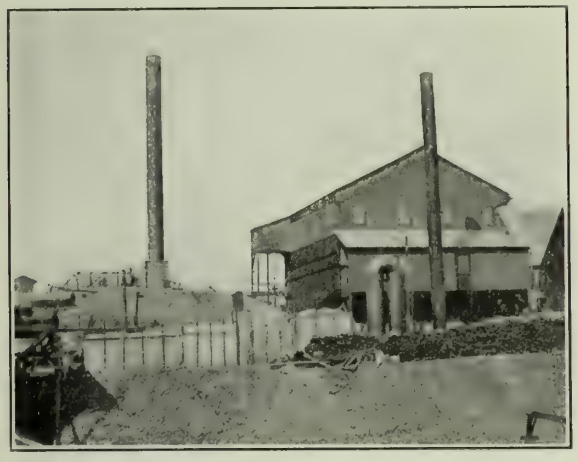
*From an advance chapter of 'Mineral Resources of the United States for 1911.'

[1]Diller, J. S., Redding folio (No. 138), Geol. Atlas U. S., U. S. Geol. Survey, 1906; Bull. U. S. Geol. Survey No. 213, 1903, pp. 123-132; Bull. U. S. Geol. Survey No. 225, 1904, pp. 169-179. Graton, L. C., 'The Occurrence of Copper in Shasta County, Cal.'; Bull. U. S. Geol. Survey No. 430, 1910, p. 71.

combined electric railroad, gravity tram, and steam railroad. The ores of the Balaklala mine are delivered to the smelter over a cable tramway.

FOOTHILL DISTRICT

The Foothill belt is a rather extensive area of copper deposits which has its best development in Calaveras county. This belt furnished practically the entire copper production from California in the sixties. Following that period of activity, the district was inactive for many years. From 1887 to 1892 the mines made some production. The present period of activity began about 1901, and for some years the district has made important contributions to the copper output of the state. There is no accurate record of the output of this district in the early days, but from the records of the production of the state it is estimated that to the close of 1911 it has yielded approximately 109,500,000 lb. of copper. The production for 1911 was approximately 5,500,000 lb. In total output the district ranks eleventh, and in production for 1911 fourteenth among the copper districts of the country. The ores,[2] consisting of pyrite and chalcopyrite, occur as lenticular bodies replacing schist. The ores



PART OF PENN MINING CO. SMELTER.

vary in different parts of the district from those carrying nearly pure pyrite and chalcopyrite with very low gold and silver content to ores carrying considerable lead, zinc, and precious metal. The ores treated in the district during 1911 averaged about 4.7% copper, with about 2c. in precious metal per pound of copper. The matte smelter of the Penn Chemical Co. was operated in the district, and ore was shipped to custom smelters.

Queensland Gold Output

The yield of gold in Queensland for August 1912 was 29,976 oz. fine, of the value of £127,330, this being a decrease, when compared with the output for August of last year, of 3210 oz. in quantity and £13,635 in value. The falling off is attributable to the decline in the yields from Charters Towers and Gympie, the decrease amounting to 2700 on the former and 2600 on the latter field. Against these decreases there were improvements at the Etheridge of 263 oz.; at Mount Morgan, of 1704 oz.; at Ravenswood, of 446 oz.; while Cloncurry recorded 1326 oz. as against nothing for the corresponding month of last year. At Croydon, there was a decrease of a little over 400 oz.; while on the Rockhampton fields there was a slight increase. The dividends from gold-mining companies for the month totaled £6086. For the eight expired months of this year the output of gold has been 231,420 oz., of the value of £983,009, this being a decrease, when compared with the corresponding period of last year, of 18,053 oz., and £76,684, respectively.

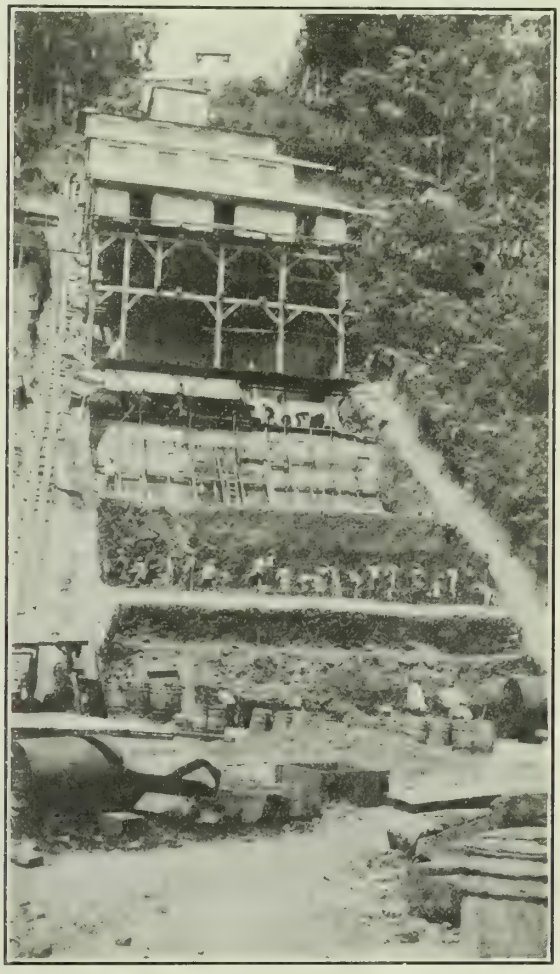
[2]Knopf, A., Bull. Dept. Geology Univ. California, Vol. 4, p. 411; Read, J. A., Econ. Geology, Vol. 2, 1907, p. 380; Lang, Herbert, *Eng. & Min. Jour.*, Vol. 84, 1907, p. 909.

The Colorado Mine and Mill, Philippine Islands

By PAUL R. FANNING

*During the first part of 1911 the Colorado Mining Co. continued development to prepare the mine for the 20-stamp cyanide mill which was nearing completion. During 1911 the mill operated irregularly for less than two months, but steady production did not begin until the last of December.

The Mine.—An accurate description of the mine and ore-



COLORADO MILL DURING CONSTRUCTION.

bodies has already been given by Eddingfield. The vein averages 4 metres in width, strikes south 45° east, and dips 70° to the northeast. The vein matter consists of quartz, with some calcite and manganese. The ore is stated to average ₱20 per ton.

The inclined shaft now reaches a depth of 146 metres, which is the greatest depth penetrated in the district, perhaps in the Philippine Islands. As stated by the company, the average precious-metal content shows only a nominal decrease from the top to the bottom of the shaft, and the bottom ore is said to have a value of more than ₱16 per ton. It is to be noted that this ore is still above the level of the permanent ground-water, and hence in the oxidized zone. The indications are that the zone of oxidation should extend to a depth approximately equal to the level of the Guinobatan river; that is, 100 metres below the present bottom of the shaft. It is probable that good ore will be found to this depth, and it is possible that the zone

*Extract from 'Mineral Resources of the Philippine Islands for 1911.' The peso is the Philippine peso, of a value of $0.50 gold.

of oxidation may extend to an even greater depth. Whether or not a zone of enriched ore will be found at this depth is too problematic for present consideration, although the presence of manganese in the ore, as has been repeatedly pointed out, is highly suggestive of a zone of richer ore close to the level of the permanent ground-water.

The mine has been developed by means of two main adits, 53 metres apart vertically; the upper, or No. 1 adit, is 30 metres below the highest point in the outcrop. Two intermediate levels have been run, and various cross-cuts and raises put in. During 1911 a drift was run next to the hanging wall parallel to and connecting with No. 1; the main, or No. 2, adit was continued 80 metres farther to the northwest; the upper intermediate level was run for a distance of 120 metres; the lower intermediate level was run for a distance of 180 metres; and the shaft was sunk 30 metres to a total depth of 146 metres. In all, some 800 metres of work was performed, besides preparing the ore-bodies for stoping.

In stoping the ore the square-set system of mining has been used, but owing to the high cost of timbering it is probable that some modification of the method will be adopted. The mine is surrounded by a forest of magnificent hardwood trees, but the cost of cutting, transportation, and dressing is very high. The tangle of underbrush and vines require an extra amount of work to fell the trees after cutting, and the wood is so hard that the natives saw it with difficulty. The sets are framed by hand and are so heavy as to require several men to handle each piece. The substitution of dressed pine shipped from the United States for native timbers is being considered as an economical measure.

The Mill.—The 20-stamp cyanide mill is of Traylor design and is of the all-sliming type, crushing in cyanide solution. The striking feature of the practice is that the gold solutions from the Dorr thickeners pass to the zinc-boxes without filtering in the Oliver filters. The ore is delivered from the second level of the mine to the storage bins, and thence to the mill by means of a 2-bucket aerial rope tramway 320 metres long.

Crushing.—The ore from the buckets passes to a 3 by 8-ft. grizzly; the oversize is crushed in a 10 by 20-in. Blake crusher and passes to the bin. The ore is fed into four 5-stamp batteries by Challenge feeders. Lime, which is prepared in a kiln near the mine from a local deposit of calcite ore, is added at the batteries. The 20 stamps, weighing 1,750 lb. each, drop at the rate of 100 per minute; the height of drop is about 8 in., and a 4-in. discharge is used. The ore is crushed in solution of a strength varying from 0.12 to 0.20% potassium cyanide. A capacity of 4.5 tons per stamp per 24 hours is obtained when a 6-mesh screen is used. The pulp, which has a thickness of about 6 parts of solution to 1 of ore, passes to a Dorr classifier, where the sand is raked out and delivered to two 5 by 18-ft. tube-mills. These mills are of Traylor manufacture, with trunnion bearings and spiral feed. A speed of 28 r.p.m. is used. The lining is of the El Oro type. At first, Danish pebbles were used entirely, but at present some of the harder quartz from the mine is added. The discharged pulp, which contains about 40% moisture, passes to a bucket elevator and is returned to the Dorr classifier.

Treatment of the Slime.—The slime, having a thickness of about 9 to 1, passes from the Dorr classifier to a 20 by 14-ft. Dorr thickener. The overflow from the thickener passes to a clarifying tank, thence to a gold-solution tank, and thence to three sets of 7-compartment zinc-boxes.

The pulp from the thickener passes to two 12 by 40-ft. Pachuca tanks, connected in series. The central columns of the Pachucas discharge at the surface and an air pressure of about 32 lb. is used. The solution has a strength of from 0.12 to 0.20% potassium cyanide, and the pulp has a thickness of about 1.5 to 1. After agitation in the Pachucas, the pulp passes by launder to a second Dorr thickener. Previous to entering the thickener the pulp is diluted with solution from the Oliver filters. The overflow from the thickener passes to a clarifying box, and thence to two sets of the 7-compartment zinc-boxes. When first operated the thickeners gave trouble owing to the great amount of slimy foam which overflowed with the gold solution. This difficulty was overcome by removing alternate bolts on the rim launder and drawing off the solution just below the surface free from foam. The foam is drawn off separately by a central launder and passes to the Traylor agitator.

The pulp from the thickener passes to a 20 by 8-ft. Traylor agitator, which prepares the pulp for two 11 by 6 by 8-ft. Oliver filters. From the filters the gold solution passes by means of wet and dry vacuum pumps to a 12 by 10-ft. storage tank. From this part of the solution is pumped to dilute the pulp entering the second Dorr thickener, and the remainder is pumped to the 28 by 14-ft. solution storage tank at the top of the mill. None of the solution from the filters passes directly to the zinc-boxes.

Solution of the Gold.—As noted, a feature of the practice is that the gold solution is taken from the Dorr thickeners for precipitation rather than from the Oliver filters. The reason for this lies in the fact that about 80% of the gold goes into solution before the pulp reaches the Pachucas. It would seem from this that the greater part of the gold is very fine, easily liberated, and readily attacked by the cyanide solution. The presence of manganese probably has been instrumental in producing this condition of the gold. Some coarse gold and gold bound up in the minerals are present, and the Pachucas give the added time necessary to their dissolution.

Precipitation and Clean-up.—A general clean-up is made every two weeks, and the bullion is melted once a month. The zinc fine is treated with sulphuric acid, and the gold slime is washed, steam-dried, and melted in a gasoline tilting crucible furnace. The bullion is shipped to Manila, where the International Banking Corporation advances a sum based on the company's own assay. The bank ships the bullion to San Francisco, and later makes adjustments with the company.

Cost of Operations.—The cost of mining and milling at the Colorado mine has been placed at less than ₱8 per ton, and there is some reason to believe that this figure will be reduced under conditions of steady operation. The fact that the cost of mining is moderately low would lead to the belief that, considering his low salary, the Filipino is an efficient miner. It is to be remembered, however, that the vein is of such width as to permit stoping on an economical scale. Furthermore, most of the ore is sufficiently soft and fractured as to be readily mined without the use of dynamite. On the other hand, the cost of general supplies is high, although lower than at many mines in the United States not situated directly on a railroad. The anomalous condition of having a timber problem in the midst of a great forest has already been discussed, and this problem will become more acute as the trees are removed and it becomes necessary to bring timber from a distance.

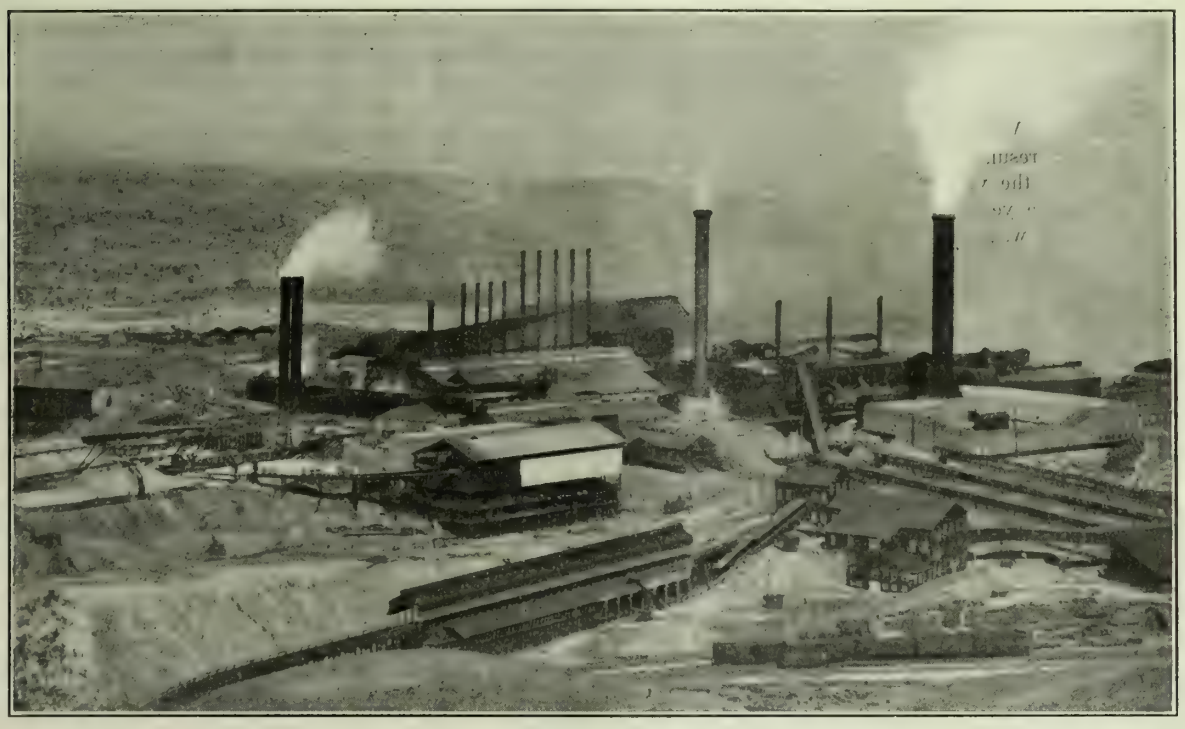
Owing to the excessive cost of the mill, the original investment is large in comparison with the capacity, and this means a higher cost per ton than usual, owing to the factors of depreciation and interest. For this mill these two factors alone mean a cost of about ₱1 per ton, and it is possible that this amount has not been included in computing the total cost of operation.

It was my belief when first coming to the Philippines that the depreciation for this country would be especially high, and experience in many cases has justified this belief. However, there are instances where, under good construction, the depreciation has been no greater than in the United States. The destruction of buildings under the attacks of white ants or other insects does not always seem a serious consideration, as there are numerous buildings, properly constructed, which have lasted for many years; certainly many years longer than the probable life of any mine. It is also known that white ants do not attack timbers which vibrate under the shocks of machinery. The construction work on the Colorado mill is of such order that it appears unnecessary to allow an excessive depreciation charge.

Work of the Cananea Copper Company

By L. D. Ricketts

*The physical condition of our mines is good. I look for a satisfactory year ahead and a notable increase in the output of both copper and silver. The important developments of new ore have all been in the limestone areas. These ores contain from 3 to 5% copper and from 1 to 4 oz. of silver, and from 10 to 30c. in gold per ton. They are direct smelting ores, highly basic in character. As intimated in my last report, no attempt was made to press production during the year, but, on the contrary, curtailed production was aimed at. On account of the development of basic high sulphur ores, there was need, however, of more silica, and operations consequently were resumed at the Henrietta mine, which was closed down in 1910, and the Cobre Grande mine was also reopened. Toward the end of the year work was also started at Puertecitos with a view to increasing output when necessary.



SMELTING PLANT OF THE GREENE-CANANEA COPPER COMPANY.

At Puertecitos a new quarry for oxidized ores has been started, and J. H. Kirk has undertaken the development of the porphyry contacts on either flank of the limestone core of this hill. The results of his work are promising, and he expects by the middle of the coming year to obtain over 200 tons of smelting ore per day from this mine. Most of the work done, however, is dead work preparatory to extraction, which accounts for the high costs at this mine.

The Henrietta mine proper, while profitable, is a small mine, and no large orebody has been found in its workings. It is used, however, as a base for broader work, and two long cross-cuts are being driven, connecting with each other for air, that will ultimately attain a length of several thousand feet. They run south, toward the main cordon, and are intended to intercept the mineral belt thought to exist far out in this direction. This work will tend to give information as to the future direction of the Combination adit, which will ultimately serve as an outlet for this district, should it develop as hoped. The face of the Combination adit, at the close of the year, was 5200 ft. from the portal, and is being slowly driven ahead. The adit has passed entirely beyond the Elisa zone and has entered the Cananea claim.

The Elisa mine has continued to improve through development in the past year. The main ore-shoot has been opened on the sixth level and has been cross-cut by extraction adits on the level of the Combination adit, and the main shaft will be sunk during the coming year to develop the ore below. The ore has been of a satisfactory grade, and the mine is looking better than it has at any time during the past several years.

Possibly the most encouraging developments on the entire property have been in the limestone area of the Sierra de Cobre mine, over the Combination adit. In my last report I referred to the fact that the Eureka fault, which appears to be the extension of the Capote fault, had large masses of gossan along it and would probably develop important bodies of ore. This prediction has proved correct, and very important orebodies have been developed in the limestone adjacent to this fault at three points, and have cross-cut ore in a number of places in the limestone that will undoubtedly yield important tonnages in stoping. The ore in this area is exceedingly irregular in its occurrence, and a great deal of prospecting is done in stoping.

Developments on the tenth level of the Capote mine under the old orebody have been disappointing, although some ore has been discovered in the old body between the eighth and tenth levels. In the early history of this district, in the year 1899, one of the Capote adits crossed an exceedingly lean body of iron pyrite on the first level. Owing to the similarity of its occurrence to the ore found in the Sierra de Cobre, and owing to the fact that in the Sierra de Cobre nearly barren pyrite is often found, it was decided to develop this zone. We first discovered ore that is undoubtedly connected with it on the ninth level. During the year the ore has been opened on the second, third, fourth, and fifth levels, and there can be no question

*From a report for the year 1911, made to the board of directors of the Cananea Copper Company.

but that this ore will continue as far as the ninth level. A great deal of the ore is an exceedingly lean iron pyrite containing a high percentage of sulphur, and cannot be handled at the present time, but there are notable quantities of the ore on the lower levels that is of profitable smelting grade. The mass of pyrite on the fifth level is about 220 ft. long, with a maximum width of 100 ft., and the indications are that a large tonnage of profitable ore will be obtained, even if a way of treating the leaner material cannot be found at present. This ore contains a certain amount of silver as well as copper, and as long as it contains over 2½% copper it should be profitable at the smelter. A considerable amount of it will average nearer 4 per cent.

The Oversight mine has maintained a steady production, and much more first-class smelting ore has been developed than was expected. At the same time, this ore has come within the limits of the main ore-zone, and during the year the amount of ore developed has not equaled the amount of ore that has been extracted from the mine. Development in this mine has not been pressed, but during the coming year a further geological study of ore occurrence will be made and development work will be more extensive. It is also intended to develop the old Esperanza orebody, which contains concentrating ore of rather low grade, but which should be profitable under present conditions. The Veta Grande mine will be opened and mining operations resumed during the latter part of the coming year. For the year 1911 it has been idle. The Kirk mine during the year produced about 95,000 tons of ore, most of which was of a smelting grade. There are no new developments of importance in this mine. The Cobre Grande mine has produced a notable quantity of ore for converter lining and for smelting. The old orebody is not adapted to concentration. A new body of concentrating ore has been found to the west. It is of good grade, but apparently not of large extent.

The tendency for the future is toward lower-grade matte, and I am endeavoring to develop ores low in sulphur to help raise the grade of the matte. With this aim in view, a four-fifths interest in the Superior Bonanza mine, situated near Imuris, Sonora, has recently been bought. This mine yields a silicious ore containing small quantities of copper and notable quantities of gold. This class of ore is needed to assist in raising the grade of the matte and to furnish flux for the iron.

The amount of money involved in the purchase of this mine is not large. It is probable that no production will be made from it until some time in 1913, as development is being continued and it is hoped before that time a sufficient tonnage of ore will be developed to justify building a railroad for the 5½ miles between the mine and the Sonora railroad. The railway company has given a reasonable rate on this ore, so that it can be brought to Cananea and smelted at a profit.

Mine.	Total	Stoping	Development	Dead Work and Stoping Expense.	Total .....
Puertecitos	6,505	$3.373	$4.561	$1.976	$9.910
Henrietta	16,796	1.984	1.946	1.240	5.170
Elisa	58,771	2.020	1.303	1.013	4.336
Capote	75,425	1.318	0.528	0.999	2.845
Oversight 394,389		1.010	0.138	0.331	1.479
Veta Grande.....	237	1.562	.....	.....	1.562
Kirk	95,059	1.738	1.183	0.864	3.785
Cobre Grande....	22,669	1.313	0.540	0.843	2.696
60% S. de Cobre	81,611	1.446	0.736	0.556	2.738
	715,462	1.311	0.557	0.592	2.460

Cost of Mining

The cost of mining for the Cananea Consolidated Copper Co. in 1911 was $2.46 per ton, as against $2.75, $2.22, $2.13, and $3.28, for the four previous periods. Considering the fact that the amount of first-class smelting ore, which requires a certain amount of selection and hand sorting, has largely increased, I consider this cost as most satisfactory. The tonnage produced and the segregated costs for mining at the various mines are shown in the foregoing table.

The amount of development work driven totaled 51,784 ft. of which 696 ft. was shafts and 9811 ft. was raises and winzes. The average cost per foot for the completed work was about $8.

The Concentrators

The wooden jigs of Mill No. 2, which have been in service for about eight years, have rotted out, owing to the acid character of the water. During the year almost all of these jigs have been replaced by reinforced concrete jigs, the cost of which has been charged to operating expense. Other work has been done in the way of putting in drag classifiers to separate coarse sand from slime and very fine sand without the use of water. Many small improvements have been made, but none of great magnitude.

During the year 528,412 wet tons of ore was milled. Of this, 415,199 wet tons was produced from the company's mines, and 113,213 wet tons was produced from the Cananea Duluth mine. The former had a concentration ratio of 2.40 into 1, and the latter a concentration ratio of 5.17 into 1. The operating and repair cost was $0.646, and improvements and betterments amounted to $0.076 per wet ton, giving a total cost for the year of $0.722. The average saving of the copper in the ore in concentrate was 77.69 per cent.

The new impounding dam for tailing is serving most satisfactorily, and every pound of tailing, whether slime or sand, is being saved, and there can be no question but that the reclamation of clear water from the tailing pond is of more value than the cost of impounding the tailing. The concentrators are in most excellent condition, and in fully as good a state of repair as they have ever been in their history.

The Reduction Division

The cost per dry ton of new copper-bearing material treated for the past several years has been as follows:

1907	$6.82	1910	$2.69
1908	3.86	1911	2.57
1909	3.09		

The last report predicted that a smelting cost of $2.25 per ton would be obtained. As will be seen from the above table, this prediction has not been fulfilled so far, the reason being that the average grade of the matte has been much lower than formerly, the converting department was congested, and the amount of by-products to be handled very largely increased. The management is, however, attacking this question, as will be seen later, and has by no means given up hope of attaining the cost predicted.

The reduction works treated 580,060 dry tons of new copper-bearing material. The high cost of converting may be seen from the segregated costs for this division:

	Per dry ton.
Sampling	$0.0222
Bedding	0.0584
Reclaiming	0.0202
Blast-furnace costs	1.4055
Reverberatory costs	0.3197
Calcining costs	0.0510
Converting costs	0.6518
Indirect custom ore costs	0.0351
Flux	0.0071
Total	$2.5710

The cost of McDougall roasting for the year was 40c. per dry ton, and the gross cost was made up as follows:

Sampling, bedding, and reclaiming	$0.1262
Operating furnaces	0.1894
Transportation of calcines	0.0228
General expense and flux	0.0619
Total	$0.4003

Of the total charge to the reverberatories of 113,782 dry tons, 41,883 tons was flue-dust, 66,299 tons was calcine, and the remainder was silicious ore and flux, the latter amounting to but 1194 tons. The average weight of the calcine produced from a ton of the concentrate was 1675 pounds.

The second reverberatory furnace was completed and put in operation early in the year. The old furnace was then torn down and rebuilt. Twelve-inch buckstays were used in place of the old 8-in. buckstays, and a 20-in. arch was employed in place of the previous 12-in. arch. New castings were furnished for the furnace, and the flue leading to the boilers was enlarged. This entire cost, amounting to $0.223 per ton of material smelted, was charged to operation. The cost of smelting a ton of charge was $1.65, as against $1.90 for the previous year.

Without the cost of rebuilding the No. 1 furnace, which with ordinary repairs will last for many years, the cost was $1.427 per ton of charge. These figures are shown as follows:

Labor, operating	$0.2982
Labor, repair	0.1547
Shop expense	0.0151
Supplies and material	0.2070
Power	0.0095
Fuel oil	1.4882
Flux, cost of	0.0223
Sundry	0.0566
	$2.2516
Steam credit	0.8245
	$1.4271
Rebuilding No. 1 furnace and flue	0.2232
Total costs	$1.6503

During the year basic lining has been employed in our barrel type shells, but investigation has demonstrated that these shells are not as well adapted to economical work as the Great Falls type of converter. Two stands of converters of the Great Falls type have accordingly been ordered, together with additional blowing engines, and shortly after the middle of the coming year the converting capacity will be increased until it will be capable of producing a total of eight to nine million pounds of copper when necessary. At the same time it has been decided to increase the blowing capacity for the blast-furnaces, for the reason that the sulphur content of the newly developed ores requires more oxygen for smelting.

The Power-House

Heavy expense has been incurred at the power-house during the year, but, notwithstanding, the cost of power has shown a satisfactory decrease. The cost per indicated horse-power for the year has been $5.568, as against $6.54 for the previous year. This cost should be gradually decreased when the contemplated additions to the power-house are finished.

Mining and Reduction

The copper costs for the past year were as follows:

	Per lb. of copper.
Gross costs, f.o.b. Cananea	$0.09568
Freight to New York, refining, marketing, etc.	0.01343
Total costs	$0.10911
Credit:	
Value of precious metals	$0.01339
Miscellaneous revenues	0.00484
Total credits	0.01823
Total cost, fine copper sold	$0.09088
Construction	0.00755
	$0.09843

The total cost of mining and treating a ton of ore, including every cost until the refined copper has been sold, has been as follows:

	Per ton.	Tons treated.
Fiscal year 1905-1906	$10.210	947,977
August 1, 1906, to October 31, 1907	7.625	1,305,291
July 11 to December 31, 1908	5.976	295,554
Fiscal year 1909	5.459	835,929
Fiscal year 1910	5.765	792,856
Fiscal year 1911	5.257	741,873

These costs are exactly comparable, and for the year 1911 the figure of $5.257 includes an item of $0.377 to cover construction as well as every item of repairs and replacements, which were quite extensive. The actual yield per ton of ore treated was 50.01 lb., as against 46.58 lb. and 44.12 lb. for the two preceding years. It is probable that during the coming year the yield will not be so high, for the reason that certain bodies of very lean concentrating ore have been found that can be mined very cheaply, and with the high price of copper it will be profitable to mine this ore at the expense of a drop in the yield per ton, but the cost per ton for mining and beneficiating should also drop. The total amount of money spent for betterments and improvements and extraordinary repairs was about $435,000, of which, in round numbers, $280,000 was charged to construction and the balance against operating costs. Aside from the improvements to the power-house and the converter department, the construction to be done during the coming year is not so heavy.

Tonnages

	Wet tons.
Domestic ore mined	751,462
Domestic ore treated	741,872
Foreign ore treated	195,091
Total ore treated	936,963
Domestic ore milled	415,199
Foreign ore milled	113,213
Total ore milled	528,412
Domestic ore milled, ratio of concentration	2.404 tons into 1
Foreign ore milled, ratio of concentration	5.169 tons into 1

Production

	Pounds.
Domestic ore, bullion product	37,530,749
Foreign ore, bullion product	7,886,151
	45,416,945
Returnable fine copper, domestic bullion	37,101,119
Returnable fine copper, bullion from foreign ore	7,796,347
Total fine copper	44,897,466
	Ounces.
Silver, domestic bullion	795,160
Silver, bullion from foreign ore	500,137
Total silver	1,295,297
Gold in domestic bullion	3,610
Gold in bullion from foreign ore	2,282
Total gold	5,892

Recovery from Ores

Recovery from domestic ores treated was as follows:

Copper...2.5% Silver...1.0718 oz. Gold...0.005 oz.

Concrete Shaft-Lining

By F. E. Calkins

The reinforced concrete lining of the 2-compartment Kingdon shaft at the United Globe mine of the Old Dominion company at Globe, Arizona, was completed on August 28, the lining extending from the collar to the bottom of the shaft, a distance of 1017 ft. In October 1911 the timbering of this shaft was destroyed by fire, and it was decided to put in a concrete lining. The contract was let to Paul Michaelson and C. H. Weideman, construction engineers formerly employed by the Old Dominion company, and preliminary work was started in January 1912. It was decided to build the lining by lifts or sections, beginning near the top and working downward, and the work was finally accomplished in six sections, from 150 to 220 ft. in height, depending on the condition of the ground.

About a month was spent in the preliminary work of erecting a temporary head-frame, crushing plant, concrete mixer, and other machinery, and in cleaning down the charred timbers and loose rock from the first section, extending from the collar to a point 160 ft. below. Two specially built, heavy wooden cages, swinging freely in the shaft, were used throughout the work. In lining a section, the walls were stripped of charred timber and loose rock, beginning at the top and working downward, and light temporary sets of timber were put in, with some lagging wherever necessary, so that the men were always protected from falling ground. When the bottom of the section was reached, temporary timber bearers were placed along the sides and ends and across the centre of the shaft, forms were built upon them, and a permanent reinforced concrete bearer, four or five feet high, was put in. Two or three days were allowed for this to set, after which the concrete lining was built up on top of it. The forms were built in sections 12 ft. high, and the concrete poured in between the form and the rock walls of the shaft. As soon as one 12-ft. section was filled, another was erected on top of it, plumbed and blocked, and filled with concrete in the same manner. The work proceeded thus until the bottom of the finished lining above was reached, the temporary timbering being removed as fast as the forms were erected.

The concrete was made to run from the conical mixer into a hopper and down the shaft through a 4-in. iron pipe to the point where it was needed, where it was caught in an ordinary steel sinking-bucket suspended from the finished portion of the lining above, and allowed to run through a hole cut in the side of the bucket a few inches above the bottom, and through a short steel chute into the forms. This was a very efficient and flexible arrangement, as the bucket could be easily swung or turned, and a continuous stream of concrete directed to any part of the forms desired. The concrete was successfully dropped in this manner for a distance of over 1000 ft. in building the last section.

The long walls of the lining were given a minimum thickness of 10 in., and the short walls and centre wall 8 in. Where the rock walls were very irregular, forming large hollows, large rocks brought down on the cages were thrown into the concrete. The centre wall was reinforced every 18 in. vertically with mine rails laid across the shaft in the centre of the wall. The end and side walls were thus reinforced only at points where the ground was bad and at stations. Bolts were imbedded in the concrete at regular intervals for fastening the guides.

The concrete was a 1:3:6 mixture of portland cement, quartz sand, and crushed limestone from ¼ to 1-in. size. About 2300 cu. yd. of concrete and 750 cu. yd. of large rock were used. About 25 men were employed on the job, working two shifts. The total time consumed was 8 months, of which the first month was spent in rigging up the surface plant, cleaning down the walls, and putting in temporary timbering preparatory to concreting. Also, the lower 110 ft. of the shaft consisted of a raise driven to one-compartment size, and this had to be enlarged to full size. The actual work of concreting was done in 100 days, or about 40% of the total time consumed. Ordinarily, one 12-ft. section of concrete per day was put in, but in bad ground a 6-ft. form would be used. The maximum day's work was 22 feet.

The two compartments are 5 by 7 ft. 2 in. inside the finished lining, and the shaft will be used only for ventilation and for hoisting and lowering men working in the east end of the mine. It is most interesting to note that the area of the compartments is over 60% greater than the area of the old timbered compartments, which were 4 by 5½ ft., showing that with a given area of ground broken a much larger shaft area may be obtained with a concrete than with a timber lining. The contractors received $30,000 for their work, or $28 per foot.

Cleveland Meeting of the Institute

The 103rd general meeting of the American Institute of Mining Engineers was held at Cleveland, Ohio, on Monday, Tuesday, Wednesday, and Thursday of this week. The meeting was opened on Monday evening at the Statler hotel by an informal social gathering at which two hundred members were in attendance. Technical sessions were held on Tuesday morning and afternoon and on Thursday morning. Nearly fifty technical papers were scheduled for presentation, and these were first grouped for presentation and discussion. The first paper was by R. W. Hunt, on the inspection of steel rails, and was followed by a study of the cleansing effect of titanium on cast iron, by Bradley Stoughton. W. A. Barrows and Carl Zapffe presented a description of the Cuyuna iron range, and were followed by R. R. Abbott with a comparison of the action of various carbonizing materials. Next came a study of the hardening of steel by different methods, presented by M. A. Ammon, followed by a commentary on Ruffs carbon-iron diagram, by H. M. Howe, and a criticism of Wittorff's investigation of the permutations in ferro-alloys containing more than 4% of carbon, by Bradley Stoughton and Simon Marcus, both papers being presented by Mr. Stoughton, in the absence of Mr. Howe. On Tuesday afternoon R. H. Sweetser discussed the blowing in of blast-furnaces, and Elwood Haynes exhibited a remarkable series of alloys of cobalt and chromium which have properties superior to those of steel. W. N. Blauvelt discussed the manufacture of coke, followed by F. E. Lucas and F. W. C. Schniewind upon the same subject. N. V. Hansell described the methods recently introduced in the concentration of iron ores, and J. E. Johnson presented a study of the effect of alumina in blast-furnace slags, that gave rise to general discussion. The meeting on Wednesday was devoted to the discussion of the proposed amendments to the constitution and by-laws of the Institute. The discussion was general, but no final action was taken, and a final draft of the proposed amendments will be presented at the adjourned meeting to be held in New York City on November 12, when it will be put in such form that it can be adopted at the annual meeting in February next. The technical session on Thursday morning was devoted to general Western mining and metallurgy. On Tuesday night the visiting members were entertained at a smoker and on Wednesday evening there was an elaborate subscription banquet for the members and ladies. Excursions to points of interest were made on Tuesday and Wednesday afternoons.

The Tengo Mining Co., in the Aroroy district, Masbate, Philippine Islands, did a little development work and operated the mill for a few days, during which some ₱2000 worth of gold was recovered by amalgamation alone. It is now fairly well established that the ores of the district require a large outlay of capital before successful work can begin.

Prospecting in Tasmania

LAUNCESTON CORRESPONDENCE

The Tasmania Minister of Mines, Edward Mulcahy, is seeking to cope with the falling off in mineral production that has been pronounced in Tasmania for some years past. In five years the value of the output has declined about 50%, despite the great increase of the prices of metals. This is due to some extent to a deficiency of labor, but mainly to the fact that the value of the ores generally has declined materially. The Minister has come to the conclusion that the only way to remedy this serious state of affairs is to make new discoveries, and for this purpose to expend a sum of $90,000, quite a considerable amount for the small and not very rich state of Tasmania, on the erection of a public stamp-mill at a cost of $30,000; on equipping and sending out prospecting parties to explore and report upon likely mineral areas; and on granting assistance to properly equipped private parties operating in favorable areas under approved conditions, conditionally on their undertaking to provide the Department with certain required information. The scheme is a wise one, and may lead to something; but, as has been pointed out, it is not clear what is to happen if any discoveries of value be made. It would be interesting to know if it be Mr. Mulcahy's intention to take up and work on behalf of the state, deposits discovered by Government parties on Crown lands; and if, where the Government has merely granted assistance, it will claim an interest. On these points all is silence and there may never be any call to ascertain the Minister's intention. But, again, there may.

Record Zinc Production

The production of primary spelter (zinc) from domestic ore in 1911 was 271,621 short tons, valued at $30,964,794, according to a statement just issued by the United States Geological Survey. This is the greatest production in the history of the industry and shows an increase of 19,142 tons over 1910. The imports of spelter, however, reached the lowest figures in recent years, while exports increased about one-half over those for 1910. The great growth of the zinc industry in the United States is indicated by the following figures:

PRODUCTION OF SPELTER IN THE UNITED STATES FROM DOMESTIC AND FOREIGN ORES, 1880-1911

	Short tons.
1880	23,239
1890	63,683
1900	123,886
1905	203,849
1910	269,184
1911	286,526

The following table is of interest as showing the principal sources of the domestic zinc production:

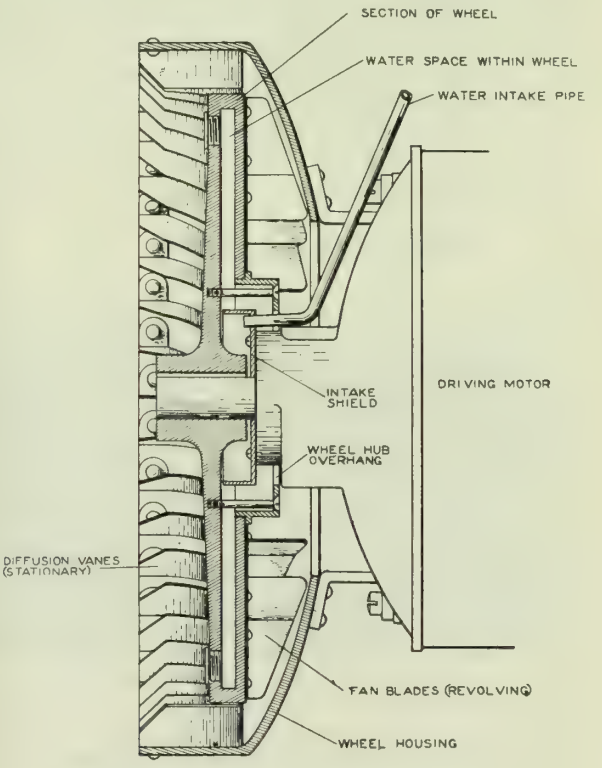
PRODUCTION OF ZINC IN THE LEADING STATES IN 1911, IN SHORT TONS

State.	Recoverable zinc.	Crude zinc and zinc-lead ore.
Colorado	47,304	325,230
Kansas	10,272	761,465
Missouri	122,515	8,162,076
Montana	21,905	225,714
New Jersey	77,445	375,064
New Mexico	5,119	24,735
Oklahoma	5,150	224,450
Utah	8,920	286,570

AT Penang a development syndicate has been formed to exploit tin properties on the border of Siam. The tin ground appears, from reports, to be extraordinarily rich.

A New Type of Mine Air Humidifier

The United States Bureau of Mines has on exhibition at its Pittsburg testing station a machine for producing a water mist that is almost fine enough to be termed a fog. As shown in the illustration, the machine consists of a hollow wheel mounted upon the shaft of an electric motor. The wheel is provided at its periphery with spray nozzles, at its hub with an opening for the admission of water, and on its back with fan blades. The back and rim of the wheel is enclosed in a steel housing that serves as a casting for the fan, as a support for the air-diffusion vanes, and as a shield for the revolving parts. When



MINE AIR HUMIDIFIER.

the wheel is rotated at normal speed by the motor, and water is admitted (under practically no pressure) to the opening in the hub, centrifugal force develops, at the nozzles in the wheel's periphery, a hydraulic pressure of more than 200 lb. per square inch. This pressure drives the water through the nozzles in the form of a fine spray which is seized, broken up still more, and finally carried away by the blast of air that the fan-blades on the back of the wheel blow out all around the rim of the wheel between it and the surrounding housing. The diffusion vanes cause the air to be discharged in the form of a cylinder whose axis is coincident with the fan shaft. The mist produced is extremely fine, and there is practically no dripping of solid water. The device, which was developed by H. H. Clark, one of the Bureau's engineers, is not yet in its final form, and has not yet been tested in actual practice.

THERE has been a gradual, if fluctuating, increase in the amount of iron ore, zinc ore, and phosphates mined in Algeria, about $2,000,000 worth of each of these products having been exported in 1911. It is likely that when the projected railroad to the hitherto undeveloped Ouenza mine has been completed there will be an important increase in the amount of iron ore exported, as the Ouenza mine is believed to be one of the largest bodies of iron ore yet discovered.

DURING September the Elmore vacuum plant at the Sulitjelma mines, produced 1104 tons of copper concentrate.

Discussion

Readers of the MINING AND SCIENTIFIC PRESS are invited to use this department for the discussion of technical and other matters pertaining to mining and metallurgy. The Editor welcomes the expression of views contrary to his own, believing that careful criticism is more valuable than casual compliment. Insertion of any contribution is determined by its probable interest to the readers of this journal.

Cripple Creek History

The Editor:

Sir—In your issue of October 12, you quote from the 'Twenty Years Ago Today' column of the *Colorado Springs Gazette* to the effect that shipments made in 1892 from the Cripple Creek district went out on burros. The *Gazette* is in error. The ore was hauled in wagons, most of it to Florissant and Divide on the Colorado Midland railroad, though some went to Canon City on the Denver & Rio Grande railroad. Burros were never used to pack ore from Cripple Creek, as there were wagon-roads into the district from the very beginning.

Colorado Springs, October 16. HORACE F. LUNT.

What Are Mining Profits?

The Editor:

Sir—It is announced by the Treasury Department in Washington that R. E. Cabell, Commissioner of Internal Revenue, will soon make some ruling on how to estimate depreciation in oil land and mining properties so as to arrive at a basis for levying the corporation tax. Mr. Cabell has been traveling through the West, together with L. F. Speer, chief of the corporation tax division, studying this question. In your issue of October 5, J. R. Finlay objects to an editorial criticizing the decision of a Colorado judge that the removal of ore from a 'mine is not depreciation.' While I believe that Mr. Finlay's objection is well taken and agree with most of his contentions it would be interesting to hear the ideas of other engineers, and in this connection the following may interest some of your readers who are not familiar with the subject. The decision in question was that rendered by Judge Polk of the Federal district court at Denver in the case of Strattons Independence *v.* F. W. Howbert, collector of internal revenue. The court held that the value of the ore extracted cannot be charged to depreciation in estimating the net income, which is the subject of the tax levy. The court also decided that the corporation tax is not a tax levied upon the estate proper and is thus without the constitutional prohibition against levying a direct tax not apportioned among the states. The following extract from the court's decision will be of interest with reference to the definition of net income and depreciation to be observed in computing mining income for purposes of taxation.

"In popular sense the net income of mining properties is the value of what is extracted after deducting the cost of extraction and treatment, and the cost of administering the company which may be conducting the operations, and finally after a reasonable reservation for contingencies. This is true not only as a matter of general understanding, but it has been held uniformly by the courts to be a proper rule in determining whether or not a dividend is declarable by such companies.

"The net income of a mining property for the purpose of dividends does not take into account so-called waste of the property by reason of the extraction of ore in place, but that such is to be determined by a comparison of the proceeds of the company, after a deduction for operation, expenses of the company, and such reasonable contingencies as may in the light of experience be expected.

"If, therefore, the net income is not affected for the purposes of dividends by the amount of ore extracted, neither should it be affected by that circumstance for the purpose of an excise tax. We conclude, therefore, that the words "net income" do not carry with them any contemplation of law that there shall be such a deduction as plaintiffs here claim.

"The ordinary definition of depreciation is the lessening of value. As applied to mining properties, the word carries with it, as in the case of any other business, the idea of deterioration in visible improvements, so far as they are put in by the hand of man, and, therefore, speaking popularly, when we think of depreciation in mining properties we think of a lessening in value by time, or perhaps by accident, of those physical elements which go to develop and to improve the property.

"Now, does this meaning, commonly entertained and accepted and which is common to every class of corporations, become enlarged in case of mining companies, so as to make the extraction of ore likewise an element of depreciation? The court's view is that it does not. This conclusion is in part induced by the reasons which have been above discussed in connection with the term "net income" and in part by the peculiar nature of the mining business. The latter is *sui generis*. It lives by dying. It is a business that is intrinsically uncertain.

"The taking out of ore, while in a sense depreciation from the body, very often leads to the revealing of still larger bodies, and thus results not in a lessening of the value of the claims, but in a great increase in such value. As applied to this class of corporation, having as its purpose to exhaust—it may be a year hence or a hundred years hence—the body of ore for profit, the mere fact that ore may be extracted does not, in my judgment, make the value of such ore an element to be classed and deducted as a depreciation of the property. The court, therefore, holds that the extraction of ore does not constitute a credit in favor of mining companies upon the account between them and the Government when the excise tax is to be assessed."

In this connection the following extract from the secretary's report of the Goldfield Consolidated, for the year 1911, showing the method employed at that property for figuring 'depreciation' for tax purposes, may be of interest.

"Under the act of Congress approved August 5, 1909, and popularly known as the Federal corporation income tax law, depreciations in the value of property are made available as against gross income. The methods prescribed for ascertaining such depreciations make necessary the adoption of an estimated unit of depreciation ascertained by reference to the cost of the property subject to the depreciations in question. Avoiding unnecessary detail, it may be briefly stated that the unit employed by this company for that purpose, in obedience to the requirements of the Treasury Department, is $16.36 per ton, being the estimated average cost per ton to the company of its whole estimated commercial tonnage.

"The theory upon which these depreciations for exhaustions of ore are based is the well known economical principle, which has in numerous cases received judicial recognition and approval, and which should always be borne in mind by investors in mining property, namely, that unlike most other business projects, the earnings of a mine distributed in dividends are chiefly derived from exhaustions of the mine property in which the capital has been invested. Therefore, no matter how profitable the investment may prove to be, the dividends should not be regarded as profit in the ordinary acceptation of that term until the net amount realized shall have equaled the capital investment in the mine property. It will be observed that by reason of the adoption of a depreciating unit as required by the United States Treasury Department, it necessarily results that the net realizations in any year from the company's operations may be derived in part from exhaustions of assets and in part from apparent profits flowing from a net recovery per ton in excess of the estimated cost per ton."

It is interesting in this connection to observe that the unit adopted by the Nevada Hills Mining Co. is stated in the last annual report of that company as being $42.57 per ton. As the average recovery per ton for the year is given at $24.02, it is difficult to see where the tax collector comes in.

San Francisco, October 24. CHARLES JANIN.

Special Correspondence

GLOBE, ARIZONA

IMPROVED CONDITIONS.—MIAMI OUTPUT.—ELECTRIC RAILROAD FOR GLOBE.

Improved conditions in the copper industry are reflected in the increase in prospecting and mine development, and in general business, that has occurred in the past few months, and which is still continuing in the Globe and Miami districts of Gila county. The Globe hotels are filled nightly with mining and commercial men, the merchants all report increasing business, and the amount of freight hauled in by the Arizona & Eastern railroad last month is nearly 40% greater than for the corresponding month last year, most of the increase going to Miami, 7 miles west of Globe. The town is looking livelier than it has for over two years, and one is reminded of the 'good old days' previous to the sad years of 1910 and 1911.

The Old Dominion smelter is producing at the rate of about 30,000,000 lb. of copper per year, including production from ores from the Gibson and Black Warrior mines in the Miami district and from the Iron Cap and Superior & Bonton mines near Globe, besides intermittent shipments from smaller properties. Most of this production is from the mines of the Old Dominion company. The company is employing about 1200 men and is spending half a million dollars in the construction work in and around the mine and smelter. The Arizona Commercial is retimbering its Copper Hill shaft preparatory to resuming development work, the Iron Cap is exploring and developing through the Williams shaft, and the Superior & Boston continues exploration of the lower levels, with recent favorable results. Conditions at the two latter mines are more favorable than they have been for years, and both are making regular shipments of ore to Old Dominion. The old McMorris and Irene silver mines are being reopened, and many small copper and silver prospects are being developed.

It is in the comparatively new Miami district, however, and in the three-year-old town of Miami that the greatest activity is found. Where three years ago was a desert waste there now stands the town of Miami, with several hundred houses and business blocks and a population variously estimated at from 3000 to 4000. The town is growing more rapidly than ever before, and new buildings are going up on every block. Concrete is used in the construction of most of the business buildings, giving the town an air of permanency uncommon in mining communities. Dwelling houses are in great demand, and men working in the mines find it difficult to get a place to room. Miami was started on its career by the Miami Townsite Co., which is still selling lots and helping to build up the town. It is a corporation in no way connected with the mining companies, and the town is an independent one, distinguished in that respect from Ray, Morenci, and other copper districts of Arizona. Its foundation and the cause of its being is the extensive orebody, averaging over 2% copper, that has been developed within a radius of two miles to the north and west by the Miami and the Inspiration Consolidated Copper companies and which gives the district an assured life of at least twenty years.

The Miami Copper Co. is now producing 35,000,000 lb. of copper per year, and this will probably be increased to over 40,000,000 lb. There are 18,000,000 tons of ore developed averaging 2.58% copper, and this tonnage is being increased by diamond and churn-drilling. The Inspiration Consolidated has proved 45,000,000 tons, averaging 2% copper, and has started development and construction work involving the expenditure of $7,000,000 during the next two years. Over 500 men are employed in and around the mines, and over 200 more in railroad construction, consisting of 11½ miles of track to the mines and the millsite. H. Kenyon Burch and staff are working on plans for the 7500-ton concentrator, power-house, and shops, and their construction will be started after the railroad work is a little more advanced. This work is now hampered by a scarcity of labor, consisting mostly of Mexicans and Indians. It is expected that Inspiration Con. will be producing 70,000,000 lb. of copper annually within three years.

Besides these mines, the Gibson and the Black Warrior mines are regular producers on a small scale and will contribute materially to the district's output. Southwestern Miami and South Live Oak are conducting churn-drill exploration over a large area of mineralized schist to the west of the Inspiration Con. mine, and while it is too early to draw definite conclusions, they have already obtained encouraging results. Some new development companies are in the process of formation, and many smaller prospects are being developed by their owners. There is a scarcity of labor in both the Globe and Miami districts

MIAMI, LOOKING SOUTHEAST.

owing to the fact that natives of the Balkan states are leaving on every train to fight for the fatherland. It is estimated that from 300 to 400 will leave within the next few days. The shortage will be accentuated by the additional fact that there will be no immigration from the Balkan countries for some time.

An electric railroad to connect Globe, Miami, and the Inspiration Consolidated mines is a probability of the near future. N. L. Amster, president of the Shannon Copper Co. at Clifton, owner of the famous R. R. R. mine at Patagonia, and who has extensive interests in Globe, including the Globe Light & Power Co., was in Globe last week in connection with the promotion of a company for building such a line. A franchise was submitted to and approved by a meeting of the citizens, and a committee was appointed to secure signatures to a petition to the board of supervisors asking that a special election be called at which the question of granting the franchise will be submitted to the voters of the county. Many citizens have agreed to take stock in the company if a franchise is granted.

Besides the Globe and the Miami districts, the country around San Carlos, 30 miles to the southeast, is attracting considerable attention because of favorable development at the Copper Reef mine, where the drift on the California vein, at the adit level, is in ore for over 300 ft. The ore is reported to have an average width of 5 ft. and carries 4% copper, $10 gold, and $4 silver per ton. Everything points to the advent of an era of unprecedented prosperity. When Inspiration Consolidated is producing at full capacity, the combined output of the mines at Globe and Miami will be from 140,000,000 to 150,000,000 lb. of copper annually, or from 12½ to 13½% of the production of the United States for 1911.

LONDON

Increased Richness of Kolar Vein.—Work at Aporoma.—African Tinfields.

Some years ago John Taylor & Sons tackled two auriferous districts in India, in addition to the Kolar, in Mysore; namely, the Dharwar in Bombay Presidency and the Anantapur in Madras province. The Dharwar has so far proved a failure. The Anantapur, however, may now be recognized as a successful undertaking. During the last few months the developments have been excellent. The ore reserve has been substantially increased. The ore-shoot that was first discovered in the 150-ft. level north of No. 5 shaft has been intersected by the 450-ft. level north of the North shaft. In this lower level the orebody has been proved for 283 ft., and cross-cuts have shown it to be as much as 57 ft. wide at one place. The average width of the level is 4 ft., and across this width the assay-value was 25 dwt. A winze below the level is 75 ft. deep and is still in ore of the same quality. The outlook is so satisfactory that 10 more stamps are to be erected, bringing the total to 30, having a capacity of 3000 tons per month. A tailing plant is being provided, and a new hoist capable of hoisting ore from 2000 ft. is nearly completed. To provide funds for this expansion of operations, 25,000 preference shares of £1 each were issued last October and readily absorbed by shareholders. This capital was also partly devoted to the extra development work. A pleasing feature of the position is that the average content of the ore treated has been steadily increasing. The output for September was 750 oz. from 2000 tons, both figures being the highest on record. While writing of Indian mining, I may mention that at the Champion Reef in the Kolar goldfield the recent developments in the deepest level, the 43rd, are reminiscent of the palmiest days of this mine. After an unchecked career of prosperity covering fifteen years, a poor zone was entered six years ago, and the dividends have been much lower ever since. Things have been improving again and the latest news, as recorded above, is most encouraging, as the lode is 6 ft. wide, averaging over one ounce per ton. The Kolar mines are noted for their alternating zones of richness and poverty. The pitch of the ore-shoots is very flat, and the question arises whether the successive zones of profitable ore are not a series of parallel flows.

South American gold placers occasionally attract attention in London. So far it cannot be said that any important success has been won, for the engineering difficulties in the Andes are varied and great. For instance the Aporoma Goldfields is having a hard fight. The company was formed over two years ago to work a property in the province of Sandia, Peru. It had been worked many years ago by natives and by Spaniards, and their ditches are still of some engineering importance. Merricks, Crane & Co. are the engineers. Operations were commenced in December 1910 in connection with the water-supply, and enough of the work and the treatment plant was sufficiently advanced to start hydraulicking in February last. Unfortunately an unprecedently dry season followed, and regular work has not been possible since. However, a test clean-up was made on May 31 on 6000 cu. yd. of gravel, which yielded 46 oz. gold, or 8d. per cubic yard. The gravel washed came from the upper part of the face, which is 200 ft. high, so that the yield will probably be increased when the lower portions are worked as well. A mule-road from Phara, a distance of 35 miles, has been built. The deposit covers two square miles and varies in thickness from 50 to 400 ft. More capital has been required than originally estimated and the directors and the chief shareholders have provided the additional necessary funds. The cost of treatment is estimated at 2d. per cubic yard.

I have from time to time referred to the future prospects of the Transvaal, Swaziland, and Rhodesia as producers of tin. Two tin mines in the northern Transvaal are making profits and paying dividends, the Rooiberg and Zaaiplaats. The results of the past years work at Rooiberg have just been published and afford interesting reading. Operations started in 1910 with 10 stamps, and in May of this year an additional 10 stamps were brought into use, together with treatment plant for accumulated middling and slime. During the year ended June 30, the old stamps treated 18,295 short tone of ore, and the new stamps 2504 tons, of which 789 tons was accumulated middling and slime.

NEW YORK

Lull in Business.—Transfer of United Verde Extension.—New Copper.

The usual lull in general business which may always be expected to precede the presidential election has arrived on schedule time, and a waiting attitude prevails in all lines. The metropolitan press is filled with optimistic interviews concerning the outlook in various lines of trade, but the undertone does not speak the prosperity that is said to be so prevalent. In the copper-metal market the consumers, who have maintained a skeptical attitude, being somewhat strengthened therein by the producers' report published on October 8, are now refusing to buy, and for the most part the metal market is a nominal affair. Sellers have fixed the price at 17¾c., and refuse to deviate therefrom. It is rather to be expected that an additional amount of copper will come in sight when October figures appear, as the shrinkage due to interruption of production at Bingham, and Ely, Nevada, will not make itself felt in the coming month's report.

The unwilling attitude of the public toward the share market is remarkable. The increase in the quarterly distribution by the Amalgamated Copper Co., the expectation of an early dividend to be paid by the Ray and Chino, have alike failed to incite the public to buy copper shares. Styles change in investments just as in everything else. At the moment by far the larger part of public buying is going into hydro-electric properties, more often than otherwise connected with public utilities companies, and industrial issues of various descriptions. In the case of the porphyry copper mines there has been some foreign selling within the past few days from holders abroad who, on account of the trouble in southeastern Europe, are selling anything that can be sold. Apart from copper-mining, market conditions are peculiar, in that the Eastern public has no centre of interest at this time, and the promotion of and speculation in mining enterprises generally is consequently at a low ebb.

The British Columbia Copper Co. is gradually absorbing the securities of the New Dominion Copper Co., its near neighbor. Within the past two months the British Columbia Copper Co. has invested nearly $100,000 in New Dominion bonds, now owning more than a third of the entire bond issue. The American Smelting & Refining Co. is to have some competition hereafter in the selling of lead. The United Metals Selling Co. is to handle the lead production of the International Smelting & Refining Co., which has a lead stack at the Tooele plant and has also recently erected a lead refinery at East Chicago, just over the Indiana state line at the south end of Lake Michigan.

The United Verde Extension, at Jerome, Arizona, has been taken over, under a working arrangement for development, by a syndicate composed of James Douglas, Arthur Curtiss James, of the Phelps-Dodge company, Chester A. Congdon, George E. Tener, James Hoatson, of the Calumet & Arizona, John D. Ryan, of the copper world generally, and one or two associates. The United Verde Extension has been through many reorganizations, but at last is apparently started upon its way to success if the property develops into a mine. About $225,000 has been provided in the reorganization to be expended in sinking a new shaft and in equipping the mine.

In view of the much-discussed question of new production of copper, it is interesting to note the latest step of the Rothschilds in securing new copper properties. The Rothschilds have for many years controlled the copper properties of Spain, the Rio Tinto and the Tharsis. The latter company has practically exhausted the deposits upon

its present holdings; though this is not a matter for surprise, in view of the fact that the first production of copper from these mines was in days so ancient that no record remains. Like the Rio Tinto, the Tharsis was worked by the Romans some two thousand years ago. The Tharsis management has been in every quarter of the globe in search of copper deposits and some recent purchases in Peru by the Paris branch of the house of Rotchschilds are believed to have been made in the interest of the Tharsis. The search for a copper deposit to develop such as was made in this instance goes a long way toward justifying the present position of the copper producers, who claim that there have been no recent important discoveries, the greater part of the increased yield of the metal coming from metallurgical progress and not from the opening of new bodies of copper ore.

Alaskan properties are coming in for an increased share of attention. The Alaska copper yield for the year is expected to approximate 40,000,000 lb., as compared to 27,000,000 lb. for last year. The Kennecott or Bonanza mines are producing at the rate of about 23,000,000 lb. per year. A large low-grade property is in course of development by James Phillips, Jr., who was at the head of the Nevada Consolidated during its earlier days. It was Mr. Phillips who waged so strenuous a battle against the Utah Copper at the time the control of Nevada Consolidated was sought by the Guggenheim people. The Alaska property belonging to Mr. Phillips and his associates is on McCarthy creek near the Kennecott mines. Transportation is the chief problem, as is the case with the development of nearly all or any of the natural resources of Alaska. The Kennecott mines are in a fair way to earn the name of Bonanza in the fullest sense of the word; in February last the shareholders participated in a million dollar distribution, the first payment so made is now about to be followed by a second of two million dollars. While this return is large and dividends of three million dollars within eighteen months is apparently a very rapid return of capital outlay, it must be borne in mind that the Morgan-Guggenheim syndicate is credited with having expended some twenty million dollars in the construction and equipment of the railroad alone. A recent washout involved an outlay of fifty thousand dollars in repairs.

The predictions of the gradual decline of Cobalt production seem about to be realized. The Nipissing is still the biggest property in Cobalt, but has failed to develop new orebodies, though this failure has been compensated in part by the persistence of some of the veins which have been worked during the past year. La Rose, Trethewey, Temiskaming, and others are prospecting for new orebodies and must find them if they are to remain in the ranks of the producers any great length of time. Wettlaufer, the Lewisohn property, at South Lorrain experienced a bad break in the market this week, when the quarterly report appeared with the frank statement that dividends could not be long expected from the known ore reserves. Some of the traders are saying that there has been steady selling pressure in Wettlaufer for at least four months. Kerr Lake holds 150,000 shares of Wettlaufer in its treasury, and rumor has it very recently that part of this holding had been liquidated in the open market. The officials of the Kerr Lake emphatically deny that anything of the kind has taken place.

Figures just published by the Canadian Government show that during the first half of 1912 Cobalt produced 973,566 oz. less than during the similar period last year, but the rise in silver prices has saved the day for Cobalt and given it $292,400 in profits more than it had up to June 30, 1911. The output for 1912 will be in round numbers about 30,000,000 oz., and receipts will be at least a half million dollars in excess of those of 1911. The Rochester Cobalt Mines, Ltd., is to be reorganized into the Rochester Mines, Ltd., on a basis of 4 shares of the old stock to be turned in for 1 share of new to be issued. The new concern will have a capital of $1,000,000 and by reason of the exchange of stock will have a block of treasury stock for sale to provide development funds.

DULUTH, MINNESOTA

Labor Shortage from Balkan War.—Concentrating Iron Ore.

Mining on the Mesaba range is comparatively active this year and indications now point to shipments to the lakes being continued into December, or as late as practicable. The scarcity of labor has not led the mining companies to increase the wage scale, but several properties have closed down and others are not working to full capacity. The trouble in the Balkan states has caused an emigration of Montenegrins and Greeks to enlist. Over 600 have already gone and this will tend to make the shortage greater. The Mesaba Electric railway is nearly completed and the laborers who have been attracted by the high wages offered will probably return to the mines and relieve the situation to some extent.

The Oliver Iron Mining Co., which operates the mines of the United States Steel Corporation, has relinquished its lease on the Great Northern lands, to take effect in 1915. These mines will be operated by the Arthur Iron Mining Co., which is already taking steps to develop a large number of new properties. Several large stripping contracts

STRIPPING AT THE OLIVER MINE.

have been let and it is reported more are to be let in the near future. The success of the large concentrator at Coleraine, of 20,000 tons daily capacity, for washing sand from the ore has led to experiments elsewhere over the range to ascertain if different low-grade ores were amenable to washing. While some negative results have been obtained, others have been found which would yield to treatment. A small plant of 3500 tons capacity is now operating on ore from the Hawkins mine at Nashwauk. A small experimental plant has also been constructed in Virginia by A. B. Coates, and others are contemplating plants. The silica content is reduced in the process sufficiently to bring the ore to the desired grade, and it is noticed that in nearly all cases the percentage of moisture is reduced at the same time. The moisture in the natural ore runs from 8 to 16% on the average while in the concentrate it seldom exceeds 6%. The question of moisture alone is receiving some attention. The dryer which has been constructed at the Brunt mine is said to be working successfully. The saving in freight pays a profit on the operation and the ore having once been reduced does not absorb any appreciable amount in transit.

BOSTON

Copper Shares in France.—The Lake Situation.

The forward market movement of the 'porphyry copper' shares was recently checked by the strike at Bingham and Ely and the Turco-Balkan war scare. Chino and Ray Consolidated, at a time when property conditions are reported to have never been more promising, suffered declines of four or five points, due to the heavy unloading of American stocks on the Continental bourses, the result of apprehension over the turn hostilities might take in the Near East. Chino has been rapidly developed, has at no time had any setback, and is known to be an excellent

mine. It is good for a long period of production, notwithstanding the fact that its predecessor, the Santa Rita, was one of the oldest copper mines in the United States, its history dating back for over a century. It is expected that Chino will enter the dividend class by the end of the year. The directors are expected to meet for dividend action just before the Christmas holidays, and it is reported that the stock will be placed on a $4 per share annual basis by the declaration of a quarterly dividend of $1 per share. Chino is after the world's laurels for low-cost copper production, having maintained a 6c. cost for the quarter ended September 30, applying to a production of over 10,000,000 lb. of copper. Ray Consolidated is reported to have quite a treasure in Ray Central ores, and is now producing at the rate of 3,000,000 lb. of copper per month with half of its mill facilities in operation. International complications of any kind are of more concern to the 'porphyry coppers' than any other class of Boston and New York mining shares, since it is estimated that around 300,000 shares of these stocks have been shipped to Paris and distributed among the proverbially thrifty French investors. Of this amount, probably half, or 150,000 shares, consists of Utah Copper. Miami comes next, with approximately 75,000 shares, and the remaining 75,000 shares are divided between Ray Consolidated and Chino in the approximate proportion of 50,000 shares of Ray and 25,000 shares of Chino. The *Boston Journal* states that French investors, on account of the war scare, 'threw over' from 20,000 to 25,000 shares of Chino. If this be true, there is not much Chino stock held in France at this time. The strength of Chino's market support was shown in the fact that interests close to the management absorbed the foreign-sold stock. It is thought in Boston that if the copper market will permit it, Chino sponsors will manipulate the stock to higher figures by the first of the year, thus emphasizing the company's advent upon its dividend-paying career. Strange to say, no liquidation of importance has been reported in Utah Copper and Miami, both of which are dividend payers. Not even the Utah Copper strike prompted French investors to sell what they regard to be a good dividend-paying investment issue. Miami is also closely held in France for the same reason. The burden of liquidation had to be borne by the non-dividend-paying mines, notwithstanding it is assured that Ray and Chino will become steady dividend payers soon. This market episode well illustrates the thrifty habits of French investors, who are far less inspired by speculative motives than Americans. Another point of interest about the French market for 'porphyry coppers' is that, with the exception of Miami, they are traded in on the Paris bourse in the shape of bearer certificates which have been issued by New York trust companies, the trust companies holding the stock certificates of the companies themselves. A considerable block of Miami stock in the original certificates has been sold directly in France, making it perhaps the closest held issue of all this group. Pond Creek Coal and Butte & Superior, Hayden, Stone & Co. specialties, have also been added to the Paris trading list.

The Lake market situation here remains mixed, and the possibilities are that this will continue for some time to come. To the Dow disaster and the Wolverine slump have been added weakness in Lake, which, from the prize copper speculation on the Boston board of three years ago, has declined into a commonplace and dubious issue. The recent selling of the stock was attributed to the attitude of the New York banks, some of which called for a reduction of loans on industrial and copper shares because of loss of cash to the sub-treasury and the receipt of a large shipment of American securities from abroad. It developed that Lake and other local coppers here have been carried on a margin more extensively than had been thought. Lake's troubles seem to be due to the swinging of the main Lake lode to the west, the lode growing leaner meanwhile. Some ore is being regularly hoisted from what is called the East lode, but that vein has not been opened to any great extent because it can be developed more cheaply in connection with the work on the main lode. The East lode is maintaining the average of the rest of the property as to copper content, and is believed to have considerable possibilities.

SALT LAKE CITY, UTAH

FAILURE OF BINGHAM STRIKE.—MOYER QUITS.—AUGUSTIN PROCESS AT PARK CITY.

The backbone of the Bingham strike appears to be broken. The mines have resumed operation and are steadily increasing their crews at a rate which will soon reach the full quota. The Utah Copper Co., on October 26, had 1500 men employed, with 15 steam-shovels at work. Night work has been resumed regularly under searchlights, and the property is fast resuming its regular aspect. The United States, Ohio Copper, Utah Consolidated, Bingham-New Haven, and other properties have resumed and are making progress similar to that of the Utah Copper. The announcement that the Western Federation of Miners has practically abandoned its position at Ely, allowing strikers to return to work without opposition, while it is accompanied by statements that the battle will be continued at Bingham, is generally taken as a confession that the strike is recognized as a failure in Utah also. The refusal of the Butte union to contribute strike pay was another blow which has taken the heart out of the men at Bingham, although they have been receiving strike pay from the contributions of miners elsewhere. At the Magna and Arthur mills of the Utah Copper Co. men are being put on at about the same rate as at the mines. D. C. Jackling, the general manager, states that more than half the normal tonnage is now being handled and that the force will be steadily increased as added tonnage comes from the mines. The output is now running as high as 11,000 tons of ore per day, compared with a maximum capacity of 20,000 tons.

The failure of the Bingham strike, it is generally believed among operators and others, will seriously injure the prestige of the Western Federation of Miners and have an effect on the labor situation in mines all over the West. At present the officials of that organization, notably C. H. Moyer, the president, are seeking to clear their skirts by maintaining that the strike was entered into at the outset contrary to their advice. Men close to the Federation head are declaring that he opposed the strike in the early councils, and yielded only in the face of overwhelming sentiment among the men. This is to a large extent true. It is understood that Moyer was afraid from the start that he would not be able to hold together the men of different nationalities who make up the Bingham miners. He deserted early in the game, leaving Yanco Terzich, of the executive board, in charge. There has been a comparative absence of the usual dynamiting tactics. In fact, to date no attempts have been made to blow up any of the works, although there have been some exchanges of shots between strikers and guards. Whether there will be more serious attempts at violence before the strikers finally surrender is, of course, still a question. In any event, the hold of the Western Federation on Bingham has already been loosened, if not practically removed.

Metallurgists are watching with much interest the work of the Mines Operating Co. in solving the problem of treatment of the ores of the old Ontario at Park City under its ten-year lease. In former times these ores were treated by a chlorination process. The ores now being treated by the lessees were too low in grade for successful handling under the old method. The Mines Operating Co. experimented with cyaniding at first, but it was found that too much of the silver was escaping, although the gold was satisfactorily extracted. To get out the silver the company is now dry-crushing, giving the ore a chlorination roast, and then leaching by the Augustin process, which is said to be giving satisfactory results.

General Mining News

ALASKA

Cordova

The output of the Ruby district will be about $100,000 this season, according to J. Zug, of the Alaska Road Commission. Practically all this came from Long creek, from which the largest amount of gold was won from the Windy bench, opposite Discovery, where T. McKinnon and associates are working. They recovered $24,000 during the season, while others got from $2000 to $6000. Nearly all the production of the district is made without machinery, there being but one 30-hp. boiler on the creek.

Fairbanks

The Pioneer Mining Co. will have its 5-stamp mill at work within a few days. A shaft has been sunk 100 ft., and a drift driven 150 ft. on the vein, on which stoping has been started. It is about 12 in. wide and carries good gold content. Over 500 ft. of sinking and driving has been done at the Woods and Olsen property on Mineral creek, and the vein is 12 ft. wide, averaging $20 per ton. A 40-ton mill will be built in the spring and will be driven by electric power, water for which can be obtained from the stream flowing from a glacier nearby. Rich gravel has been discovered on Ester creek and is supposed to be a continuation of the ground being worked on the right limit of Ready Bullion creek, a tributary of the Ester. Work at the Biglow claim, on Goldstream, has been stopped for the season, water being scarce; in fact, it has been so right through the past season. The output from the claim is estimated to be $250,000. There is a big block of ground to be taken out yet, and this will be washed next spring. The Niggerhead claim recovered $9000 in its clean-up.

Juneau

During September the 240 and 300-stamp mills at the Alaska Treadwell mine worked 29.70 and 29.65 days, crushing 31,724 and 47,712 tons, and producing 547 and 1007 tons of concentrate, respectively. Gold saved by amalgamation totaled $91,985, and from concentrate treatment $85,915, with a total realizable value of $176,121. Operating expenses were $82,100, and construction $15,512, leaving a net profit of $78,509. Development covered 928 ft., and the stock of broken ore decreased 25,798 tons.

Nome

There has been great disappointment among litigants who have been fighting for possession of the Bon Voyage claim during the past year. The dump was estimated to be worth $100,000, and on being washed only yielded $30,000. The gold is being held by the bank pending settlement of new suits. Local opinion is that the lawyers will get everything and the litigants nothing.

ARIZONA

Graham County

The Detroit Copper Co., of Morenci, has purchased all the property belonging to the New England Copper Co. The transfer embraces 125 claims about five miles northwest of Clifton. The ores are mainly chalcopyrite and chalcocite, carrying a little gold and silver.

Yavapai County

(Special Correspondence.)—The Jerome Verde Oil Co. reports that its drill has entered the artesian-water stratum at a depth of about 1000 ft., and the flow of water is bringing up about 1 gal. of high-grade oil per minute. The water will be cemented off and drilling resumed. T. C. Snider has secured the contract for grading the railroad from the U. V. tunnel to the new smelter site at Clarksville, as the new town is to be named, a distance of nearly nine miles. Mr. Snider will also grade the smelter site. Several hundred men will be started at once.

Prescott, October 26.

It is stated that the Bagdad Copper Co. has been financed and will resume work at once. Development will include much drilling, and driving an adit about 8000 ft. in length, which will be connected with existing adits in the group. A large concentrating plant will be erected similar to that at Ray.

CALIFORNIA

Amador County

Sinking was commenced last week at the Kennedy mine, and the shaft will be sunk 150 ft. farther to 3900-ft. depth, taking about 90 days to complete. At the South Jackson mine the shaft is now 50 ft. deep, and will be sunk 100 ft. farther before opening out. The 79th dividend, of 5c. per share, has been paid by the Bunker Hill company. This amounts to about $10,000, and during the past six years over $750,000 has been paid. It is stated that the last clean-up at the South Eureka yielded $14,000 net profit, but does not include operations at the Oneida property.

Nevada County

If a permit is obtained from the Débris Commission, the Manzanita Hydraulic company will resume operations. It is intended to impound débris in the old pit at the mine. Water will be obtained from the new ditch being built from Deer creek, about eight miles from Nevada City, to the old pit at the mine, about a half-mile north of the city.

Placer County

It is stated that an electric smelter is to be erected near Colfax to treat the large deposits of low-grade gold-bearing ores in this and neighboring counties. With the completion of the great dam of the Pacific Gas & Electric Co. at Clipper Gap, electricity will be cheaply generated. This company has 1200 men working at Cisco at present, and intends to enlarge the supply ditch from 2000 to 14,000 miner's inches below the dam.

Plumas County

The town of Quincy has had two fires within one week, the second one occurring on October 23 and resulting in $11,000 damage. The adit at the Berry Creek mine is in 100 ft. in hard formation, and the mill erected last spring is working full time.

Sacramento County

The clean-up from the first 8 days' operation of the Natomas Consolidated Co.'s new dredge, No. 10, yielded $16,500.

San Bernardino County

(Special Correspondence.)—The Skidoo Mines mill lost 10.66 days during September, and crushed 580 tons of ore for the company and 460 tons for lessees. The total revenue from mill, cyanide, and custom treatment was $10,724. Working expenses were $4530 and development $518, leaving the month's profit as $5676.

Los Angeles, October 28.

Sierra County

There is some likelihood of the Rising Quartz mine, at Alleghany, being reworked after a long period of idleness. It is connected with the mill by aerial tramway. The plant only worked a short time, and was then shut down. J. W. Finch, of Denver, and W. J. Morris, of Grass Valley, have examined the property lately. The mill at the Kate Hardy mine is nearly finished. Two tables will be installed to save pyrite. A transformer station has been erected at the South Fork mine. The main adit is to be lighted, and an air-compressor driven by electricity will be installed. The first orebody to be opened is in 1500 ft. from the portal of the adit. An important discovery of gravel has been made near Nigger Tent, at a depth of 50 ft. It is identical with that found in the Orient mine.

Siskiyou County

(Special Correspondence.)—The Yreka Development Co. is prospecting a coal deposit on the Henry Hougedorn ranch, four miles north of Montague. The mineral is lignite, and the 20-ft. shaft has disclosed a 40-in. seam.

Tests recently made with the product by the Yreka Steam Motor Railroad Co. showed satisfactory heating properties. Considerable water is in evidence as prospecting advances. J. W. Barham is president. The Vere Gold Mining Co. is installing a placer plant at its holdings near Hornbrook. The property embraces 20 acres, situated on the Klamath. Oakland people are largely interested. V. Wilson is superintendent. The Portuguese placer claims, six miles from Selad, have been bonded to the Jerome Mining Co. of San Francisco. The cemented surface gravel has handicapped operations in the past.

Yreka, October 19.

TRINITY COUNTY

The new dredge of the Trinity Dredging Co., which cost $150,000, has been working for two weeks, and has proved satisfactory. Fourteen men are employed. C. J. Meade and T. Friend, who have a claim on Big Ryecroft creek, a tributary of the Trinity river, have uncovered a large vein which shows rich ore. In Ames gulch, about eight miles from Lewiston, S. Williams and J. Clayton are erecting a 5-stamp mill to crush their ore.

COLORADO

LAKE COUNTY (LEADVILLE)

In the early days of this district, ore which was under $30 per ton was either used to fill stopes or put on the dumps, due to high smelting and other charges. At present many old stopes filled with this ore are being mined by lessees at a fair profit, and dumps also are being worked over for the same purpose.

The lost drill-hole at the St. Louis adit, Breece hill, has been found, and the shaft drained. Sinking is in progress, and from the adit-level the shaft will be sunk 450 ft. The formation in the shaft is porphyry, and water is not troublesome. Work at Breece hill has been encouraged by opening a good orebody of carbonate of zinc in the Little Johnny claim. The Big Four company has resumed operation, principally on the 400-ft. level. The Winthrop Mining Co., Birdseye, will extend the Crescent adit, which is in 1300 ft. Connections have been made with the upper adit and shaft.

TELLER COUNTY (CRIPPLE CREEK)

Sampling of El Paso mine by T. A. Countryman is finished, after nearly three months work. Water is receding from the Mary McKinney shaft at the rate of four inches per day. One of the most profitable leases in the district is that of Pervis & Caley, on Block 239 of the Stratton estate, who are shipping about four cars of ore per week, which returns over 3 oz. per ton. This ore comes from 110 and 160-ft. depth, where the vein is 4 ft. wide, of which about 20% is sorted as waste. The shaft is 210 ft. deep, and at 220 ft. a station will be cut. The weather has been favorable to dump lessees generally, and those of the Isabella are said to be doing well. Water in the Gold Coin shaft has receded to within 7 ft. of the top of No. 11 level. The Blue Bird shaft, on Bull hill, is 1770 ft. deep, and is the deepest in the district, and water is receding about 3 in. per day. It is stated that the Little Giant mill, in Pony gulch, will be removed to the El Oro, in Eclipse gulch. Development at the Gold Dollar is proving satisfactory, and dividends may be paid every three months.

IDAHO

SHOSHONE COUNTY

During the year ended August 31, 1912, the total production of the Federal Mining & Smelting Co.'s mines was valued at $4,911,996. Mining, development, and smelting totaled $4,053,730, leaving net profits at $858,265, and after adding other income and deducting general expenses the balance was $895,429. Out of this $749,131 was paid in dividends, leaving $146,298 surplus. The profit and loss account surplus stands at $1,324,026. The Morning mine has given an increased profit of $201,419, as compared with the previous year. Work at the mine is satisfactory, save the shaft, which has given a little trouble. At Wardner the profits have been good, but the area of ground to be opened for ore reserves is limited, and profits from the Omaha lease have ceased for the present. The old property at Mace is of little value, but the work on the Cleveland-Green Hill lodes will add considerably to the life of the property. The necessity for the company to procure more ground is apparent, and an option has been taken on the Phi Kappa group of claims in Custer county, where development is now under way.

At 8 o'clock on the morning of October 24 a skip in the White raise of the Bunker Hill & Sullivan mine, got out of control and dropped to the bottom, 300 ft. below, with 12 men, 11 of whom were injured more or less. It is stated that the friction brake failed to hold, and the hoistman did not apply the safety brake in time to stop the skip getting up speed. The first-aid training came into good service for this accident. The body of F. Bentz, the missing pumpman, who was lost in the fire of October 7, was found on October 26, on No. 13 level. It would appear that he stuck to his post until forced to escape from the smoke which resulted from the fire. Recent development in the Idora Hill mine, on Sunset peak, near

GLIMPSE OF COEUR D'ALENE. KELLOGG PEAK IN CENTRE.

Wallace, has exposed two new veins on the 600-ft. level. The formation is not slate, as has been contended, but quartzite similar to other Coeur d'Alene properties. The veins carry galena free from blende. Shipments will be sent out as soon as possible.

The annual meeting of the Caledonia Mining Co. was held at Wallace on October 11, and the following are the more important details of results shown:

Ore produced, tons		18,391
Metal production:		
Silver, 1,209,432 oz., valued at		$646,728
Gold, 1.6 oz., valued at		33
Lead, 9,069,845 lb., valued at		332,886
Copper, 127,253 lb., valued at		9,808
Total value		$989,455
Freight, treatment, and royalty		377,147
Net value of shipments		$612,308
Cost of mining, development, power, etc		408,785
		$203,523
Litigation with Bunker Hill company	$28,220	
Keating adit, depreciation, etc	39,665	
		$87,885
Net profit		$115,638
Dividends paid		52,100
Surplus, with $130 interest, etc		$63,668

The injunction secured against the company by the Bunker Hill company covers all ore developed in the work-

ings. A demurrer to their complaint has been filed; and it is not certain when the case will be tried. The Caledonia and O'Connor claims only yielded ore worth $79,271; while the Omaha lease produced $910,183.

MISSOURI

Jasper County

During the week ended October 20 the output of blende was 11,020,330 lb., and 1,732,140 lb. of lead. The highest settlement for zinc ore was $61 per ton, and $27 to $32 per ton for calamine ores of 40% zinc. The fuel situation is growing serious, and gas pressure has been low. Chapman and Lennon, working the old Prudential ground at Galena, have unwatered it by means of a siphon, dispensing with steam or electric pumps. The Waneta Pearl Mining Co. has five drill-holes in ore. In the last hole bored, ore was cut at 70-ft. depth, and 9 ft. averaged 15% of lead. At 84 ft. zinc ore was cut, and to 120 ft. averaged 35% of zinc and lead. Mention was made recently in these columns of drilling to be done by the Granby company, and 19 holes are in ore, although of no great value. Below 200-ft. depth nothing was found. In 1911 Missouri produced 640,000 lb. of copper, a by-product from treating lead ores of St. Francis county. A boiler exploded at the Joe Lewis mine and did considerable damage.

MONTANA

Silverbow County

(Special Correspondence.)—The Butte & Zenith Mining Co. has been formed with a capital of $3,000,000, divided into 300,000 shares of $10 each, by Duluth capitalists, to prospect and develop the country five miles west of Butte and two miles beyond the old Blue Bird property. W. H. Weed has examined the claims, and the report seems to have been satisfactory, as the company was organized and surface equipment ordered. The new hoist at the Butte & Superior is almost ready for work. It will have a capacity of 2000 tons per day from a depth of 3500 ft. Improvements to the second section of the concentrator are practically completed, while No. 1 section is treating 500 tons of ore per day. The extension of the Butte, Anaconda & Pacific railroad to Georgetown is finished, and ore will be sent from the Southern Cross and other mines in the district to the Washoe smelter. The Butte Central company's concentrating plant will probably start early in December, and will treat 100 tons per day. W. A. Clark is laying foundations for a concentrating plant just south of Butte, and will work through the winter.

Butte, October 28.

NEVADA

Churchill County

(Special Correspondence.)—The Nevada Hills mill treated 3915 tons of ore in September, yielding $82,647, at a cost of $32,856, leaving a profit of $49,791. The gross value was $23.13 per ton, loss in residue $2.02, and costs $8.39, the net profit being $12.72 per ton. Balance due to Bank at October 28 was $175,000; $50,000 having been paid during the past month. The financial statement shows liabilities to be $94,000 over liquid assets.

Reno, October 28.

Esmeralda County

The Goldfield Consolidated and Tonopah & Belmont Development companies have filed a complaint against railroad companies for excessive freight charges on cyanide. The suit was heard at Reno last week, before Mr. Pugh, of the Interstate Railroad Commission. It involves $30,000, the difference between $2.37 and $2.08 per ton, the price charged, and $1.15 per ton, the rate which should have been applied. It is proposed to consolidate the leading properties in the Diamondfield part of the Goldfield district. Only 10 of the 20 stamps at the Bonnie Claire mill are crushing ore from the Polverde mine of the Jumbo Extension Co. Five Johnston vanners are to be installed and the mill will then handle 100 tons per day. The best ore in the mine has been opened by a winze below the 850-ft. level, which will be connected by the 930-ft. level drift. The ore being treated averages over $20 per ton. At the Merger, the 1330-ft. level cross-cut developed a flow of water equal to 30,000 gal. per day.

The Vernal, in the Diamondfield district, and adjoining the Goldfield Belmont is doing some development which should be of value in proving the importance of the district.

At the Big Four, Manhattan district, two raises driven 30 ft. above the 400-ft. level, have proved 10 ft. of ore averaging $75 per ton. The Joshua Hendy Iron Works of San Francisco has a contract for the new mill, which is to be finished by January 15, which, according to local opinion, is rushing the work too fast.

Lincoln County

The Home Run mine came into notice several months ago by the discovery of several large caves filled with first-class copper and silver ore. They were opened by a vertical shaft and incline from the 90-ft. level down. Later the incline was extended to the surface, being a better way to get the ore. The 90-ft. level was continued past the ore pockets and has cut 4 ft. of good ore. The same vein is being opened on the 150-ft. level, where 4 ft. of copper ore averages $70 per ton. Ore shipments are being made regularly.

Lyon County

Shipments from the Ludwig mine of the Nevada-Douglas company have averaged 5% of copper during October, and 3.75% from the Douglas Hill mine, while daily shipments are 400 tons. Over 20 men have been dispensed with lately. New ore-bins at the Douglas Hill are finished. In the Ludwig, the 100-ft. level is being driven south, and is at present in high-grade carbonate ore about 7 ft. wide. Generally, the outlook is satisfactory. The Kennedy Consolidated copper property, at Buckskin, Douglas county, has been acquired by the Nevada-Douglas company, at a cost of $105,000, payments to extend over several years. Los Angeles people have a lease on the Kennedy property, but its transfer does not affect them. It is situated about six miles from the Nevada-Douglas mines. During the week ended October 17 the Thompson smelter handled 6217 tons of ore, of which 2845 tons came from the Nevada-Douglas. Twelve cars of matte were sent out during the week.

Nye County

Fire destroyed the sub-station of the Nevada-California Power Co. on October 30, and all the mines and mills at Tonopah were shut down, but it was expected that the temporary connections would be made during the day. The damage is estimated at $50,000 and the outbreak was due to a short-circuit in one of the transformers.

During the week ended October 26, eight mines at Tonopah produced 10,390 tons of ore valued at $259,750. At the Belmont, the east drift on No. 13 level has cut rich veins of sulphide ore. Shipments of bullion were 69,045 oz. valued at $56,916. The Montana has cut two new ore-bodies on the 565-ft. and one on the 615-ft. level. The North Star has shipped 50 tons of ore worth $60 per ton from the 850 and 1250-ft. levels. Development at 1000 ft. in the Halifax is very encouraging. The new 150-hp. motor for the North Star tube-mills is being installed. An 18-drill compressor has been purchased and a concentrate drier is being built.

Storey County

On the 2500-ft. level of the Sierra Nevada the vein has opened to a width of 7 ft. assaying $17 per ton. Two cars of ore averaging $50 and $164 per ton were saved, also 300 lb. of specimen ore of high value. The Mexican mill treated 482 tons, worth $27.39 per ton, with 94% extraction. The Crown Point produced 542 mine-cars of ore from the 1400-ft. level stopes, having a gross value of $7000. The Yellow Jacket mill has been running during the past week on Point ore, 727 tons being in the bins. The Ophir cyanide plant is working full time with good results. At the C. & C. shaft the Reidler pumps worked

65, 130, and 139 hours, respectively; the two centrifugal pumps at the 2310-ft. station, 159 hr., and the pump at 2500 ft. 159 hr. Necessary repairs were made to the shaft. On the 2100 and 2475-ft. stations at Ward shaft removal of pumps, motor, and pipes is in progress. A. Elkins was badly scalded with hot water at the 2475-ft. station on October 24 and died soon after.

White Pine County

The ill-advised strike at the Nevada Consolidated mines was declared off on October 28, the men returning to work at the rate of wage offered on October 1, which gave an increase of 25c. per day to all miners and laborers.

NEW MEXICO

Grant County

The electric plant being installed at the Emma copper mine, at Fierro, by the Phelps-Dodge company, will soon be in operation. Development continues to open rich ore. Chino produced 3,549,862 lb. of copper in September, this being the first month that the mine and mill were in full operation.

UTAH

Juab County

The Dragon Iron mine is shipping 100 tons per day to the United States smelter. This ore comes from the 300-ft. level, while it has been opened on the 600-ft. level. The shaft is down 1025 ft., and indications are promising for more iron ore. During the past week the east drift on the 2300-ft. level of the Grand Central cut the orebody which, on the level above, carried high-grade copper ore. Assays taken along the lode return $8 per ton. The new ore-house, of 300-ton capacity, at the Eagle & Blue Bell, is now in use and will make the handling of ore much easier than in the past. Lessees at the New Bullion, in the North Tintic district, are shipping zinc ore, while at the Gemini 100 men are working as lessees. The October production should be 1500 tons of ore. The Scranton mine is to use electric power, and a contract has been made with the Telluride Power Co. for a supply. Owing to car shortage, several of the Tintic mines have been unable to ship ores lately.

Salt Lake County

On account of the strike during the second week in the month, the September copper output of the Utah Copper company was only 6,965,144 lb., against 11,841,044 lb. in August.

Summit County

The new treatment plant of the Mines Operating Co. at the Ontario mine, Park City, is doing satisfactory work. The process consists of dry crushing, chlorinating roasting, and leaching by the old Augustin method. Experiments on roasting were carried out at the Consolidated Mercur mill and the University of Utah by a new process invented by N. C. Christensen and T. P. Holt, of this state. The two roasting-furnaces built will only treat about 75 tons per day, so others are to be constructed. Otherwise the plant is a success.

Tooele County

Since the new railroad was built to the Ophir district there has been renewed activity at many of the mines, many new discoveries have been made, the mill at the Ophir Hill property is well on toward completion, and shipments have been increasing. The Ophir Hill is sending out regular lots of concentrate from its dump, the Cliff is also shipping a good tonnage, and rich ore is being mined at the Lion Hill Consolidated property. At this mine the Monogram drift is being driven from the 1300-ft. Chloride Point adit to open the south and west portions of the mine. In the Monogram drift ore assaying 500 oz. of silver and $2 to $4 per ton in gold has been opened. At the Eastside adit, on the north end of the property, a raise has cut what seems to be a series of cavities, which are filled with soft ore composed of chloride and hornsilver, assaying from 142 to 208 oz. of silver per ton. The ore has been opened for 30 ft., and is continuous. About 20 men are employed and four machine drills.

WASHINGTON

Stevens County

The June-Echo Mining & Milling Co. has been incorporated with a capital of $1,500,000. The property consists of the June and Echo claims, situated two miles from Chewelah in the old district of Embreetown. Thirty years ago the first silver ore was taken from the property and hauled by wagon to Spokane. Different managements have had control in later years.

CANADA

British Columbia

(Special Correspondence.)—At a depth of 250 ft. in the shaft of the Blue Bird, near Rossland, 7 ft. of high-grade ore has been opened. At 220 ft. the vein was from 9 to 36 in. wide, carrying galena, while at the present depth copper is showing strongly. During the first nine months of the current year mines in the Kootenai and Boundary districts of British Columbia have paid $932,000 in dividends, to which Le Roi No. 2 contributed $30,000,

PART OF BRITISH COLUMBIA, SHOWING MINING DISTRICTS.

Nickel Plate $180,000, Standard $325,000, British Columbia Copper Co. $177,000, and Canadian Consolidated $220,000.

Spokane, October 25.

(Special Correspondence.)—At the Coronation mine, on Cadwallader creek, Lillooet, the raise from No. 4 to No. 3 level is finished. The vein averaged 14 in. wide for 89 ft., and 50 to 60 tons of ore worth $175 per ton was saved. On No. 4 level driving is in progress at both faces, where the vein is 18 in. wide, with free gold and sulphides showing. At the Countless, an adjoining claim of the company, the adit is in 490 ft., in diorite, and progress is slow. The Little Joe vein should be cut within 35 feet.

Victoria, October 25.

At the Hidden Creek properties of the Granby company extensive diamond-drilling is under way. On No. 2 orebody a drill has passed through 95 ft. of ore below the adit level, which assays 2.91% copper, while the drill on No. 1 orebody is down 105 ft. in ore averaging 3% copper. The net earnings of the company in September were $181,500. During the past week the president and vice-president of the Hedley Gold Mining Co. visited the Nickel Plate property. Prospecting by diamond-drill has enabled further development to be mapped out. It has

been decided to sink a new incline from No. 4 adit, and will be large enough for a double skipway and a manway. It will serve the new orebodies found in the low levels of the mines. Another 150-hp. boiler is to be installed, while the general power question is being considered.

COBALT

Development at La Rose has resulted in finding the Cobalt Lake fault at the 380-ft. level. The work here was done from a winze in which Keewatin chert was cut, but is now in conglomerate. A vein 2 ft. wide is being driven on, but at present contains no silver. At the Fisher-Eplett property of La Rose four veins are being opened on the 200-ft. level. They are of calcite and quartz in the Keewatin formation. During the week ended October 19 ore shipments from Cobalt totaled 420 tons, making 18,022 tons for the year to date, while shipments of silver amounted to 161,297 oz. The Kerr Lake company has declared a dividend of 25c. per share, payable December 16. During the first eight months of 1912 La Rose has produced silver valued at $1,101,849, while the net income was $600,745. The surplus now stands at $1,783,885. On the 200-ft. level of the Crown Reserve the branch vein shows 2 in. of calcite and cobalt assaying 3500 oz. of silver per ton. During the year ended August 31 the Kerr Lake company produced 1,885,495 oz. of silver, compared with 2,388,420 oz. during the preceding year. The net profits were $769,175, against $937,379. Cost of production was: mining, 12.10c. per ounce; shipment and treatment, 5.55c., and general 0.65c.; a total of 18.30c. per ounce of silver recovered. Development covered 8481 ft., the greatest amount being done on the 140-ft. level of No. 7 shaft. Rich ore was opened on the 225-ft. level. Ore reserves on September 1 were estimated to contain 6,660,091 oz. of silver.

DAWSON

An overland mail service has been arranged for the Dawson district for the present winter, and all classes of mail may be sent in as soon as there is an improvement.

MEXICO

SONORA

(Special Correspondence.)—During September the old mill of El Tigre worked 61% of the time, crushing 1500 tons of dry ore, and the stamp-mill ran 75% of the time, crushing 2767 tons of dry ore, while the cyanide plant treated 4150 tons of current and 1125 tons of dump tailing. The total output from shipping ore, concentrate, and cyanide plant was valued at $85,620. Costs amounted to $57,732, leaving a net profit of $27,888. Taxes were $4668. The poor profits for September were due to the effects of the revolution near the mine, while metallurgical results were better than during any previous month.

Kansas City, Missouri, October 19.

During the first six months of 1912 the subsidiary companies of the Mines Company of America received from sales of bullion $1,309,913, while expenses aggregated $949,509, leaving an operating profit of $360,404. After deducting general expenses and taxes, net profits were $343,932. The balance sheet of the subsidiary and holding companies shows supplies, bullion in transit, cash, etc., amounting to $1,034,073. Liquid assets over liabilities are $852,809, and cash and accounts receivable by the Mines Company are $229,438, making a total of $1,082,247. At the last meeting of the directors, the dividend was passed, and in view of the present conditions in Mexico the large cash surplus seems to be the right policy.

PERU

The New Chuquitambo Gold Mines, Ltd., near Cerro de Pasco, has started to sink an inclined shaft to open its ground below the Santiago adit, hoping thereby to find the ore it has been working above this level. From 2000 to 3000 tons of ore is being crushed monthly. This is low grade but profitable, but there have been difficulties on account of the presence of copper. Experiments are being made to overcome this trouble.

Personal

Professional men are invited to send news of their engagements and travels. Such news is interesting to friends.

I. E. ROSE is in San Francisco.

W. P. SIEBERT is at the Palace.

C. A. NONES is here from the East.

M. J. MONETTE is at the St. Francis.

F. B. CALDWELL is here from San Dimas.

R. N. BISHOP has been in Nevada recently.

BARNEY RONONDO has returned from Alaska.

T. G. PATTON was in San Francisco recently.

THEODORE BOUCHELLE has gone to Nicaragua.

A. K. TIERNAN has returned to Salt Lake City.

G. H. GARRY was at Knoxville, Tennessee, recently.

ERROL MACBOYLE has returned from the Southwest.

C. T. NICOLSON left Nome on October 30 for San Francisco.

W. O. NORTH has returned to Los Angeles from Singapore.

W. H. LATIMER, of Los Angeles, was here during the week.

H. D. BODDINGTON has left London and is now at El Paso, Texas.

J. T. HODSON has returned to Salt Lake City from a trip through Nevada.

H. FOSTER BAIN is in Denver and expects to reach San Francisco on Tuesday.

E. L. GODBE has returned to Salt Lake City from a business trip to New York.

ALGERNON DEL MAR was in San Francisco and has returned to Los Angeles.

T. SKEWES SAUNDERS has returned to La Aurora, Mexico, from a trip to Europe.

E. T. DUMBLE, chief geologist of the Southern Pacific railroad, is in San Francisco.

H. B. SHERRICK, manager of the Mars mine in Nicaragua, has returned from his vacation.

D. W. JESSUP has resigned from his position with the United States Mining Company.

H. KENYON BURCH was at Los Angeles and returned to Globe, Arizona, early in the week.

R. G. SMITH is returning to San Francisco on the last steamer leaving Nome this autumn.

VAN H. MANNING was in San Francisco early in the week and has returned to Washington.

E. D. MCDERMOTT is now with the South Urals Mining Co., Tanalyk, Orenburg Government, Siberia.

R. P. MCLOUGHLIN has gone to the White Pine district of Nevada and will remain two or three weeks.

F. L. SIZER is visiting the Clifton-Morenci district and expects to come to San Francisco about November 10.

HERBERT GREGORY, geologist of the Yale Peruvian expedition, was in Arequipa recently and has gone to Cuzco.

A. W. MCCUNE has returned to Cerro de Pasco from an inspection of the route of the projected Amazon-Pacific railway.

C. DAWES CLARK is engaged in professional work in New Mexico, expecting to return to New York early in December.

W. H. RADFORD has returned to San Francisco from Alaska, where he has been for the past six months on professional work.

D'ARCY WEATHERBE left Arequipa, Peru, about the middle of September for a two-months trip to Cuzco and the Apurimac river.

GUILLERMO HILEMAN has been appointed field manager of the Government oil wells in Argentine Republic, with headquarters at Buenos Aires.

ARTHUR THOMAS and WALTER NEBEKER have been appointed as the representatives of the Salt Lake Mining and Stock Exchange at the Mining Congress at Spokane.

Market Reports

LONDON QUOTATIONS

(By cable, through the courtesy of C. S. Burton & Co., New York.)

	October 31.
Camp Bird Ltd	$ 6½
El Oro	3⅜
Esperanza	9⅜
Oroville Dredging	1⅛
Santa Gertrudis	6⅜
Tomboy	6½

COPPER SHARES—BOSTON

(By courtesy of J. C. Wilson, Mills Building.)

	Closing prices, October 31.		Closing Prices October 31.
Adventure	$ 6¼	Mohawk	$ 6
Allouez	39½	North Butte	33⅜
Calumet & Arizona	77	Old Dominion	59
Calumet & Hecla	545	Osceola	104
Centennial	18	Quincy	81
Copper Range	54	Shannon	18¼
Daly West	3½	Superior & Boston	1⅞
Franklin	10¼	Tamarack	39¼
Granby	62	Trinity	4
Greene Cananea, ctf.	9⅛	Utah Con	11⅜
Isle-Royale	31	Victoria	2½
La Salle	4¾	Winona	4
Mass Copper	6½	Wolverine	74

NEVADA STOCKS

(By courtesy of San Francisco Stock Exchange.)

San Francisco, October 31.

Atlanta	$ .18	Montana-Tonopah	$2.10
Belcher	.25	Nevada Hills	1.47
Belmont	9.20	North Star	.37
Big Four	.43	Ophir	.44
Con. Virginia	.40	Pittsburg Silver Peak	.85
Crown Point	.37	Round Mountain	.36
Florence	.70	Savage	.10
Goldfield Con.	2.55	Sierra Nevada	.37
Halifax	1.75	Tonopah Extension	2.40
Jim Butler	.63	Tonopah Merger	1 02
Jumbo Extension	.30	Tonopah of Nevada	6.37
MacNamara	.21	Union	.60
Mexican	2.55	Vernal	.11
Midway	.45	West End	1.62

OIL SHARES

(By courtesy of San Francisco Stock Exchange.)

San Francisco, October 31.

Associated Oil	45.00	Monte Cristo	$ 1.32
Brookshire	.58	New Pa Pet	.50
Caribou	.75	Palmer	.20
Claremont	.65	Palmer Union	.18
Coalinga Central	.20	Premier	.40
De Luxe	.70	Republic	.26
Maricopa 36	.28	United Oil	.32
Maricopa National	.20	W. K. Oil	1.85

MINING STOCK QUOTATIONS—NEW YORK

(By wire from C. S. Burton & Co., New York.)

	Closing Prices. October 31.		Closing Prices. October 31.
Alaska Mexican	$ 13⅞	McKinley-Darragh	$ 1⅞
Alaska Treadwell	38⅜	Miami Copper	27
Alaska United	21⅜	Mines Co. of America	2⅜
Amalgamated Copper	84	Nevada Con	21⅛
A. S. & R. Co.	82⅛	Nipissing	8⅛
Braden Copper	6⅞	Ohio Copper	1⅜
B. C. Copper Co.	4⅜	Ray Con	21⅜
Chino	46	Tenn. Copper	41⅜
First National	1⅞	Tonopah Belmont	9½
Giroux	4⅜	Tonopah Ex	2⅜
Goldfield Con.	2⅜	Tonopah Mining	6½
Greene-Cananea	9⅜	Trinity	6⅛
Hollinger	14⅜	Tuolumne Copper	2⅜
Inspiration	19½	Utah Copper	62½
Kerr Lake	2⅜	West End	1⅜
La Rose	2⅜	Yukon Gold	3½
Mason Valley	12⅜		

ASSESSMENTS ON COMSTOCK MINES.

Company	No.	Del. Board	Sale Day	Amt.
Union Con.	31	Oct. 12	Nov. 6	.15
Bullion	24	Oct. 13	Nov. 6	.03
Yellow Jacket	42	Oct. 27	Dec. 3	.10
Exchequer	23	Oct. 27	Nov. 20	.03
Best & Belcher	100	Nov. 1	Nov. 25	.05
Ophir	90	Nov. 3	Dec. 9	.15
Crown Point	13	Nov. 7	Dec. 4	.10
Alpha Con.	19	Nov. 11	Dec. 4	.03
Scorpion	21	Nov. 23	Dec. 18	.01
Bruns. Potosi	3	Nov. 24	Dec. 19	.01½
Con. Virginia	22	Nov. 24	Dec. 20	.15

LOCAL METAL PRICES

San Francisco is not a primary market for the common metals except quicksilver. The prices quoted below therefore represent sales of small lots and are not such as an ore-producer could expect to realize. Ore contracts usually call for settlements on the basis of Eastern prices, less freight and treatment charges. The prices quoted are in cents per pound, except in the case of quicksilver, which is quoted in dollars per flask of 75 pounds.

San Francisco October 31.

Antimony	11—11½c	Quicksilver (flask)	41.50
Electrolytic Copper	18—18¼c	Tin	52—53¼c
Pig Lead	5.35—6.30c	Spelter	8¼—8¾c

Zinc dust, 1400 lb. casks, per 100 lb., small lots $9.50—9.75; large $7.50—8.50

METAL PRICES

(By wire from New York.)

NEW YORK, October 31.—On account of the European situation the copper market continues to be easy. Lead is weak, since a good deal of Western lead is being pressed for sale. Spelter is also weak, as the smelters are anxious to make sales. Average daily prices for the past week, in cents per pound, based on wholesale transactions, standard brands, are given below.

Date.	Electrolytic Copper.	Lead.	Spelter.	Silver, per oz.
Oct. 24	17.35	5.08	7.28	63¼
" 25	17.35	5.08	7.28	63
" 26	17.30	5.08	7.28	63
" 27	Sunday.	No market.		
" 28	17.30	5.06	7.28	63
" 29	17.25	5.06	7.28	63¼
" 30	17.25	5.06	7.28	62¾

SILVER

Below is given the average New York quotation, in cents per ounce, of fine silver for the months indicated:

	1911.	1912.		1911.	1912.
Jan.	53.81	56.25	July	52.57	60.67
Feb.	52.23	59.06	Aug.	52.17	61.32
Mch.	52.76	58.37	Sept.	52.43	62.95
Apr.	52.32	59.20	Oct.	53.37	63.16
May	53.31	60.88	Nov.	55.77	....
June	53.04	61.29	Dec.	54.85	....

COPPER

Daily quotations on copper as published in this column represent average wholesale transactions on the New York market and refer to electrolytic copper. Lake copper commands normally from 1-5 to 1-4c. per lb. more. Below are average monthly quotations in cents per pound:

	1911.	1912.		1911.	1912.
Jan.	12.29	14.09	July	12.47	17.19
Feb.	12.26	14.08	Aug.	12.41	17.49
Mch.	12.14	14.68	Sept.	12.20	17.56
Apr.	12.02	15.74	Oct.	12.19	17.32
May	11.99	16.03	Nov.	12.61	....
June	12.39	17.23	Dec.	13.55	....

COPPER SURPLUS

Figures showing the visible supply of copper at the beginning of each month are now widely available. Below are given the amounts, in pounds, known to be available at the first of each of certain months.

		U. S.	European.
January	1911	122,030,195	230,264,280
January	1912	89,454,695	178,329,920
February	"	66,280,643	153,820,800
March	"	62,939,988	141,125,680
April	"	62,367,557	137,806,000
May	"	65,295,368	134,176,000
June	"	49,615,643	117,801,600
July	"	44,335,004	107,817,920
August	"	50,281,280	113,285,760
September	"	46,701,376	112,743,680
October	"	63,065,587	107,396,800

UNITED STATES PRODUCTION AND CONSUMPTION

(Compiled from reports of the Copper Producers' Association)

	Production.	Domestic deliveries.	Exports.
September	115,588,950	57,311,584	50,824,011
October	118,255,442	64,068,656	60,084,349
November	111,876,601	68,039,776	67,049,279
December	122,896,697	65,988,474	79,238,716
Total for 1911	1,431,938,338	709,611,945	754,932,733
January 1912	119,337,753	62,343,901	80,167,904
February	116,035,809	56,228,368	63,148,096
March	125,694,601	67,847,556	58,779,566
April	125,694,001	69,513,846	53,252,326
May	126,737,836	72,702,237	69,485,945
June	122,315,240	66,146,229	61,449,650
July	137,161,920	71,093,120	60,121,600
August	145,628,521	78,722,418	70,485,150
September	140,089,819	63,460,810	60,264,796

LEAD

Lead is quoted ordinarily in cents per pound or dollars per hundred pounds delivered at St. Louis or New York. The difference is normally 15c. per hundred pounds, and any larger or smaller difference is promptly met by sales. The daily price in New York is published each week in this column. Below are the average quotations by months:

	1911.	1912.		1911.	1912.
Jan.	4.48	4.43	July	4.50	4.71
Feb.	4.44	4.03	Aug.	4.50	4.54
Mch.	4.39	4.07	Sept.	4.48	5.00
Apr.	4.41	4.20	Oct.	4.27	5.08
May	4.37	4.20	Nov.	4.30	....
June	4.34	4.40	Dec.	4.45	....

ZINC

Zinc is quoted as spelter, standard Western brands, and based upon St. Louis or New York delivery. While New York quotations, as a matter of convenience, are commonly used, relatively little spelter actually goes to or comes from New York. The bulk is shipped direct from the plants in the Mississippi Valley to manufacturers, due allowance being made for freight. New York daily quotations are published in this column each week. Below are given averages by months:

	1911.	1912.		1911.	1912
Jan.	5.45	6.42	July	5.70	7.12
Feb.	5.52	6.50	Aug.	5.95	6.96
Mch.	5.56	6.57	Sept.	5.86	7.45
Apr.	5.40	6.63	Oct.	6.10	7.36
May	5.35	6.68	Nov.	6.38	....
June	5.50	6.88	Dec.	6.30	....

Zinc-dust is quoted separately, the price being based upon the cost of spelter in Illinois and the cost of preparation. About half the zinc-dust used in the United States is imported through San Francisco. Delivery prices are determined largely by quantities and contracts.

QUICKSILVER

The primary market for quicksilver is San Francisco, California, being the largest producer. The price is fixed in the open market, and, as quoted weekly in this column, is that at which moderate quantities are sold. Buyers by the carload can usually obtain a slight reduction, and those wanting but a flask or two must expect to pay a slightly higher price. Average monthly quotations, in dollars, per flask of 75 lb., are given below:

	1911.	1912.		1911.	1912.
Jan.	44.60	43.75	July	48.00	43.00
Feb.	48.40	46.00	Aug.	50.00	42.50
Mch.	52.50	46.00	Sept.	47.50	42.12
Apr.	50.90	42.25	Oct.	46.12	41.50
May	46.50	41.75	Nov.	45.50	....
June	46.50	41.30	Dec.	44.50	...

TIN

New York prices control in the American market for tin, since the metal is almost entirely imported. San Francisco quotations, averaging about 5c. per lb. higher than New York, are quoted weekly in this column. Below are given average monthly New York quotations in cents per pound:

	1911.	1912.		1911.	1912.
Jan.	41.25	42.53	July	42.40	44.25
Feb.	41.61	42.96	Aug.	43.32	45.80
Mch.	40.16	42.58	Sept.	39.75	48.64
Apr.	42.18	43.92	Oct.	41.18	50.01
May	43.11	46.05	Nov.	43.12	....
June	44.61	45.76	Dec.	44.65	....

Current Prices for Chemicals

(Corrected monthly by Braun-Knecht-Heimann Co.)

Prices quoted are for ordinary quantities in packages as specified. For round lots lower prices may be expected, while in smaller quantities advanced prices are ordinarily charged. Prices named are subject to fluctuation. Other conditions govern Mexican and foreign business.

	Min.	Max.
Acid, sulphuric, com'l, 66°, drums, ℔ 100 lb	$0.75	$1.00
Acid, sulphuric, com'l, 66°, carboy, ℔ 100 lb	1.00	1.50
Acid, sulphuric, C. P., 9-lb. bottle, bbl., ℔ lb	0.13	0.18
Acid, sulphuric, C. P., bulk, carboy, ℔ lb	0.09½	0.12
Acid, muriatic, com'l, carboy, ℔ 100 lb	1.60	3.00
Acid, muriatic, C. P., 6-lb. bottle, bbl., ℔ lb	0.15	0.20
Acid, muriatic, C. P., bulk, carboy, ℔ lb	0.10½	0.15
Acid, nitric, com'l, carboy, ℔ 100 lb	5.25	6.50
Acid, nitric, C. P., 7-lb. bottle, bbl., ℔ lb	0.16	0.22
Acid, nitric, C. P., bulk, carboy, ℔ lb.*	0.12½	0.15
Argols, ground, bbl., ℔ lb	0.20	0.25
Borax, cryst. and conc., bags, ℔ 100 lb	2.75	3.85
Borax, powdered, bbl., ℔ 100 lb	3.00	4.00
Borax glass, gd. 30 mesh, cases, tin lined, ℔ 100 lb	10.00	13.00
Bone ash, 60 to 80 mesh, bbl., ℔ 100 lb	4.50	5.50
Bromine, 1-lb. bottle, ℔ lb	0.55	0.65
Candles, adamantine, 14 oz., 40 sets, ℔ case	4.60	4.80
Candles, adamantine, 14 oz., 60 sets, ℔ case	5.25	5.45
Candles, Stearic, 14 oz., 40 sets, ℔ case	5.00	5.20
Candles, Stearic, 14 oz., 60 sets, ℔ case	5.70	5.90
Clay, domestic fire, sack, ℔ 100 lb	1.50	2.00
Cyanide, 98 to 100%, 100-lb. case, ℔ lb	0.20¾	0.24¾
Cyanide, 98 to 100%, 200-lb. case, ℔ lb	0.20	0.24
Cyanide, 129%, 100-lb. case, ℔ lb	0.27½	0.28½
Cyanide, 129%, 200-lb. case, ℔ lb	0.26¾	0.27½
Lead acetate, brown, broken casks, ℔ 100 lb	8.75	9.65
Lead acetate, white, broken casks, ℔ 100 lb	10.00	10.25
Lead acetate, white, crystals, ℔ 100 lb	11.75	12.25
Lead, C. P., test., gran., ℔ 100 lb	13.00	15.00
Lead, C. P., sheet, ℔ 100 lb	15.00	18.00
Litharge, C. P., silver free, ℔ 100 lb	10.50	13.00
Litharge, com'l, ℔ 100 lb	7.75	9.25
Manganese ox., blk., dom. in bags, ℔ ton	20.00	25.00
Manganese ox., blk., Caucasian, in casks, ℔ ton (85% MnO_2—3% Fe)	42.50	50.00
Nitre, double ref'd, small cryst., bbl., ℔ 100 lb	7.00	8.00
Nitre, double ref'd, granular, bbl., ℔ 100 lb	6.50	7.50
Nitre, double ref'd, powdered, bbl., ℔ 100 lb	7.25	8.00
Potassium bicarbonate, cryst., ℔ 100 lb	12.00	15.00
Potassium carbonate, calcined, ℔ 100 lb	15.00	18.00
Potassium permanganate, drum, ℔ lb	0.11	0.12½
Silica, powdered, bags, ℔ lb	0.03	0.05
Soda, carbonate (ash), bbl., ℔ 100 lb	1.50	1.75
Soda, bicarbonate, bbl., ℔ 100 lb	2.25	2.75
Soda, caustic, ground, 98%, bbl., ℔ 100 lb	3.15	3.50
Soda, caustic, solid, 98%, drums, ℔ 100 lb	2.65	2.85
Zinc shavings, 850 fine, bbl., ℔ 100 lb	12.05	13.50
Zinc sheet, No. 9—18 by 84, drum, ℔ 100 lb	10.25	11.50

*Extra charge for packing nitric acid for shipment to conform to regulations.

Current Prices for Ores and Minerals

(Corrected monthly by Atkins, Kroll & Co.)

The prices are approximate, subject to fluctuation, and to variation according to quantity, quality, and delivery required. They are quoted, except as noted, f.o.b. San Francisco. Buying prices marked *.

	Min.	Max.
Antimony ore, 50%, ℔ ton	*$22.00	$25.00
Arsenic, white, refined, ℔ lb	0.05½	0.05½
Arsenic, red, refined, ℔ lb	0.08	0.09
Asbestos, according to length and quality of fibre, ℔ ton	100.00	350.00
Asbestos, lower grades, ℔ ton	5.00	50.00
Asphaltum, refined, ℔ ton	10.00	20.00
Barium carbonate, precipitated, ℔ ton	42.50	45.00
Barium chloride, commercial, ℔ ton	42.50	45.00
Barium sulphate (barytes), prepared, ℔ ton	20.00	30.00
Bismuth ore, 10% upward, ℔ ton	*75.00	upward
Chrome ore, according to quality, ℔ ton	10.00	12.50
China clay, English levigated, ℔ ton	15.00	20.00
Cobalt metal, refined, f. o. b. London, ℔ lb	2.50	
Coke, foundry, ℔ 2240 lb	14.50	15.00
Diamonds:		
Borts, according to size and quality, ℔ carat	2.00	15.00
Carbons, according to size and quality, ℔ carat	50.00	90.00
Feldspar, ℔ ton	5.00	25.00
Firebrick:		
Bauxite, ℔ M	175.00	
Magnesite, ℔ M	190.00	275.00
Silica, ℔ M	42.50	47.50
Flint pebbles for tube-mills, ℔ 2240 lb	19.50	22.50
Fluorspar, ℔ ton	10.00	15.00
Fullers earth, according to quality, ℔ ton	20.00	30.00
Gilsonite, ℔ ton	35.00	40.00
Graphite:		
Amorphous, ℔ lb	0.01½	0.02½
Crystalline, ℔ lb	0.04	0.13
Gypsum, ℔ ton	7.50	10.00
Infusorial earth, ℔ ton	10.00	15.00
Magnesite, crude, ℔ ton	5.00	7.50
Magnesite, dead calcined, ℔ ton	20.00	25.00
Magnesite, brick (see firebrick).		
Manganese ore, oxide, crude, ℔ ton	10.00	25.00
Manganese, prepared, according to quality, ℔ ton	30.00	70.00
Mica, according to size and quality, ℔ lb	0.05	0.30
Molybdenite, 95% MoS_2, ℔ ton	400.00	500.00
Monazite sand (5% thoria), ℔ ton	150.00	200.00
Nickel metal, refined, ℔ lb	0.45	0.60
Ochre, extra strength, levigated, ℔ 100 lb	2.25	3.25
Platinum, native, crude, ℔ oz	40.00	45.00
Silex lining for tube-mills ℔ 2240 lb	32.50	35.00
Sulphur, crude, ℔ ton	20.00	25.00
Sulphur, powdered, ℔ ton	40.00	45.00
Sulphur, 80%, ℔ ton	16.50	18.50
Talc, prepared, according to quality, ℔ ton	20.00	50.00
Tin ore, 60%, ℔ ton	450.00	475.00
Tungsten ore, 65%	425.00	475.00
Vanadium ore, 15%, ℔ ton	150.00	180.00
Wolframite (see tungsten ore).		
Zinc ore, 50% up, ℔ ton	*15.00	20.00

Book Reviews

Any of the books noticed in this column are for sale by, or can be procured from, the MINING AND SCIENTIFIC PRESS.

MANUAL FOR ENGINEERS. By C. E. Ferris. 169 pp., index. University of Tennessee Press, Knoxville, 1912. For sale by the University of Tennessee, Knoxville, Tenn. Price 50 cents.

This is a handy little volume of vest-pocket size, useful for students and engineers, and contains memoranda frequently needed. In securing matter for the book, manufacturers' handbooks, books for engineers from the publication of the University professors, and other sources have been drawn upon. The presswork and binding are exceptionally good.

ELEMENTS OF DRAWING. By G. E. Blessing and L. A. Darling. 193 pp.; ill. John Wiley & Sons, New York, 1912. For sale by the *Mining and Scientific Press.* Price $1.50.

The purpose of this book is to present a course of instruction in mechanical drawing for beginners who intend to pursue a course in engineering or who desire to prepare themselves for commercial drafting. The authors, who were formerly members of the faculty of Sibley College, Cornell University, have written along the lines developed in their teaching experience. In accordance with the title, much of the matter is quite elementary, but the general arrangement for beginners is good.

DANA'S MANUAL OF MINERALOGY. By W. E. Ford. 460 pp.; ill., index. John Wiley & Sons, New York, 1912. For sale by the *Mining and Scientific Press.* Price $2 net.

This, the thirteenth edition of a standard work on mineralogy, has been entirely revised and rewritten, the previous revision having been published in 1887. The scope and character are nearly the same, though the text and figures are new, and are intended to supply the needs of students, mining men, and other interested in the subject. The chapter on petrography has properly been omitted. So many good textbooks of mineralogy are now available that the revised edition of this work has not the importance of the original publication, but is likely to enjoy deserved popularity. The convenient size of the book and the excellent half-tones with which it is illustrated add not a little to its attractiveness.

QUALITATIVE CHEMICAL ANALYSIS. By Julius Stieglitz. Part I, Theoretical, 308 pp. Part II, Laboratory Manual, 148 pp. The Century Co., New York, 1911. For sale by the *Mining and Scientific Press.* Price: Part I, $1.40 net; Part II, $1.20 net.

Within the past few decades chemistry has advanced tremendously as a science from the general acceptation of the new viewpoints developed by advanced workers in the science. But these have been curiously slow in finding their way into the elementary text-books of chemistry, so that the work of beginners in high school and college was ill adjusted to the later work in the university. It is possible that Professor Stieglitz has set the plane of his instruction above the head of the ordinary student, but this is at least open to doubt. There is no more apparent reason for the student to begin his study of chemistry with faulty concepts than that a young architect should begin to build houses with material rejected from first-class work. The value to the student of the inspiration conveyed by books of this type can scarcely be overestimated, and is calculated to develop a thinking chemist rather than an automatic analyst. Its publication in two parts is a convenience, for many practising chemists will doubtless welcome the opportunity thus afforded to enlarge their knowledge of chemical theory. The Century Company is also to be complimented on securing for its initial chemical publication a book of the highest class.

Concentrates

Most of these are in reply to questions received by mail. Our readers are invited to ask questions and give information dealing with the practice of mining, milling, and smelting.

POWER required for a Wilfley table averages three-quarters horse-power.

CYANIDE precipitates of silver accounted for $337,081 of the $430,085 declared exports to the United States, through the American consular agency at Amapala, Honduras, in the first half of the current year.

'SHOOTING off the solid,' that is, blasting down coal without having undercut it, is bad practice. Heavy charges of powder produce an unnecessary quantity of fine coal and make the lump coal friable; also they weaken the roof and supporting pillars, and failure to undercut or shear the coal causes the danger of windy shots, the cause of frequent dust explosions.

MOLYBDENITE prices vary with its purity. In August of the current year the pure metal used in the manufacture of hard steel was selling in Germany for $8.11 per pound. The metal which is from 99 to 99.5% free from carbonic acid sells at $2.38, and that which is 90 to 95% free at $1.62 per pound. There is a special kind of molybdenite, prepared by an electric process, which brings as high as $41.90 per pound.

PITTSBURG consumes more coal, and more is shipped to and through the district than any other in the world. Besides using 16,500,000 short tons of coal in 1911, Pittsburg used several million tons of coke and considerable quantities of natural gas. Greater New York consumed about 19,000,000 tons of coal last year, and its coal traffic was about 36,000,000 tons. Pittsburg's coal traffic by rail and water amounted to 53,000,000 tons.

POTASH deposits can be located under the provisions of the law governing other saline deposits and springs, which states: "That all unoccupied public lands of the United States containing salt springs, or deposits of salt in any form, and chiefly valuable therefor, are hereby declared to be subject to location and purchase under the provisions of the law relating to placer-mining claims: Provided, That the same person shall not locate or enter more than one claim hereunder."

NATURAL GAS amounting to 508,353,241,000 cu. ft., and valued at $74,000,000, was produced in the United States in 1911 from 28,428 wells. The increase in demand for natural gas from consumers of all kinds makes the supply a matter of concern. The gas that can be furnished in many of the fields of the United States is simply a function of the capital invested in pipes and power-plants for pumping the gas, but the safety of such large investments decreases in proportion as the unsatisfied demand becomes indicative of a failing supply.

ELECTRIC furnace steel was produced during the past three years with the following tonnage:

	1909.	1910.	1911.
Germany	17,773	36,188	66,654
United States	13,762	52,141	29,105
Austria-Hungary	9,046	20,028	22,867
France	6,456	11,759	13,850
Total	47,039	120,116	126,476

England had hardly commenced to produce for the general market. The lead of Germany and drop of the United States are notable. France makes more ferro-alloys than the others, producing 60,200 tons in 1910, of which 23,800 tons was made in electric furnaces.

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EDITORIAL

THROUGH an inadvertence the initials of Mr. A. E. Wheeler were last week given in our editorial columns as H. A.; a slip the more embarrassing since we number the able superintendent of the Great Falls smelting plant of the Anaconda Copper Mining Company among our good friends.

LEGISLATION proposed by the Colonial Court of Policy of British Guiana is peculiar in providing that only British capital may engage in the development of the petroleum resources of the colony. Money exhibits no racial characteristics, and is usually welcomed, whatever the source of origin.

STATEMENT that twelve independent steel corporations have a total capitalization of $552,000,000 and annual output of 9,800,000 tons, or one-third of the capitalization of the United States Steel Corporation and two-thirds of its output, indicates one of the characteristics of 'big business' and causes of high prices.

WORK on the Panama canal is rapidly nearing completion. It was reported on October 1 that the construction of the Gatun dam and locks was 93 per cent finished, while the excavation work in the central division is 92 per cent completed. Money order sales at the post-offices of the Canal Zone during September amounted to nearly $400,000 and over $100,000 was deposited to postal savings accounts, thus indicating that the canal workmen are frugal as well as efficient.

DECISION of the Supreme Court of the United States sustaining the patents of the Moore Filter Company, granting a judgment for infringement against the Butters Patent Vacuum Filter Company, and enjoining all infringers of the Moore patents finally ends a protracted legal controversy. It is truly unfortunate that the efforts of two men who have done so much for the development of the gold mining industry have been hampered by protracted disputes as to the validity of patents. It is certainly anomalous that a non-technical court is required to decide whether the rulings of the source of technical authority, the Patent Office, are right or wrong. Why not determine the validity of patents before issuance?

CONFERENCE of mine owners and state officials in Arizona upon a proper and reasonable basis of taxation of mines is expected to result in the preparation of a bill to be submitted to the Tax Commission for introduction at the next session of the legislature. Taxation of the mining industry is often heavy, and in California mining corporations are obliged to pay a county tax, state franchise tax, state license tax, and a Federal corporation profit tax, which, together with the necessary insurance, often amounts to as much as 7 per cent of the assessed valuation. This is a heavy burden, and though mining companies are not desirous of avoiding their just contribution to the cost of government, it is only fair that the problem should be studied with care to ascertain whether they are not now obliged to contribute more than their share.

EVEN the dredging industry has its by-products. A contract has been let by the State Highway Commission of California for 500,000 tons of crushed cobbles to be used in highway construction, and the demand for this material to be used in county and municipal paving and for concrete work is so large and persistent as to make its production a not inconsiderable factor in the profits to be derived from gold dredging operations.

UNUSUAL interest is being taken in the annual meeting of the Doe Run and St. Joseph Lead companies, held at Bonne Terre today, because of a bitter attack upon the existing management made by Robert Holmes and others of St. Louis. These companies have long been in control of the Jones, Camp, and Parson families, descendants of the men who found and developed the mines. As capitalization has increased, the ownership has become divided, until now a large minority, if not actual majority, is in the hands of outsiders, including many St. Louis people. The mines have practically been operated as family affairs, paying regular 6 per cent dividends until last year, when Doe Run borrowed $2,000,000, and cut the dividend rate to 3 per cent, to provide for the bonds. Mr. Holmes alleges gross extravagance in the executive offices, and the payment of large salaries to men in New York who contribute nothing to the success of the property, but who inherited their jobs. The technical work is not criticized, except that the continued operation of the Doe Run No. 1 mill is shown to result only in waste and expense. The mill has recently been closed. In his report to the Doe Run stockholders, Mr. D. A. Jones, the president, shows that the company since its organization in 1886 has increased its holdings from 100 to 7057 acres, and the two companies, together with the Mississippi River and Bonne Terre Railroad, have a gross capitalization of nearly $35,000,000. In the past year 932,220 tons of ore has been hoisted, yielding 53,080 tons of concentrate and 33,729 of metallic lead, worth $2,267,155. All expenses, including operation and interest, amounted to $1,687,167. The approximate net profit was $576,988. A 3 per cent dividend was paid, and bonds to the amount of $203,000 were retired. It is estimated that next year, due to economies and enlargement of No. 3 mill, the net income will be doubled. The technical work is under direction of Mr. O. M. Bilharz.

ELECTION of Mr. Woodrow Wilson to the presidency is likely to meet the approval of that large body of American citizens who incline to believe that whatever party may be in power the country will not go, as Mr. Mantalini said, to the 'demnition bow-wows.' The large vote polled by the Progressive party will be of great effect in influencing legislation during the succeeding four years, and it is not improbable that a Democratic president of broad vision and progressive tendencies may be able to evoke from a Democratic Congress as much or more of useful legislation as the more vigorous Mr. Roosevelt could extract from a rebellious House and refractory Senate. Though the Democratic party theoretically opposes the whole doctrine of protection, it is not likely that any change more severe than a wholesale downward revision of the schedule will be attempted, for even slight reduction of duties causes many pinches in the business world, and the dissatisfaction arising from the necessary readjustment usually leads to a change of administration. The disappointed Republican and Progressive leaders can therefore look forward to an excellent chance to win in 1916, with the troublesome tariff removed from the field, and other collateral questions, such as the direct primary and woman suffrage, more nearly settled than at present. Business has been good previous to the election, and is now likely to be better. To the impartial observer, perhaps the two most significant features of the contest were the personality of Mr. Wilson and the support of the Progressive party. It is a credit to American politics that a man of the character of the Democratic nominee could seek and secure election. A man of quiet and scholarly tastes, a distinguished teacher of history and political economy, and a successful executive in academic and political work, he is the type of man whose absence from the field of practical politics is most frequently lamented. Even more significant was the number of men prominent in the world of business who actively supported a platform calling for increased compensation and better safeguards for the laborer and a closer regulation of the activities of large aggregations of capital. Support of such a platform by such men could only result from a conviction that the right line of progress lies in that direction and the sooner 'big business' gets into line with true progress the more it will prosper.

Utilization of Power

Not the least of the many valuable features of the important discussion by Mr. E. P. Mathewson of the development of the reverberatory furnace in copper smelting, which we reprint elsewhere in this issue, is his record of the interesting and suggestive results obtained from the use of wood gas producers at Kyshtim, Russia. The low power cost there obtained is, of course, largely due to the low cost of wood, but the achievement of a fuel cost of 33.6 cents per ton smelted, even under favorable conditions, is a notable example of what can be done in an isolated power-plant. Mr. M. W. von Bernewitz also describes the use of gas-producers and gas-engines at the Waihi mine in New Zealand, where the cost of power was reduced to less than two-thirds of that with the steam-plant formerly employed. It is safe to say that the development of the utilization of power in the mining and metallurgical industry has been somewhat neglected, largely because the rapid progress in the generation and transmission of hydro-electric power has enabled many plants to change instantly from the old low-efficiency steam-boiler and slide-valve engine to the highly efficient electric motor. This is admirable, so far as it goes, but hydro-electric power is not everywhere available and the operator in districts where it is not, profits nothing from its economies in more favored districts. The early stages in the development of the gas-producer excited great general interest and no less general disappointment when it became definitely known that the cost of construction and the difficulties of operation upon a small scale render it unavailable for plants of small or moderate size, though highly efficient in large installations. More recently great improvements have been made in the construction of producers and engines of small size, especially the oil-gas producer, while the development of internal-combustion engines of the Diesel and other types is perhaps the most important event in the mechanical world of today. Neglect of the unit power cost by the small consumer is not unnatural, since it forms only a small part of the total operating cost, and the manager finds it necessary to devote his attention to the control of operating items which greatly exceed it in influence on the total. In addition, low-efficiency types of machinery are often employed in order to minimize capital expenditure in the early stages of an enterprise, and the assured saving to be effected by more efficient types is not always sufficient to justify the cost of installation. On the other hand, the increased capital cost of the more efficient type is often small enough so that, depending on the outlook for success in the enterprise, it is better business to employ the more expensive type from the beginning. The increasing demand for

high-efficiency machinery for power development and utilization upon a small scale is stimulating manufacturers to supply the equipment needed, while, on the other hand, the operator has begun to learn what can be done to supply his needs, and to lay his plans accordingly. Now that the mining and metallurgical industries are changing from the high cost and large profit condition of the early days, to moderate profits won by careful planning and skilful operation, it is to be expected that power-plant practice will exhibit a corresponding degree of advancement.

Europe and the Balkan War

The busy engineer, having paid but little attention to the historical development of modern Europe because of more imminent matters, such as the stopping of frothing in his cyanide vats or the prevention of 'camming' in his stamp-mill, to absorb his mental energies, is likely to share the attitude of little Peterkin and inquire, "what good will come of it at last?" as he reads of the series of victories which the allied Balkan armies have gained over the Turkish forces. Any more illuminating answer than the inquisitive child received is difficult to make, but the possibility of these battles having a direct influence upon world policies of powerful nations, and consequently upon the citizens of every country, is sufficiently great to make a brief summary of the history of the vexatious Near Eastern question of interest and importance to the cosmopolitan mining engineer.

The Balkan peninsula is a mountainous area lying south of the Danube and Save rivers and is washed on its southern margin by the Ionian, Mediterranean, Egean, Marmora, and Black seas. With a total area, including adjacent islands, of about 150,000 square miles, or approximately the same as the state of Montana, it contains within its borders the sultanate of European Turkey, the czardom of Bulgaria, Eastern Rumelia, the kingdoms of Greece, Servia, and Montenegro, and the Austrian provinces of Bosnia and Herzegovina. The peninsula has been a seat of civilization since an early period and the Macedonian Empire under Alexander as well as the subsequent intellectual empire of Greece dominated the world of their time. Later a part of the Roman Empire, its inhabitants became converted to Christianity in the time of the Christian emperors. In the time of Diocletian, the Roman Empire was, for administrative purposes, divided into two parts, of which the Balkan peninsula formed the eastern division. When the western empire of Rome was overthrown by the Gauls in 476 the eastern division continued its troubled existence for a thousand years, until in 1453 the Ottoman Turks under Mohammed II swept across the Bosporus and conquered the whole peninsula. Suleiman I extended his dominion over Hungary, and even, in 1529, besieged Vienna, but his successors were less vigorous and his death marks the beginning of the decline in power which has ever since been characteristic of Turkey. That peaceful conditions in the peninsula could never be attained under Turkish rule was evident from the beginning. With Christian races of the lineage of ancient Greece and Macedonia, governed by corrupt and venial Mohammedan officials and with fanatical religious antagonism superimposed on political injustice, continual unrest is sure to be the result. As Turkish power waned the unrest of its Christian subjects increased until, by the beginning of the nineteenth century they were ready to successfully assert themselves. In 1820 the Greeks revolted and after a ten years war their independence was recognized by the Porte. Meanwhile Russia had declared war upon Turkey, and in both these conflicts the most potent and significant factor was the concerted action of the great European powers. Following the treaty of Chaumont in 1814, and the subsequent Congress of Vienna and fostered by the influence of Prince Metternich, the European nations had come to act together to maintain the equilibrium of power throughout the continent. The effects of this 'political trust,' as it may be called in the language of the day, are perhaps most clearly seen in the maintenance of Turkish sovereignty in the face of conditions which would normally have led to its overthrow. Every European power is interested to prevent Turkey from being overthrown because each is unwilling to have any of the others obtain possession of the Balkan peninsula. Russia has coveted it since the time of Peter the Great, for that enormous empire urgently needs for its development better seaports than those on the ice-bound Neva and Amur and at Vladivostok. England no less urgently strives to check the Russian advance toward the borders of India. Domination of the eastern Mediterranean by a Russian fleet, with the possibility of a blockade of the Suez canal is as undesirable to England as the opportunity for naval and maritime progress is essential for Russia. Austria would also be glad to secure the Balkan peninsula, while Germany, France, and Italy, for commercial and strategic reasons are as anxious to prevent it. Nevertheless, in the words of Mr. C. M. Andrews, referring to the treaty which terminated the Crimean war, "the maintenance of the integrity and independence of the Ottoman Empire * * * was probably the most ill-advised and suicidal diplomatic action that has ever been taken by a body of representatives discussing international questions. To guarantee the integrity of a state that for two centuries had been suffering steady but certain dismemberment, was to ignore the lessons of the past, to invite war, and to insure anxiety for the future. * * * The Mohammedans refused to be associated with the despised infidels in administration and to obey them in places of authority, either in the state or army. The Christians preferred to pay tax rather than serve in the army and were afraid to take their places in the tribunals or to hold positions of prominence." Various attempts at reform proved futile, and in succession the people of Rumania, Servia, and Montenegro rose in revolt and, as a sequel to the Russo-Turkish war in 1877, achieved independence. Bosnia and Herzegovina were placed under the sovereignty of Austria, and Eastern Rumelia was made autonomous under a Christion governor-general, nominated by the Sultan. The quarrels between Mohammedans and Christians have continued unabated, and the Balkan states have been in continual unrest through difficulties with each other and from their concern in the oppression suffered by their compatriots who still remain under Turkish sovereignty. The war now in progress is the outcome of the measures taken by Turkey during the past year in suppressing a revolution on the borders of Montenegro. The King of that tiny country, which has an area of 3600 square miles and a population less than that of San Francisco, courageously declared war, in which Greece, Servia, and Bulgaria hastened to join. In three weeks vigorous fighting the allies have pushed the Turks back to the outskirts of Constantinople and the Turkish Government has requested the intervention of the great European nations to prevent its complete overthrow. Austria and Italy are disposed to intervene, but England, France, Germany, and Russia seem disposed to give the allies a free hand, for the present at least. What will be the final outcome only the event will tell. If the varying interests of the great European powers can be so reconciled as to permit the expulsion of the Turks from Europe, lasting peace may come after three centuries of turmoil. If not, there will follow a new buttressing of Turkish power in order to postpone a little longer its inevitable fall.

Cyanide Plant at the Empire Mines, Grass Valley

By Frank A. Vestal

This plant was started on December 1, 1910, and has since been in continuous operation, treating the tailing and concentrate from a 40-stamp mill, together with the concentrate purchased from the Pennsylvania Mines Syndicate. The stamps used weigh 1050 lb. each, crushing approximately 3½ tons per stamp per day through a 35-mesh slotted screen. Both inside and outside amalgamation are used, 90% extraction being obtained.

From the plates the pulp passes over sixteen 6-ft. Frue vanners, which remove from two to three tons of concentrate per day. The tailing goes directly to the cyanide plant, while the concentrate is re-ground in a 4 by 8-ft. Allis-Chalmers tube-mill. The concentrate is shoveled into an 8-ft. receiving box of one ton capacity, which rests just above the mouth of the tube-mill at an angle of 6°. After passing through the tube-mill the product is raised by a water ejector to a Merrill concentrating cone, the overflow passing over two amalgamated plates 2 by 5 ft., where from 15 to 20% is saved. The oversize drops into a long receiving launder. This launder is movable, being attached to an 8-ft. screw shaft by means of a two-piece nut.

EMPIRE CYANIDE PLANT, GRASS VALLEY.

The shaft is geared so as to move the launder 8 ft., the length of the receiving box, in 6 hours. The discharge end of the launder is started over the lower end of the receiving box, and the underflow from the cone washes the concentrate into the tube-mill at the rate of one ton in six hours.

The tube-mill is run continuously, handling about 4 tons in 24 hours, 85% of which passes a 200-mesh screen. The value of the concentrate is from $60 to $115 per ton. Much better work is being done in the leaching plant since the Pennsylvania concentrate has been added, as the tube-mill was not before run continuously and the concentrate formed in layers in the sand-vats, making the sampling of the residue very uncertain. The tailing from the vanners is conveyed to the cyanide plant through a 16-in. terra cotta pipe. After 18 months continuous use this pipe shows little or no wear. The concentrate, after leaving the tube-mill plates, is conveyed to the regular tailing launder in a 2-in. galvanized iron pipe.

The mill tailing is 46% fine and 54% coarse. The entire discharge runs to a distributing sump, which in turn feeds to two Merrill settling cones, the overflow from these cones passing to four clarifiers or de-waterers, the underflow passing to four Merrill hydraulic sizing-cones. The overflow from these cones passes to the clarifying tanks, while the underflow goes to the sand-vats. The settling-cones are fitted with interchangeable nozzles, by means of which the overflow can be regulated as to amount and fineness. The sizing cones are fitted in the same way, but in addition water is introduced through a special casting at the bottom. This gives a decidedly flexible classifier, almost any product being obtainable either as sand or slime. The slime runs to a central distributing sump fitted with slide gates, which permits a varying amount being sent to any clarifier. These clarifiers are 22 ft. deep and 24 ft. in diameter, built with a false conical bottom. The centre cylinders in the clarifiers were originally 10½ ft. long, but on experimenting it was found that a cylinder 6½ or 7 ft. long would cause no agitation on the surface and give more settling room when forced to shut down any part of the slime department for repairs, and still maintain a clear overflow.

The discharge is in the centre of the bottom, the pipe running to the side of the tank and rising 9 ft., allowing the slime to run to the Pachuca tanks by gravity. The discharge pipes are fitted with interchangeable Merrill nozzles, and any density of pulp is obtainable. At present pulp from 1.4 to 1.6 gravity is in use. There are four Pachuca tanks, 10 by 18 ft., run in series. The pulp is run into Pachuca No. 1, dropping into a 12-in. cylinder 8 ft. long; this is used to force the pulp to make at least one circuit before any part of it runs over into Pachuca No. 2. This Pachuca is fitted up in the regular way with the centre cylinder 10 in. from the bottom of the tank and a few inches above the level of the pulp. The discharge is about 4 ft. from the top of the tank and enters Pachuca No. 2, 10 ft. from the top, No. 2, 3, and 4 Pachucas being piped in the same way.

In No. 2 Pachuca the cylinder is only 8 ft. long, being submerged at all times. A baffle-board is fixed about 1 ft. from the top of the cylinder, the idea being to break up any possible heavy slime and to help in mixing. No. 3 Pachuca is arranged in the same way, with the exception of the cylinder, which is 12 ft. long. No. 4 Pachuca contains no central cylinder at all, being merely a tank with a false conical bottom. The pulp is fed directly to the filter-boxes from the No. 4 Pachuca.

Both cyanide and lime, dissolved with barren solution, are added to Pachuca No. 1 to get the necessary strength. Barren solution is also added to No. 2 and No. 3 Pachuca to bring the pulp to the consistence best suited to the filters. This solution, being added to No. 2 and No. 3 Pachuca, freshens up the charge and gives better results than when all added at No. 1. Sufficient lime and cyanide are added to keep effluent solution from filters at a strength of 0.04% KCN and a sufficient degree of protective alkalinity.

The cyanide consumption ranges from 0.75 to 0.90 lb. per ton of ore. Several experiments were made with solutions ranging from 0.04 to 0.12%, but the extraction was no better, while the cyanide consumption increased almost at the same rate as the amount of cyanide added. In other words, using a 0.12% solution, the consumption reached 0.09%, or 1.8 pounds.

The pulp passes to two 35-ton Oliver continuous filters. The gravity is kept between 1.3 and 1.35.

An Oliver wet-vacuum pump is used, maintaining a vacuum of 22 in. The filters are fitted with a front and back wash, being piped so as to permit either barren solution or water being added either in front or back or both. When the filters were installed it was thought that a front wash would be all that was necessary for this particular product. Some experiments made may be of interest.

Before the concentrate was added, the slime-heads averaged in precious-metal content as follows:

January, heads $1.81, residue 24c.; April, heads $1.99, residue, 25c.; February, heads $2.03, residue, 30c. This shows the residues without a back wash.

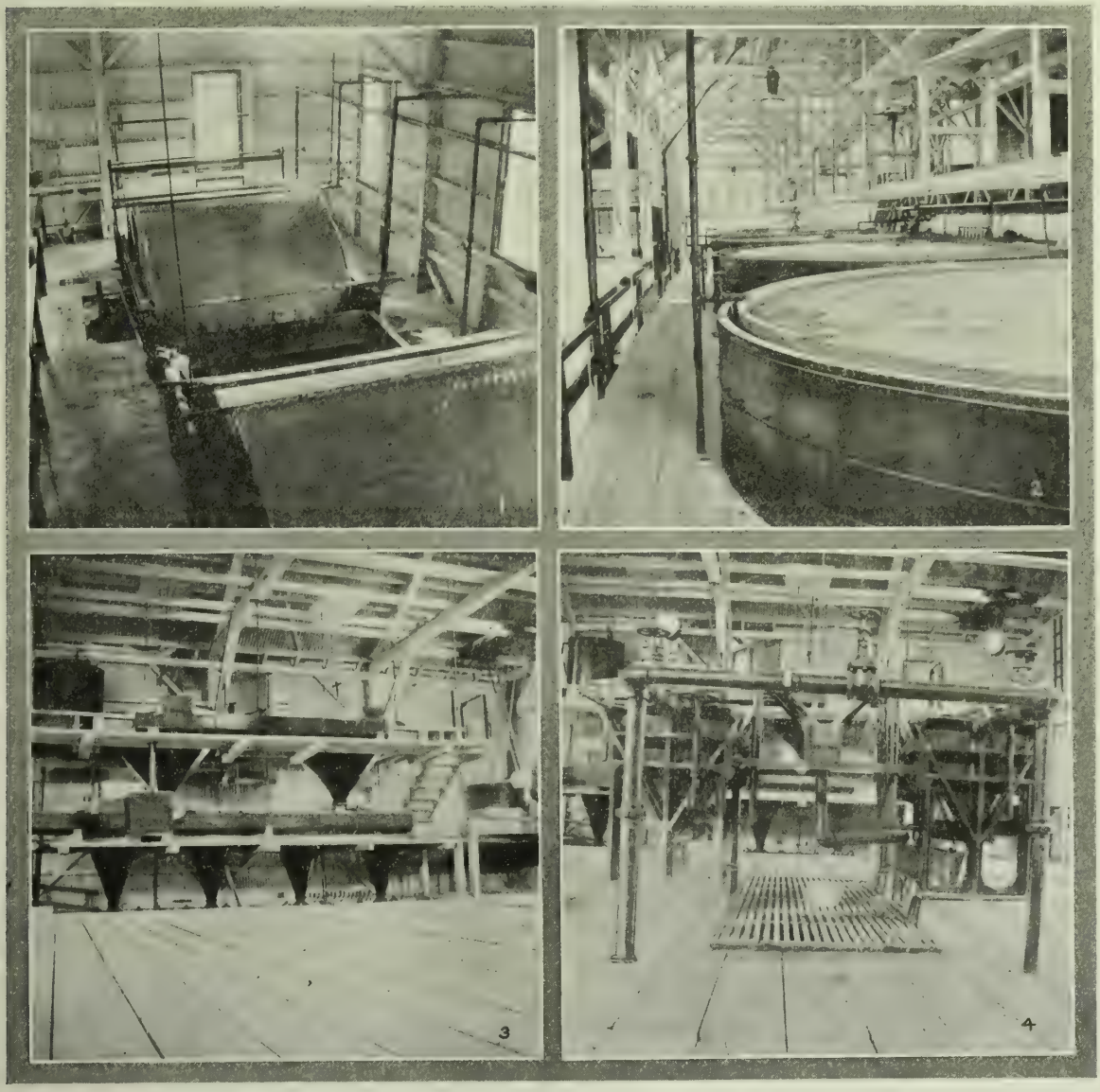
May, heads $1.95, residue 14c.; June, heads $2.11, residue, 15c.; July, heads $1.65, residue 11c. With both front and back wash.

After the sulphides were added the gold content in-

creased as follows: August, heads $2.38, residue 17c.; September, heads $2.89, residue 22c.; November, heads $2.60, residue 20c. With both front and back wash.

On a 2-hr. test made without a back wash the residue content reached as high as 40c. per ton. The filters, making a revolution in 8 minutes, allow 1¼ min. for washing with a front wash. With the added back wash a period of 2¾ min. is obtainable. The former time is more than doubled because on the front side of the filter one compartment (or 1/24 of the filtering surface) is discharging the cake, while at the back side that one compartment is gained for washing.

To prevent the excess water or barren solution added at the back of the filter from running down into the filter-box and diluting the solution and thinning the pulp, a launder was constructed to catch this excess. In the first experiment a heavy piece of rubber belting formed in the shape of a U-launder and supported by a strip of wood across the filter-box, was set at an angle, the excess wash running to waste at the lower end. This was not satisfactory, mainly because a thick belt was necessary for strength, and as a result the water would strike the edge of the belt and be carried to one edge of the filter and deposited in the filter-box. Next a wooden V-shaped launder was built and a strip of rubber 1 ft. wide by 1/32 in. thick was tacked to the side of the launder. This rubber was allowed to rest against the cake for practically two-thirds of its width. This caught nearly all the excess for the first few days, but later it began to curl up and during the cold weather would freeze. Another objection was that when the power would go off, or a shut-down occur, on starting up the filters the vacuum would tear the rubber from the launder. Next a sheet-iron launder (No. 20 iron being used) was made with one side 15 in. high and the other 3 in. The high side is bent to meet the contour of the filter, with the upper edge flattened out so as to only leave a bearing surface of ½ in. The overbalancing of the launder against the filter holds it in place. Up to the present time this launder has given entire satisfaction. In 24 hours hardly enough fine slime is washed away for an assay, and the excess water only carries a trace of gold.



OLIVER FILTERS.
CONE CLASSIFIERS AND LIME-FEEDER.

LEACHING VATS.
MERRILL PRECIPITATION PRESSES.

The filters are doing good work and require little attention, only one man being required to run the entire plant on the two night shifts. A cake from 3/16 to 5/16 in. is formed. The slime is practically free from granular particles, and is exceedingly sticky and impervious. The scraper for removing the discharge cake must be filed at least twice a week, taking one man about 15 minutes for each. When properly taken care of, the life of the canvas is from five to six months. The Pachuca tanks are run in series and several samples taken at different times between the tanks showed a uniform extraction, proving that very little, if any, slime made the circuit before being attacked by the solutions.

There are four sand-vats of 155 tons capacity each, fitted with inside overflow-launders. The sand is carried by

means of an overhead launder to each vat and distributed by a Merrill distributor. During the filling, lime is added to the charge, about 2 lb. per ton of ore being used. After filling, the charge is allowed to drain for 5 hr., the top being raked and leveled and 100 lb. of slaked lime added. After a vat has been filling for 12 hr. the drain valve is opened, which, in decreasing the overflow, lessens the chances of losing gold in this way. The gold being mostly in the fine, makes this necessary. Several samples were taken of the overflow water, the amount of solids being weighed and assayed, and it was found that from 1/6 to 1/4 ton was being lost every 24 hr. This assayed $2 per ton, a maximum loss of 50c. per day. As an experiment an inner rim 12 in. high was placed inside of the regular overflow edge of a vat, this rim resting 1 in. higher than the top of the vat, and being held away from the inside of the regular overflow by small blocks 1/2 in. thick; the idea was to get away from the waves caused by the distributor and to force the overflow to go down under the inside rim. A much more even overflow was thus obtained, but several samples taken showed little, if any, saving over the old method.

The product in the sand charges is 87 1/2 coarse, against 12 1/2% fine. After the 5-hr. drain period, a 0.10% solution is added to the top of the charge, 40 tons in all being used. The solution coming from the vats is allowed to go to waste until it shows a trace of KCN, when it is turned into the gold sump. After a KCN strength of 0.04% has been reached, the content is the highest. At this time the effluent valve is closed and the charge is allowed to stand for 10 hr.; the idea is to give less solution tonnage and at the same time enrich the solutions. The effluent solution from the filter is added as a second solution. A barren solution would be preferable for a second solution, but it is absolutely necessary to clarify the filter-solution before precipitation takes place, and the sand-vats are used for this purpose even after the extraction has been completed. A small clarifying tank as well as an excelsior filter is used in the event that the sand-vats cannot handle the filter output, which amounts to 144 tons per 24 hr. Either barren solution or water is used for the final wash, about 70 tons being necessary.

Each vat is fitted with a Merrill centre gate and has a sloping bottom to facilitate sluicing. The vat itself is built in the regular way, but the false-bottom is 8 in. high at the outside against 2 in. at the centre gate. An automatic sluicing machine is used for discharging the vats. This is similar in construction to a lawn sprinkler, hanging from an overhead track. This type of machine was first used, I believe, by E. L. Oliver at the North Star mines. It works well, but plenty of water is needed. A hose is necessary for the last half-hour's sluicing for cleaning up the bottom. The weaker solutions (both in gold and KCN) are precipitated separately, and later run to waste if the assay returns are satisfactory. A great portion of this, as stated before, is used as a wash on the filter or sand-vats, or for thinning the pulp in the Pachuca tanks.

The well known Merrill zinc-dust precipitation is used. Two 125-ton presses, with ten 36-in. frames, handle the total solution tonnage for the month. The zinc-dust is uniformly distributed along a rubber-belt conveyor of the same length as the depth of the tank. The belt is operated by means of a large float which, sinking with fall of the solution being pumped, moves the belt at the proper speed. The zinc falls into a receiving-cone, where barren solution is added, an overflow pipe carrying the zinc emulsion to the suction pipe of the pump. A mechanical agitator is used in the cone in preference to air. The air tended to oxidize the zinc and at times gave more or less trouble with precipitation. In my opinion the belt feeder arrangement gives more uniform speed than any other feed if properly taken care of. The zinc consumption amounts to about 0.19 lb. per ton of ore. Consumption per ton of solution has averaged as low as 0.12 lb.; at times 0.10 lb. of zinc per ton of solution has been used, giving 1c. barren solution. The weak solution is kept at a strength of not less than 0.03% KCN. A less amount of zinc is added to the higher-grade solution, as it is standardized and used as strong solution. Using less zinc gives a higher-grade precipitate and makes a saving in several ways, while 4c. or 5c. barren solutions are of no importance when the solution is saved.

More or less trouble was encountered during December and January. At first it was thought that the cold solutions were causing this, the temperature being around 36° F., but several tanks were heated, with no better results. Forty tons were pumped with temperature at 37°, and the remaining 40 tons of the same tank heated to 56°, and the results were the same, although a little more zinc was necessary with the cold solution. At this time the sand treatment was changed in such a way that the vats could not handle the filter solution, so the other small filters, for clarifying purposes, were taxed to their capacity. Apparently the pregnant solutions were perfectly clear, but on close examination were found to contain a little fine slime. On opening the presses a thin layer of slime was found at the top of each frame. On changing the treatment of the sand and cutting out the filters, good results were almost immediate. Excess zinc tended to relieve matters a little, and this led to the belief that the fine slime merely coated over a certain part of the zinc being added and also that already in the press. While our precipitation troubles have been few, they have invariably been traced to solutions not having been thoroughly clarified.

Continuous precipitation has proved more satisfactory than intermittent. The precipitate as it comes from the press is worth from $18 to $30 per pound. The precipitate is melted with a flux containing 1/2 of borax to 1 of dry precipitate, 20% soda, and 2% silica, which gives the best results. One No. 40 and one No. 120 Steele-Harvey tilting furnace is used, with crude oil as fuel. Originally the precipitate was dried to just before the dusting point, and then screened and fluxed; at present it is not dried nor screened, but is fluxed and melted direct from the presses. In January one-half the total product, which contained 49% moisture, was fluxed and melted in less time than formerly required for melting the nearly dry product. It is necessary, of course, to feed in the precipitate fast enough to keep a crust on the top of the metal or 'spitting' will result. When pouring, the pot is emptied each time, allowing the next charge to be added at once with no chance of spitting.

The zinc fume from the furnaces was objectionable, and it became necessary to use some means of controlling it in order to protect the men. The first thing tried was a large inverted cone with a stack leading up through the roof (the building itself is fitted with a cupola for taking away the smoke), which resembled in every respect the stack on a blacksmith forge. This was not entirely satisfactory and was the cause of some dusting, the draft being very strong. A device for catching the dust was arranged in the stack of the large furnace, with the result that the greatest amount caught was 4 lb. per run, the value being $2 per pound. At present a sheet-iron house is placed around each furnace, being built from the floor up and connected to a flue 20 in. square, which runs on a downward angle for a distance of 25 ft. At this point a T was put in, the bottom being fitted with a sliding door and acting as a dust-chamber. The upper part runs into a stack of suitable height. Doors were put in at the proper places around the furnace and glass panels arranged to the best advantage for watching the fire. This arrangement has proved very satisfactory, no trouble arising from the fume. Practically no dusting takes place, none showing at the top of the stack and little being deposited in the dust-chamber after three melts.

The slag carries more gold than if other methods of melting were used. At certain periods the slag is sacked and shipped to the smelter. Great difficulty is met in getting slag assays to check, owing to the shot. In sampling, every ninth shovelful is reserved and run through a small crusher. This product is again cut down and

crushed to a fineness of about 40 mesh. This is panned and the shot separated; the percentage of shot is recorded and assayed, the rest of the sample being reground and assayed. In this way a fair check is made on the amount that should be in the slag, using the solution and precipitate value as a check against the bullion and slag. At present experiments are being run in treating the slag in the mill grinding-pan. One hundred and fifty pounds of slag was run through a small crusher and an assay taken, showing a value of $1 per pound. This was fed into the grinding pan and silver added in the necessary quantity. The result was 90 oz. of a mushy amalgam which retorted 30 oz. of base metal. This was in turn melted down (after adding litharge to give uniformity for sampling), and this assayed 347 fine. The results were $215.10 from a supposed content of $250, still leaving 14c. per pound in the slag. Assays taken from the slag residue run $0.075 per pound. If future tests work out as well, the entire product will be treated in the same way, as the cost is small and the returns are quick.

The treatment cost per ton of ore, averaged for six months, after adding concentrate showed an increase over the preceding six months of $0.005 to $0.02.

EXTRA COST DUE TO TREATING CONCENTRATE

Lime to tube-mill, ½ ton	$ 8.00
Extra lime to cyanide plant, 1 ton	16.00
Extra KCN to cyanide plant, 100 lb	18.90
Extra power	15.00
Extra pebbles	6.50
Total	$64.40

Taking the average tonnage per month makes the cost about 65c. per ton. While this seems small, a careful examination of the past 10 months' run shows this to be a just charge. An extraction of from 87 to 89% is obtained from the sand, while the extraction on the slime is 90 to 93%. Pipes are being laid direct from the tube-mill plates to the Pachuca tanks with the idea of treating all the concentrate with the slime.

The plant contains two Aldrich triplex solution pumps run by two direct-driven 3-hp. motors; one Oliver wet-vacuum pump, run by a 15-hp. belt-driven motor; two Oliver filters driven by a 7½-hp. motor, belt driven; a 4-ton Allis-Chalmers tube-mill, 10-hp. motor, belt driven; and one lime-pan with a 2½-hp. motor. The actual horse-power used per motor amounts to:

One solution pump	1.6
Compressor	15
Vacuum-pump	8
Filter	2
Tube-mill	8
Lime-pan	0.7

One shiftman and one helper are employed on day-shift, and one shiftman on each of the other two shifts. A foreman has charge of the cyanide, refining, and assay office, remaining on day-shift all the time. The assayer does the work for the mine, mill, and cyanide plant. The treatment cost for 1911 amounted to:

Labor	$0.14
Power	0.035
KCN	0.17
Lime	0.03
Zinc	0.02
Assay	0.03
Refining	0.02
Total	$0.445

Henry Hansen was the metallurgist and designer of the plant and J. T. Hooper was superintendent of construction, with F. C. Languth as metallurgical engineer on the ground to put the plant in operation.

THE Simmer & Jack East Mine, Ltd., was sold at auction to the Knights Deep, Ltd., on September 26, for £250,000.

Mine Waters

By A. C. LANE

HISTORICAL INTRODUCTION

*While the fact that the deeper waters around Lake Superior are peculiarly salty has been known for over twenty years, it was not known at the time of Pumpelly's study, because the mines had not reached the depth where this feature became characteristic. The first published analysis of Lake Superior mine waters, showing their salty character at depth, that I know is that of the Silver Islet mine, within sight of Isle Royale but on the Canadian side of the boundary. This analysis should, perhaps, be included geologically with the iron country waters (since the mine is in Huronian rocks), but the salt content is very heavy and the water may derive its salt content from Keweenawan intrusives.

I am told by W. W. Stockly, who at one time worked with L. G. Emerson, one of the most prominent early engineers and an assistant of R. Pumpelly during the time Pumpelly was preparing Volume I of the Geological Survey, that Mr. Emerson took samples of some salt water which came in at about sea-level at the Cliff mine. Johnson Vivian says that this water was 1800 ft. down. The plan of the mine in the Mineral Statistics report (for 1880) shows the bottom of the mine at the 220-fathom level, 1680 ft. below the top of the greenstone. It was probably taken, therefore, about 1879, but I have found no printed reference to it. The Silver Islet water, analyzed by W. M. Courtis, is described in the Canadian reports.[1] The analysis is also given in my papers before the Lake Superior Mining Institute.[2] The next analysis published and the first which called my attention to the matter was made by R. L. Packard when I was at the Michigan College of Mines.

It was not, however, until many years later that I fully realized the widespread character and the geological importance of these waters. It is obvious that if there is found included in the copper country rocks three different kinds of water distributed in fairly horizontal layers it is reasonably certain that there has been no round-and-round circulation since these waters have been thus arranged. The question as to how thorough the circulation of water in the upper levels of the earth's crust has been is one which has been much discussed of late years, particularly by Van Hise and Kemp, and papers on this subject are listed and summarized in Kemp's yearly review of the literature of ore deposits in the annual volumes of Mineral Industry. I have given some preliminary results of my own work in a series of papers.[3] It was natural for me to do this because I had in mind the continuation of my study of the

*Excerpt from the Annual Report to the Board of Geological & Biological Survey, Michigan, 1909.

[1]Canadian Geological Reports, H. 1887, pp. 28, 58.

[2]Vol. XIII, p. 74.

[3]Annual report to the Board of Geological Survey for 1903, see p. 141. Report of the State Geologist: 'Salt Water in the Lake Mines,' Portage Lake *Mining Gazette*, March 8, 1906; Lake Superior Mining Institute, Vol. XII, pp. 154-163; 'Chemical Evolution of the Ocean,' *Journal of Geology*, XXVI, April-May 1906, p. 221; brief description of the Geology of Keweenaw Point, Lake Superior Mining Institute, Vol. XII, pp. 81-104; *Mines and Minerals*, December 1906; 'Salt Water in the Lake Mines,' Lake Superior Mining Institute, March 18, 1907; 'The Early Surroundings of Life,' *Science*, August 2, 1907, p. 129; 'Chemical Evolution of the Ocean,' *Bull.* Geol. Soc. Am., Vol. 17; letter on Mine Waters, *Calumet News*, April 10, 1908; *Native Copper Times*, April 21, 1908; Portage Lake *Mining Gazette*, April 19, 1908; 'Mine Waters'; Abstract for *Proc.* Lake Superior Mining Institute, June 1908; *Michigan Miner*, July 1908, p. 13; 'Mine Waters,' Lake Superior Mining Institute, Vol. XIII, pp. 63-152; 'Mine Waters and Their Field Assay,' *Bull.* Geol. Soc. Amer., Vol. 19, pp. 501-512.

water resources of Lower Michigan by a study of the waters of the Upper Peninsula, which naturally led me to take up the study of mine waters. I shall not repeat in full the data which I have heretofore given, except where necessary to aid in the solution of the problem, but I shall summarize them and give new data. The more I looked into the matter the more I found it of geological and practical importance.

Summary of Results

The study of these waters is of practical interest, in the first place, because the admixture with the upper waters of the lower strongly saline waters affects the use of the mine waters in boilers. The study may lead to a different plan of pumping and other handling of the mine water. In the second place it seems fairly clear that the character of the waters has had a good deal to do with the deposition of the copper. It is a curious and significant thing that one seems to find traces of similar waters high in chlorides in other districts in which native copper occurs, and it is interesting to notice that heretofore[4] in the discussion of ore deposits the importance of chlorides seems to have been little regarded compared with sulphates, in general.

Finally, the chemical character of these waters seems to also bring up very interesting questions as to possible changes in the chemical character of the ocean throughout geologic time and also the question whether the Keweenawan rocks were laid down in the ocean or whether these waters may not have been derived from saline pools in the deserts. It may also be said that the study of these waters has its bearing upon all the theories of chemical alteration and change of these rocks and also upon the question of the temperature and the rate of increase of temperature which will be found in depth. The facts and conclusions summarized below are those which are particularly important if true. I begin with those most firmly established and pass to others of which I am not so sure.

1. In the copper country as in the iron country the surface waters are soft as compared with those of the Mississippi Valley and generally are more like those of New England. This is true also of the actively circulating waters.

2. In the copper country, in the iron country, and in the sandstone country of the eastern part of the Upper Peninsula, below the layer of soft waters, in which there is relatively active circulation, there is a layer of water in which there is a marked amount of sodium chloride. The chlorine increases steadily, the sodium increases, and the calcium increases, too, so that it is safe to say that calcium chloride is present. Moreover, in the deeper waters calcium chloride predominates. This second or middle layer of water, however, contains sodium in greater quantity than can be imagined to have been produced by simple mixture of the surface waters in which there is a small amount of sodium carbonate and silicate with the deeper waters in which the calcium chloride dominates very largely over the sodium chloride. In other words, there is a distinct belt of sodium chloride waters.

3. Beneath the second belt will be found water extremely strong and practically saturated in many cases with calcium chloride. The ratio of calcium to chlorine becomes nearly 1 to 2. Such waters are extremely corrosive in boilers and pumps and, of course, hard.

4. In this presence of calcium chloride they resemble waters which are found in connection with similar associations of copper, trap, and red sandstone in Chile, in New Jersey, and in the Sahe-Nahe region on the west bank of the Rhine. We also find similar waters in the older rocks all over the Mississippi Valley, and, in fact, more or less all over the world. Such waters seem at least in part to have been buried with the strata now containing them and may be called connate waters.

5. Flows of these deeper or connate waters when developed in mining decrease and soon drain off, showing that there is no open connection with the surface.

6. The exact level at which a given strength of water is found varies greatly, but below 1500 ft. it is common to find them stronger than the present sea water (sp. gr. 1.028).

7. The proportions of the different salts are very different from those in present sea water, so that it must be supposed that they are not derived from ocean water or that the ocean itself has changed in composition (which there is good reason to believe) or that these waters have also changed in composition since they were enclosed.

8. I can explain the strength of the strongest of these waters only as that of the residue left after most of the water had been absorbed in hydration of the rock.

9. The third or lowest kind of water not infrequently contains a measurable amount of copper chlorides.

10. Similar chloride solutions may be made artificially to precipitate copper very much as it occurs in the mines upon prehnite and other minerals which tend to keep a solution alkaline, if such a solution containing copper is kept unequally heated.

11. The mode of occurrence of the copper, the chemical character of the alterations of the rock, the character of the copper ore-shoots, and the low temperature-gradient are all consistent with the theory that the migration or circulation of water in the Keweenaw rocks is not mainly a mere up and down or a round and round circulation, but an absorption or imbibition of water by the strata acting like a sponge in which process of absorption of the water the copper is formed and accumulated in a zone of relatively low oxidation in which as it replaces chlorite and prehnite and other minerals which tend to keep the solution alkaline or at least not acid, it tends also to accumulate with other positive ions at the alkaline or negative (cathode) or warmer end of the solution.

12. This production of native copper may be associated with the production of ferric iron built into epidote from ferrous iron.

13. The accumulation of copper is also associated with reactions by which the calcium of the calcium chloride is replaced by sodium derived from the rocks, sodium silicate being largely removed in the process of decomposition, which accounts for the sodium of the middle zone of water.

14. When the accumulation of alkalis becomes sufficiently high, alkaline zeolites, etc., may be formed, but this is toward the end of the deposition of copper and in the upper levels, where it may be redissolved and migrate downward.

15. The ultimate source of the copper would seem to be the formation itself, effusive as well as intrusive beds in the same, together with copper possibly originally dissolved in the water. But there is some indication that the sulphur came from intrusives or fissures.

16. The general average of copper from extensive 'sludge' analyses would seem to indicate that the whole rock formation contains something like 0.02% of copper, and analyses of the stronger mine waters would indicate that copper content of the strong chloride waters may be as high as 8 to 16 mg. per litre.

In accordance with the idea above developed, that the copper forms where its chloride solution is kept alkaline by sodium silicate in other alkali dissolved from the rock, it is not surprising to find the copper present in the hanging and foot-wall of the porous bed proper, and so (if the data of experiment and physical chemistry may be used as a guide) one may expect to find the copper near pervious streaks, but in the part that was hotter,[5] that which was more alkaline and reducing,[6] and that which was electrically positive[7] (cathode).

[4] A paper has recently been published by C. R. Keyes, *Economic Geology* II, p. 774.

[5] Near the less porous rock at bottom and sides in case of down circulation, at the centre of the lode in case of up circulation.

[6] Associated with green colors, chlorite, epidote, prehnite, rather than red laumontite, etc.

[7] Perhaps, therefore, also on the north side.

Power at the Waihi Mine

By M. W. von Bernewitz

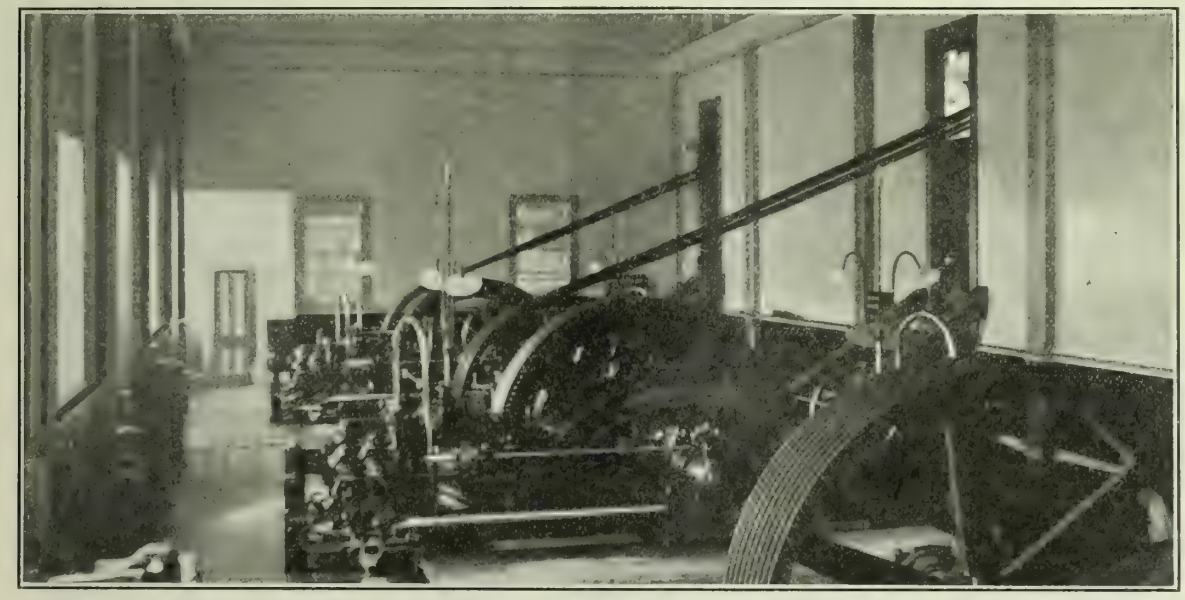
At its Waihi and Waikino mills the Waihi Gold Mining Co., Ltd., uses water, steam, and gas power, electric power not yet having been developed to any extent, though a large hydro-electric plant, costing $750,000, is well on toward completion. At the mine, a large gas plant was erected about two years ago to develop electric power for the mine pumps in No. 4 shaft. The surplus power is transmitted to the Waihi mill, about ½ mile, and a 250-hp. motor drives the tube-mills, and a 100-hp. motor drives the pumps and other machinery at the slime plant. The rainfall totals 85 in. yearly, yet after a week's dry weather the water supply diminishes rapidly. The maximum water power available is 306 hp.; the average developed for the year was 117 hp. Three main Pelton wheels of 150 hp. are in use, and one water-turbine of 100 hp. The 90 stamps crushed 111,133 tons of ore. The main steam-engine at the Waihi mill is used continuously. It was built by Yates & Thom, of England, with cylinders 15 and 30 in. diameter and 42 in. stroke, with a full load of 400 hp. A variety of boilers is used. There is an extra engine each for the tube-mills and slime plant. During 1911 the Victoria mill, of 200 stamps, at Waikino, crushed 238,093 tons of ore. The average brake-horsepower developed by the turbines and Pelton wheels was 558. One of the 200-hp. Vortex turbines was opened and inspected after 12 years' work. An enormous quantity of tailing from the Ohinemuri river had passed through the turbine during this long run, but wear from attrition was negligible. By the steam plants 261 hp. was developed, the main Yates & Thom engine being cross-compound, 19 and 36 in. diam. by 54 in. stroke.

The gas plant at this mill is of great interest, and power cost has been cut to a minimum. New Zealand coal is used in the producers, and Crossley suction gas-engines drive the tube-mills and plant. The engines vary from 200 hp. each to the 260-hp. tandem size. During the year 893 b.hp. was developed.

As before mentioned, the Waihi company is spending $750,000 on a hydro-electric plant at the Hora Hora falls, 51 miles from Waihi. So far, $360,000 has been spent on the headworks and station, roads, bridges, and plant generally. Turbines will drive the generators. It was feared that the floating pumice would wear the rotor vanes of the turbines, but on seeing the condition of the turbines at Waikino after 12 years' work, this may be disregarded. Construction of the power plant is well under way, although weather conditions have hindered work. The water required by the turbines will be 4500 cu. ft. per second. The Waikato river was exceptionally low last year, and at Hora Hora 6317 cu. ft. was gauged in the summer. Steel towers will carry the transmission wires over the hills to the mine and stamp-mills. The voltage to Waikino will be 50,000, and from there to Waihi, 6 miles, stepped down to 5000, the motors taking 550, alternating current as is usual. The Waihi company has permission to sell power to other mines and towns near the transmission line.

The following table, supplied me, shows costs for power at the Victoria mill:

Gas power...	893	hp.;	average	per	b.hp.	for year..$45.20
Steam	261	"	"	"	"	.. 76.82
Water	558	"	"	"	"	.. 4.56
	1712					$35.84



GAS-ENGINES DRIVING TUBE-MILLS AT WAIHI.

The movement of Lake Superior iron ore down the lakes in September amounted to 7,287,230 gross tons, as compared with 7,760,248 tons in August, and 7,600,233 tons in July. The total to October 1 this year was 36,338,382 tons, against 24,837,137 tons to October 1, 1911, an increase of 11,501,245 tons. The table below gives the September and season shipments by ports and the corresponding figures for 1911, all in gross tons:

	Sept. 1912	Sept. 1911.	To Oct. 1, 1912.	To Oct. 1, 1911.
Escanaba	770,974	668,595	4,010,985	3,086,847
Marquette ...	566,178	367,964	2,567,578	1,568,711
Ashland	757,764	368,945	3,623,161	1,878,786
Superior	2,031,086	1,563,836	11,097,276	7,946,109
Duluth	1,652,735	1,131,247	7,729,187	5,501,364
Two Harbors.	1,508,493	1,130,482	7,310,195	4,855,320
Total	7,287,230	5,231,069	36,338,382	24,837,137
1912 inc...		2,056,161		11,501,245

The heavy shipments from Superior show the great activity at the Hill properties which are operated by the United States Steel Corporation. It is evident that unless conditions on the lakes are unexpectedly unfavorable in November, the total brought down this year will be well about the 45,000,000-ton mark.

During September the Tomboy mill was in operation 28 days, crushing 10,000 tons of ore which yielded bullion worth $50,500 and concentrate worth $33,500. Expenses of operation were $44,000, and $11,300 was spent on permanent improvement.

Development of the Reverberatory Copper Smelting Furnace

By E. P. Mathewson

Historical

*The early development of the reverberatory furnace for smelting copper ores was the work of the Welsh smelters, particularly those of Swansea. The first record of a reverberatory furnace is made by Jars, who states that in 1765 copper smelting was effected in reverberatory furnaces at Middleton-Tyas, in Yorkshire, England. The first patent, of any importance, for improvements in reverberatory furnaces was granted to Thomas Williams in 1778 for the granulation of the regulus. The next was that of William Evetts, in Sheffield, in 1812, for cooling of the fire-bridge by the admission of air. Charge hoppers above the furnaces were in common use in 1848. The size of the hearth of the furnaces, about the beginning of the nineteenth century, was commonly 11 by 8 feet.

No material development was made until the Welsh process was brought to Colorado, where Richard Pearce, as manager of the Argo works near Denver, developed the furnace to meet the requirements of a custom plant, under keen competition with lead-silver smelting plants using blast-furnaces. His improvements are outlined in Fig. 1, elaborated by permission, from E. D. Peters' 'Modern Copper Smelting,' to which the reader is referred for further details. This figure shows that the furnaces were, in 1878, 9 ft. 8 in. by 15 ft. in hearth; and in 1894 16 by 35 ft., while the capacity of the furnace had been increased from 12 tons per 24 hours to 50 tons. The next step in development was made in Butte, Montana, by the Colorado Smelting Co., this plant being at that time affiliated with the Argo works, so that Mr. Pearce's influence was apparent. This was the lengthening of the hearth to 50 ft., with consequent increase in capacity to 105 tons in 24 hours. The first furnace of this size, built from the Colorado Smelting Co.'s plans, was constructed at the Butte & Boston plant in Butte, Montana, in the year 1900. Details of Montana practice, up to the year 1902, will be found in a paper by H. O. Hofman entitled 'Notes on the Metallurgy of Copper of Montana,' *Trans.* A. I. M. E., Vol. XXXIV, pp. 258-316. The 50-ft. furnace became very popular in Butte and Anaconda, and when the Washoe smelter was built, in 1900-1902, the 50-

*A paper presented at the Eighth International Congress of Applied Chemistry, and reprinted by permission of the author.

Details of Modern Reverberatory Furnace Smelting in America

	Anaconda (Montana)	Cananea (Mexico)	Great Falls (Montana)	Garfield (Utah)	Steptoe (McGill) (Nevada) (Coal) Fired	Steptoe (McGill) (Nevada) (Oil) Fired	Tooele (Utah)
Number of Furnaces	8	2	3	6	5		5
Average tonnage per day	253— (229.5 T. M.) 15 tons (13.6 T. M.)	192.3 (174.4 T. M.) 7½ to 9 tons (6.8–8.2 T. M.)	200— (181.4 T. M.) 35 tons (31.75 T. M.)	240— (217.7 T. M.) 6 to 24 tons (5.44–21.77 T. M.)	239— (216.8 T. M.) 14 tons (var.) (12.7 T. M.)	332— (292.1 T. M.) 14 tons (var.) (12.7 T. M.)	225— (204.1 T. M.) 13 tons (11.8 T. M.)
Average weight of Charge							
Average tons charge per ton Fuel	4.25	5.86	2.00	3.50 to 4.00	3.24	5.80	3.80
Average temperature of charge entering furnace	950°F (Est) (510°C)	500° to 550°F (260°–288°C)	788°F (420°C)	400° to 700°F (204°–371°C)	500°F approx. (260°C)	500°F (260°C)	750°F (399°C)
Kind of Fuel used	Run of Mine Coal	California Crude Oil	Producer Gas	Bituminous Coal		California Crude Oil	Run of Mine Coal
Character of Charge:							
Calcine (Hot)	84.95%	50.0%	66.00%	75% to 78%	61.3%	56.8%	95.00%
Calcine (Cold)	.....	.....	.....	19% to 16%	.....	.....	.....
Flue Dust	15.05	50.00	34.00	6.00	1.2	1.4	5.00
Conv. Slag	.	.....	.....	.....	9.8	7.1	.....
Secondaries (Cold)		.....	.....	.....	12.5	15.2	.....
Flux and Fettling Ores (Cold and Wet)		.....	.....	.....	15.2	19.5	.....
Dimensions of Hearth	111'-8"x19'-0" (34.04 x 5.79m)	100' x 19' (30.48 x 5.79m)	41'-6" x 15'-9" (12.65 x 4.80 m) Gas Fired	112' x 19' (34.14 x 5.79m) 7' x 18' (2.13 x 5.49m)	120'-10" x 19' (36.83 x 5.79 m)		102' x 19' (31.09 x 5.79 m)
Dimensions of Fire Box	7' x 16' (2.13 x 4.88m)	None	" "	None			7' x 16' (2.13 x 4.88 m)
Top of Grate Bars to top of Bridge	24" (61 cm)	None	" "	33" (84 cm)	33-1-4" (84 cm)		40" (102 cm)
Top of Grate Bars to under side of Roof	70" (178 cm)	None	" "	45" to 48" (114–122 cm)	85-3-8" (217 cm)		78" (198 cm)
Height of "Verb" or Vulcatory above Skim Plate	36" (91 cm)	36-1-2" (93 cm)	" "	36" to 38" (91–97 cm)	36" (91 cm)		36" (91 cm)
Dimensions at Throat of Furnace	7' x 4'-11" (2.13 x 1.50m)	7' x 1'-9" (2.13 x .53 m)	" "	7' x 3'-3" (2.13 x .99 m)	6'-10" x 3' (2.08 x .91 m)		7' x 4'-1" (2.13 x 1.24m)
Dimensions of flue beyond Throat (damper flue)	36" by 54" (91 x 137 cm) (natural draft)	7' x 6' (213 x 183 cm)		39" x 64" (99 x 163 cm)	(Not Given)		36" x 60" (91 x 152 cm)
Draft in inches of water at Bridge	.75"–1" (1.9–2.54 cm)	(No Data)	.2" (.5 cm)	.6" (1.5 cm)	.2"–.5" (.5 cm–1.3 cm)		.8" (2 cm)
Draft in inches of water at Throat	1.3"–1.7" (3.8–4.8 cm)	.13" (.33 cm)	.3" (.76 cm)	.8" (2. cm)	.7"–1.2" (1.78–3.05 cm)	.9" (2.29 cm)	.6" (1.52 cm)
Draft in inches of water—Main Flue beyond Boilers	1.5"–2" (3.81–5.08 cm)	.9" (2.29 cm)	1.5" (3.81 cm)	1.65" (4.19 cm)	1.25" (3.18 cm)		1.75" (4.45 cm)
Dimensions of Main Flue	15' x 20' (4.57 x 6.10 m)	115 sq. ft. 10' x 12' (3.04x3.66m)	20' x 48' (6.1 x 14.63 m)	19'-8"x22'-6" (5.99x6.86m)	29'-3" x 8'-6" (8.91 x 2.59 m)		18' x 20' (5.49 x 6.1 m)
Dimensions of Chimney	300' x 30' (91.44 x 9.14 m)	187' x 12'-6" (57. x 3.81 m)	506' x 50' (154.22 x 15.23 m)	300' x 30' (91.44 x 9.14 m)	300' x 15' (91.44 x 4.57 m)		350' x 25' (106.68 x 7.62 m)
Height of top of Stack above Grate	740' (225.54 m)	198' (60.35 m)	768' (234.07 m)	504' (153.61 m)	316'-9-1-2" (96.55 m)		412' (125.57 m)
Temperature of Gas at Bridge	2800°F (1538°C)	2700°–2800°F (1482°–1538°C)	2650°F (1455°C)	2600°–2800°F (1427–1538°C)	2700°–3000°F (Est) (1482°–1649°C)		2600°F (1427°C)
Temperature of Gas at Throat	2200°F (1205°C)	2300°–2400°F (1260°–1316°C)	2550°F (1397°C)	2000°F (1094°C)	2200°F (approx) (1205°C)		2000°F (1093°C)
Temperature of Gas at Far Side of Boilers	680°F (360°C)	500°F (260°C)	(No Boilers)	900°F (482°C)	800°F (approx) (427°C)		775°F (412°C)
Average Boiler H. P. per Furnace from waste heat	560 H. P. (568 C. V.)	971 H. P.* (984 C. V.)	None	330 H. P. (335 C. V.)	486 H. P. (493 C. V.)	632 H. P. (641 C. V.)	390 H. P. (396 C. V.)
Per cent Fuel recovered as steam	32.81	56.62	None	27.00	32.3	33.8	41.2
Per cent Fuel recovered from ashes	7.50	None	5.00	9.50	5.05		None
Ratio of Concentration	4.79	4.96	4.30	3.50	3.31	3.40	9.00
Tons charge per million B. T. U.	0.182	0.1574	0.115	0.147–0.167	0.122	0.171	0.165

* Economizers are installed at this plant beyond boilers.

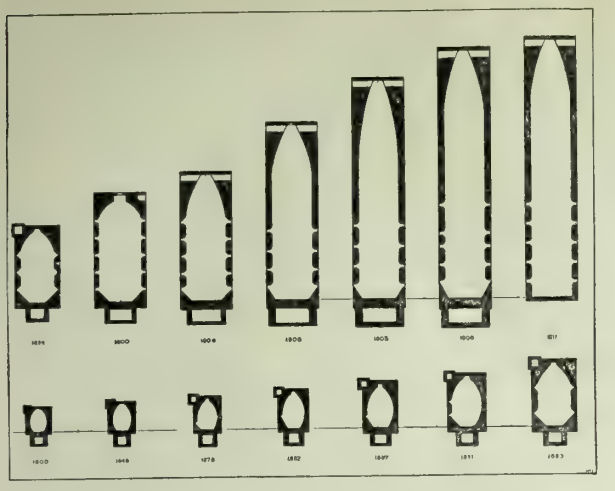


FIG. 1. STAGES IN DEVELOPMENT OF REVERBERATORIES.

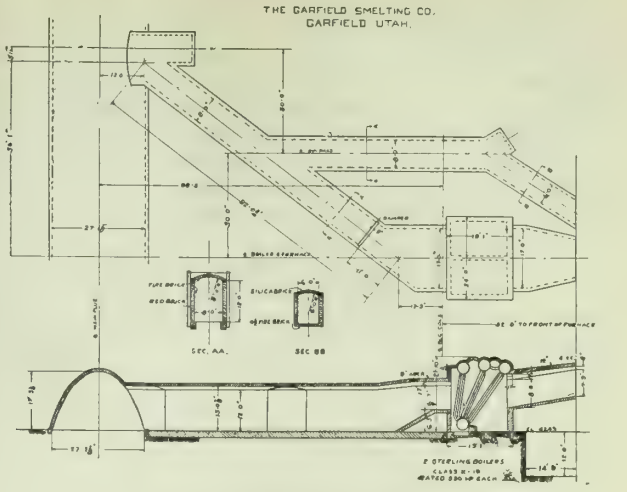


FIG. 2. ARRANGEMENT OF BOILERS AND FLUES AT GARFIELD.

ANALYSES OF MATERIALS USED AND PRODUCED

		Copper percent.	Silver Ozs. (Per Ton)	Gold Ozs. (Per Ton)	% SiO_2	% Fe & Mn.	% CaO	% S.	% Al_2O_3
Charge	Anaconda	9.31	6.43	0.028	28.63	26.46	3.50	7.34	5.22
	Cananea	6.43	2.22	0.14	26.96	31.34	2.58	9.59	5.54
	Great Falls	9.47	3.77	0.0236	22.50	26.91	4.20	11.40	6.40
	Garfield	12.00	3.50	0.16	30.00	22.50	11.50	10.50	4.50
	Steptoe (McGill) (Coal) fired	13.60	0.401	0.078	26.80	25.90	5.80	9.50	5.30
	Steptoe (McGill) (Oil) fired	13.10	0.345	0.078	27.60	24.10	5.40	9.30	6.90
	Tooele	2.90	3.80	0.11	30.50	35.00	3.80	6.50	
Slag	Anaconda	0.39	0.19	0.0006	39.68	32.83	4.62	0.91	7.03
	Cananea	0.35	0.11	.	37.44	33.58	3.83	1.08	7.96
	Great Falls	0.35	0.12	trace	42.50	23.64	11.60	0.48	9.40
	Garfield	0.45*	0.08	trace	46.50	20.58	17.50	1.00 app'x	5.50
	Steptoe (McGill) (Coal) fired	0.45*	0.06	0.005	40.20	28.90	10.50	0.40	7.60
	Steptoe (McGill) (Oil) fired	0.50*	0.02	0.007	42.00	25.90	10.90	0.20	8.00
	Tooele	0.43*	0.45	0.008	40.50	36.93	4.00		
Matte	Anaconda	41.68	28.40	0.130 (Insl)	0.27	26.54		25.76	
	Cananea	31.91	11.34	0.07	0.54	37.17		26.87	
	Great Falls	31.96	12.00	0.085	No data	35.54		26.70	
	Garfield	42.00	10.00	0.50		27 00		26.00	
Matte	Steptoe (McGill) (Coal) fired	41.76	1 25	0.25	0.70	29.00		25.10	
	Steptoe (McGill) (Oil) fired	42.99	.91	0.22	0.50	29.10		24.80	
	Tooele	23.00	27.50	0.85	0 50	43.00		26.50	

		% Moisture	% V. C. M.	% Fixed Carbon	% Ash	B. T. U. (dry)	B. T. U. (wet)
Fuel	Anaconda	6 13	36.28	45.42	12.17	12,390—	11,710—
	Cananea					No data	18,600—
	Great Falls	7.70	23.70	46.00	28.60	No data	9,382—
	Garfield	8.00	39.40	46.40	6.20	No data	12,000—
	Steptoe (McGill) (Coal) fired	2.00	39.10	51.50	7.40	13,000—	
	Steptoe (McGill) (Oil) fired					18,220—	
	Tooele	6.00	38.00	45.00	11.00		11,500—

	% CO_2	% CO	% CH_4	% H	% N
Gas—Great Falls	10.50	15.80	2.20	13.70	57.80

* Converter slag is poured into Reverberatories at these plants, thus raising copper assay, as only 75% of copper in Converter slag is recovered.

ft. reverberatory was adopted and 14 of these furnaces constructed.

The next improvement was the addition of limestone to the charge of the calciners so that it was thoroughly mixed into the charge before dropping the charge into the reverberatories. This apparently insignificant change resulted in greatly increasing the capacity of the furnace. The next step was the building of a furnace with a 60-ft. hearth, the results from which were so encouraging that a furnace with a hearth 85 ft. long was tried, with corresponding increase in tonnage. Then a radical step was taken at the Washoe plant, of connecting two 50-ft. furnaces, making a single furnace with a hearth 102 ft. long. The saving in fuel and the increased tonnage caused the management to build a furnace with a hearth 116 ft. long. The results of these experiments are given in the following tabulation, compiled by William Wraith, superintendent of the Washoe smelter.

EFFECT OF LENGTHENING REVERBERATORY FURNACES AT THE WASHOE SMELTER

The reverberatory furnaces as originally built at the Washoe smelter had a hearth area of 19 by 50 ft. After some months of operation it was decided that a longer furnace could be operated to better advantage. To determine the length best suited to the conditions, one furnace was lengthened to 60 ft., another to 85 ft., another to 102 ft., another to 112 ft., and finally to 116 ft. in length. The draft at the bridge wall was from ¾ to 1 in. of water; the fire-box area 7 by 16 ft. The coal used was from the Anaconda Copper Mining Co.'s mines at Diamondville, Wyoming, having the following average proximate analysis and thermal value:

Analysis: H_2O, 6.13%; volatile matter, 36.28; fixed carbon, 45.42; and ash, 12.17%.

Thermal value: Wet coal, 11,710 b.t.u.; dry coal, 12,390 b.t.u.

There was some variation in the quality of the coal, the ash ranging from 6 to 16% and the thermal value from 10,750 to 12,000 b.t.u. per pound of wet coal, or from 11,000 to 13,200 b.t.u. per pound of dry coal. There is also some variation in material smelted and in manipulation by the different furnace crews.

Reverberatory furnaces in different localities present their own conditions, and the lengths of furnaces will be found to be functions of the type of fuel, draft, tonnage to be smelted, and investment.

Hearth areas of furnaces, ft.	Tonnage per 24 hours	Ratios of components material to coal	Averages
19 by 50	121.74	2.75	For 1 year
19 by 60	190.7	3.94	For 7 months
19 by 85	234.1	4.13	For 7 months
19 by 102	264.9	4.31	For 4 years
19 by 112	267.1	4.30	For 4 years
19 by 116	270.1	4.19	For 4 years

The percentage of copper in the slags from the different furnaces averaged as follows:

Furnace.	Hearth length, ft.	Period.	Copper, %.
No. 1	50	Sept. 1903-Mar. 1904	0.50
No. 6	60	Mar.-Sept. 1904	0.44
No. 1	85	May-Dec. 1904	0.42
No. 1	102	Jan. 1906-May 1911	0.39
No. 4	112	July 1906-May 1911	0.38
No. 1	116	Jan. 1906-May 1911	0.36

About this time the Garfield plant of the American Smelters Securities Co. was being built near Salt Lake City, Utah, and for that plant furnaces with 100-ft. hearths were adopted. Then the plant at Humboldt, Arizona, of the Consolidated Arizona Smelting Co., built two furnaces with 100-ft. hearths, using oil for fuel. The Steptoe plant at McGill, Nevada, followed with five furnaces with hearths 110 ft. long, coal-fired, changed to oil-firing in 1911. The Cananea Copper Co. put in one furnace with hearth 100 ft. long, for flue-dust, in 1906, followed by a second in 1911. Experiments were tried with coal-dust firing, but cheap oil being available, the coal-dust experiments were discontinued and oil substituted. The reader is referred to L. D. Ricketts' article on experiments in

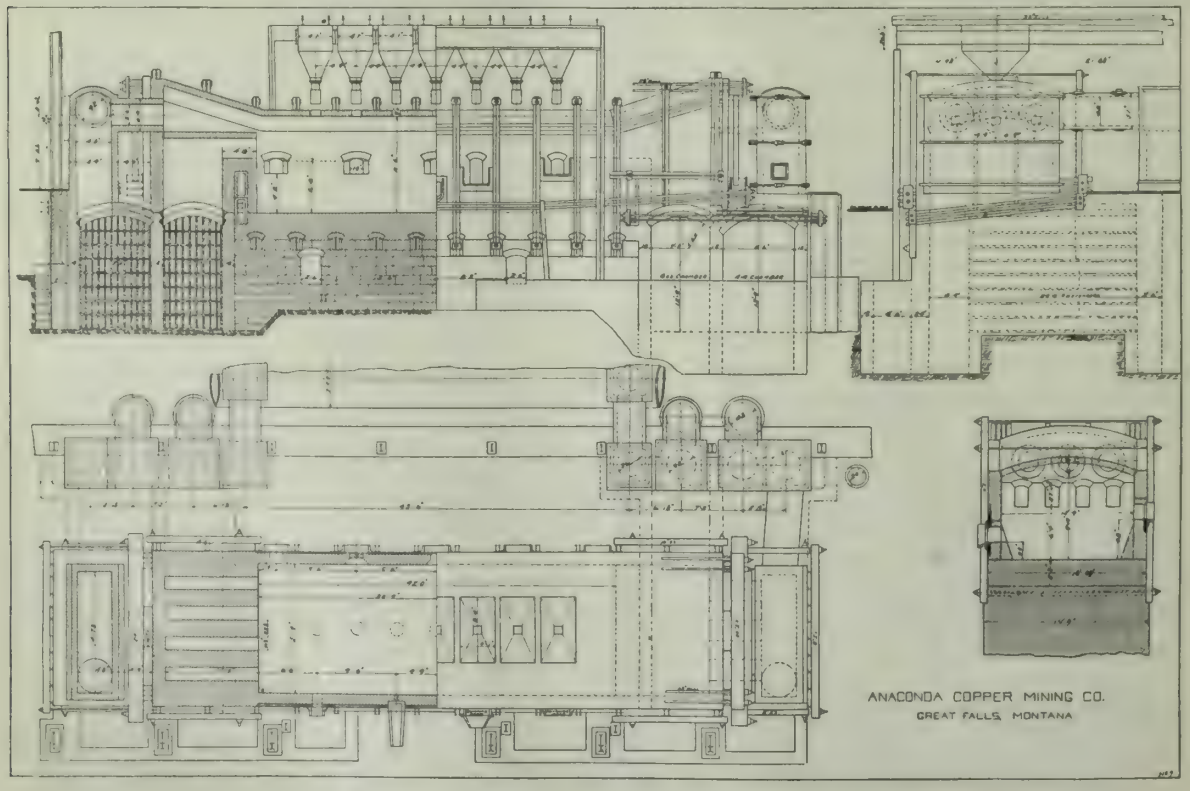


FIG. 3. ANACONDA PLANT; PLAN, ELEVATION, AND BOILERS.

reverberatory practice at Cananea (*Trans.* Institute of Mining and Metallurgy, Vol. XIX, p. 147).

The accompanying table gives important data on the best modern installations of reverberatory furnaces, and the table of analyses gives the details of the chemical composition of the charge, the slag, the matte, and the fuel. The features that distinguish the modern reverberatory are its length, solid bottom (monolith of fused quartz), structural steel plate forming the bridge-wall, frequent charging, infrequent skimming of slag, the large body of molten matte retained in the furnace to assist in melting and distributing the charge, no leveling of charge by means of rabble; thick roof (15 to 20 in. of silica brick); fettling only once a month in many plants, practically continuous operation; recovery of waste heat in the form of steam; and, where coal is used for fuel, the recovery of the unburned coal from the ashes.

During the development of the reverberatory furnace to its present state of efficiency, a great many schemes were tried and abandoned; for example, the pre-heating of the air by passing it under the furnace bottom or around the walls of the flue or fire-box, and forced blast under the grate.

A great variety of fuel has been and is being used in reverberatory practice; for example, at Kyshtim, Perm Government, Russia, producer gas from wood is in use, with gratifying results. At this plant the hearth of the furnace is about 35 ft. between ports and 15 ft. wide; the gas is made from pine wood and the moisture and tar scrubbed from the gas before going to the furnace. The following date, furnished by A. H. Allen, regarding the furnaces will be of interest:

Surface of air checker, 869 sq. m.; useful area, 688 sq. m.

Sectional area of air checker, 49 sq. m.

Surface of gas checker, 698 sq. m.; useful area, 559 sq. m.

Sectional area of gas checker, 46 sq. m.

Average gas analysis, per cent: CO_2, 7.47; CO, 26.22; H, 8.3; CH_4, 5.86; C_2H_4, 0.79.

Analysis of products of combustion in stack, per cent: CO_2, 12.2; O, 6.3; N, 71.5.

Pressure at reversing valve, 3 mm. water. Suction at stack, 25 mm.

Temperature of gas entering regenerator, 68°C.; temperature entering stack, 385°C.

Average temperature of furnace, 1600°C. Maximum temperature at ports, 2000°C. Temperature entering checker, 1300°C.

The charge was mainly flue-dust, but there was some green ore; some silicious oxidized copper ore; some converter cleanings, etc., mixed with it. I cannot give the composition of the charge, but 90% of it was flue-dust and green fine. From January to September 1910 the furnace was in operation 166 days, with results as follows:

Amount smelted, tons	10,690
Wood consumed in producers, cords	3,417
Matte produced, tons	3,326
Contents of matte, tons of copper	283
Assay, % Cu	8.5
Contents charge, copper, tons	330.8
Average assay charge, % Cu	3.1

The work is chiefly interesting for the extremely low fuel cost, which has been verified by an experienced engineer now on the ground. Wood at Kyshtim cost $1.05 per cord delivered, so that the average fuel cost, over the 9-months period, was 33.6c. per short ton of charge. It results from the fact that the Russians in charge of the furnaces have had experience with gas-producers in iron works and made a gas of high calorific power.

Kyshtim Flue-Dust and Ore Analyses

Sample taken from one month's production of flue-dust:

	Per cent.		Per cent.
SiO_2	8.8	Cu	3.3
Fe	50.9	S	9.6

Sample from 6000-ton pile of flue-dust:

	Per cent.		Per cent.
SiO_2	8.9	Cu	3.3
Fe	48.9	S	10.0

	Cu, %.
Sample one week's production	3.38
Sample of large pile (weight not given)	3.2
Sample of large pile, made in 1907	1.8

Average sample of raw ore used with flue-dust:

	Per cent.		Per cent.
SiO_2	2.1	S	47.0
Fe	38.5	Cu	3.2
CaO	0.5		

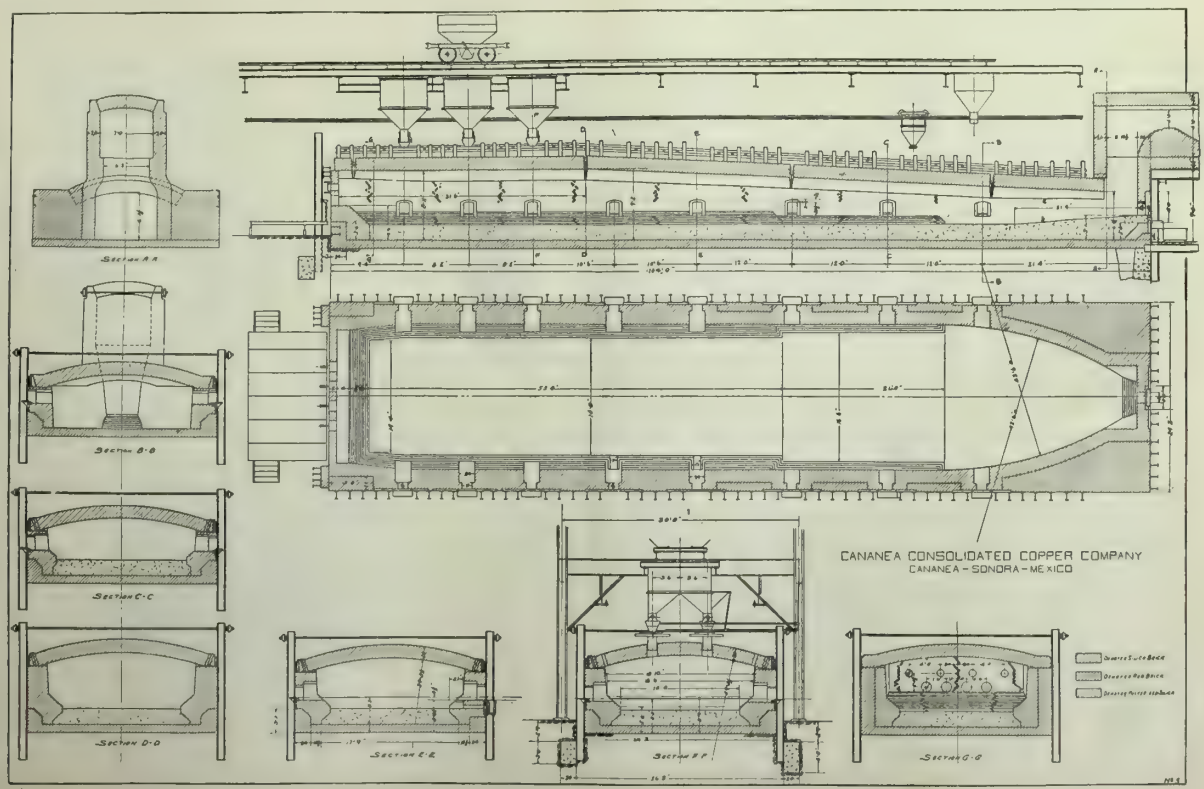


Fig. 4. Cananea Oil-Fired Furnace, Plan and Section.

At Cananea, Texas oil has been used; and at Humboldt, fuel oil from California. At the plant of the Steptoe company, at McGill, Nevada, fuel oil from California was introduced during 1911, with gratifying results. A great many different varieties of burners were tried, but a simple home-made burner, using air for atomizing the oil, has given the best results. A record performance at the Steptoe plant, McGill, Nevada, on December 17, 1911, is communicated by S. S. Sorensen, the superintendent, No. 1 furnace smelting 660 tons of total charge on an oil consumption of 5/8 bbl. of oil per ton of charge.

RECORD OF RUN OF NO. 1 REVERBERATORY FURNACE AND ANALYSIS OF CHARGE.

Total charge per furnace day, tons	666
Oil fired per furnace day, bbl.	421
Coal equivalent of oil fired, tons	124.00
Total charge per bbl. of oil, tons	1.58
Oil, bbl. per ton of total charge	0.63
Equivalent gross coal as percentage of total charge.	18.60

Components of Charge as Percentage of Total Charge.

Calcine	60.1
Seconds	16.8
Converter hot slag	9.0
Fettling	3.9
Limestone	9.6
Flue-dust	0.6

SLAG (Assay and Analysis)

Cu	0.40
SiO_2	44.00
Fe	34.30
CaO	8.60
Al_2O_3	7.40
Oxygen ratio	2.72
Grade of matte, % Cu	40.40

Draft:	Water, in.
Bridge	0.35
Throat	0.83
Stack	1.25
Temperature of verb, degrees F	1910
Infusibility factor of calcine	1.5
Burners, large Steptoe, high-pressure	7

At the Washoe plant, at Anaconda, coal is used for fuel, and a record run for one furnace was the smelting of 402½ tons of charge in 24 hours with a fuel ratio of 1 ton of fuel to 6.45 tons of charge. At Great Falls, Montana, the fuel is producer gas, but the producers are too far away from the furnaces to get the best results; new furnaces are to be built at this plant in which the producers will be placed in close proximity to the furnaces and a much greater efficiency will be obtained.

The Canadian Copper Co. is experimenting with pulverized coal as fuel, but the furnaces have not been in operation long enough to give data of any great value. David H. Browne, the superintendent, writes that he is greatly pleased with the performance of the furnaces up to date. The objections to the use of pulverized coal in reverberatory practice have been the settling on the top of the charge of ash and unburned fuel and the clogging of the flues with ashes. The Canadian Copper Co. has a peculiar condition, in that the charge is basic, and that the addition of silica, in the form of coal-ash, is rather welcome than otherwise. To avoid the other objection the coal is pulverized extremely fine, and the surplus ash goes out with the gaseous products of combustion.

At nearly all modern plants, waste-heat boilers are employed. Silica brick is used almost exclusively in the construction of the lining and roof of the modern reverberatory furnaces for copper smelting, and it is now possible to obtain silica brick, of excellent quality, all over the United States at reasonable cost.

DURING the quarter ended June 30, 1912, the output of ore and metals from mines in Tasmania was as follows:

	Quantity.	Value.
Gold recovered, ounces	13,748.76	$291,000
Silver-lead ore produced, tons	22,316	425,000
Blister copper produced, tons	1,330	566,500
Copper ore and copper, tons	270	9,300
Tin ore produced, tons	953	650,000
Coal raised, tons	14,686	33,000
Wolfram ore produced, tons	15	7,800
Bismuth, tons	1.75	3,400
Osmiridium, ounces	140.53	5,500
Total value		$1,991,500

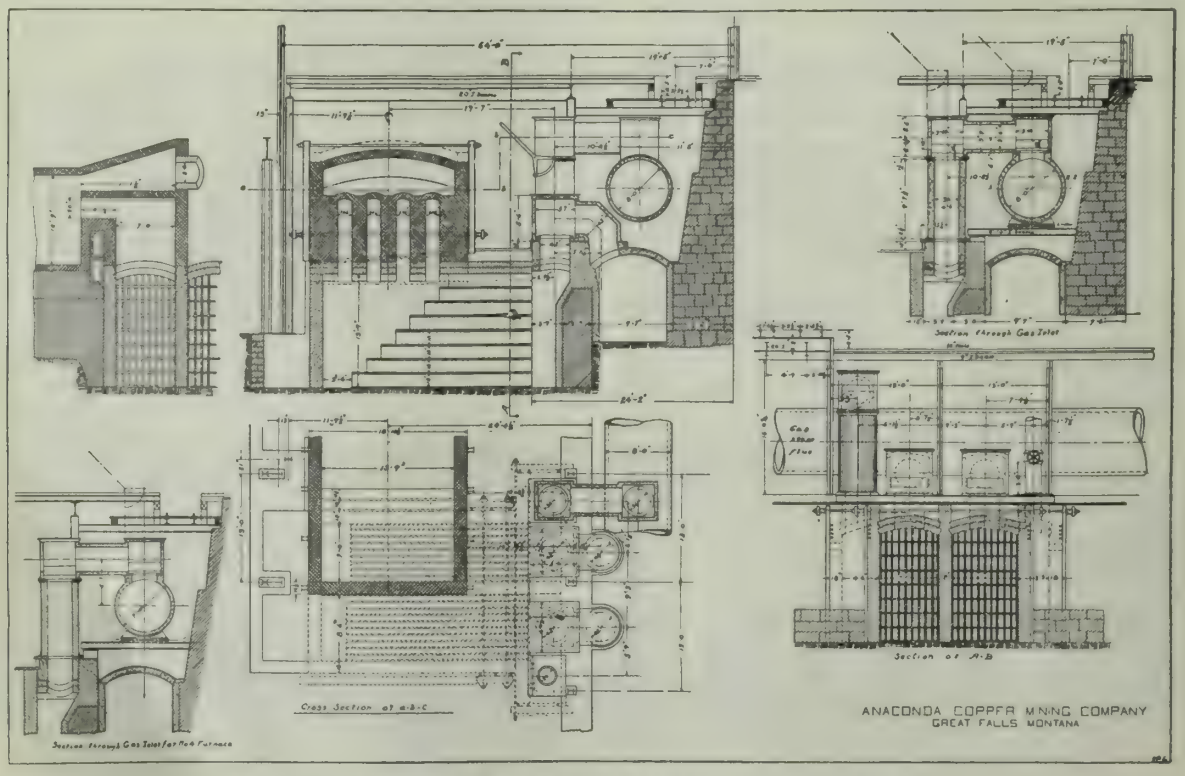


FIG. 5. GREAT FALLS, CHECKER WORK AND SECTION THROUGH FLUE.

Separation of Base Metals in Cyanide Solution for Quantitative Determination

By P. L. Guppy and Douglas Waterman

In the treatment of silver sulphide ores by the cyanide process, free alkaline sulphides are carried into solution. Lead acetate is often used as a precipitant for these free sulphides. Any excess of lead acetate over the amount required to accomplish this purpose is undesirable, as it is carried to the zinc-boxes in the form of sodium plumbate and there deposited with the silver. This entails a needless waste, not only of the acetate, but of the zinc as well, which is consumed in the process of replacement. An excess of lead acetate led to the production of a base bullion. It is highly desirable, therefore, to know if lead is present in excess. The amount of zinc and copper in solution is also of importance at times. By the following scheme of analysis these and other base metals may be recognized and separated for quantitative determination by any of the well known methods.

Partly fill an Erlenmeyer flask with 500 c.c. of the cyanide solution to be analyzed. Place a small glass funnel, with stem broken off, in the neck of the flask, which will effectually prevent the formation of excessive quantities of steam, thus avoiding all danger of the solution boiling over.

I. Add 15 c.c. concentrated HCl, salts of copper, a portion of the silver, and ferrocyanides of the heavier metals will be precipitated. Evaporate to a volume of 100 c.c. and allow the solution to cool. Add 300 c.c. of bromine water and boil until all the bromine is expelled. This should bring the ferro-cyanides of zinc, by oxidation, into soluble form.

Dilute to 400 c.c. with boiling water, and pass a rapid current of hydrogen sulphide through the solution until precipitation is complete. On withdrawing the current of H_2S the precipitate should settle rapidly, leaving the solution clear, showing that precipitation is complete. Filter through an 11-cm. paper and wash the precipitate with H_2S water. The result then is:

(a) Precipitate containing silver, gold, copper, and lead; antimony and arsenic if present.

(b) Filtrate containing zinc, manganese, and other metals not precipitated by H_2S.

II. If it is desired to test for antimony and arsenic, the funnel is inverted over an 8-oz. beaker, into which the precipitate is washed with a fine jet from a wash-bottle; 15 or 20 c.c. of sodium sulphide is added, and the contents of the beaker digested for 10 or 15 min. to bring the antimony and arsenic into solution.

Filter through the same filter-paper into a clean beaker, wash with dilute sodium sulphide, and finally with a little warm water. On acidifying the filtrate with HCl the presence of antimony or arsenic may be readily detected; antimony giving an orange-colored precipitate, and arsenic a yellow.

These substances may be determined quantitatively by any of the usual means, but an excellent method for determining small quantities of antimony and arsenic, with full explanations of necessary precautions, will be found in the first edition of Fresenius' 'Quantitative Analysis.'

III. Wash the bulk of the precipitate (a) into a casserole with hot water. Remove the filter-paper and spread over the convex surface of a watch-glass. The adhering precipitate is dissolved with hot dilute nitric acid and added to the contents of the casserole. (Care should be taken that none of the filter-paper is allowed to fall into the casserole.) Cover the casserole and heat until precipitate is dissolved. Add 20 c.c. concentrated H_2SO_4 and evaporate on hot plate until copious white fumes are given off. When cool, rinse the contents of the casserole with a little cold water into a clean beaker. The presence of lead may be readily detected by the white granular appearance of the precipitate in the bottom of the beaker, and is easily distinguished from either the chloride or the sulphate of silver, which may also have been precipitated.

IV. Filter and wash with sulphuric acid diluted 4 to 1.

(c) Precipitate containing lead (if present) and a small quantity of silver.

(d) Filtrate containing copper and nearly all of the silver.

To the filtrate (d) add just enough sodium chloride solution to precipitate the silver, which is then removed by filtration. The copper in solution is precipitated on aluminum foil. For quantitative determination of both the lead and copper, reference should be made to Low's 'Technical Methods of Ore Analysis,' fifth edition, pp. 144 and 84.

V. To the filtrate (b) containing zinc and manganese add 20 c.c. more HCl and boil to expel the hydrogen sulphide. Add a few drops of nitric acid and heat for five minutes. Add 5 gm. ammonium chloride, and then ammonia until the solution is alkaline.

(e) Precipitate containing iron and aluminum.

(f) Filtrate containing zinc and manganese.

The iron in precipitate (e) may be determined quantitatively and expressed in terms of ferro-cyanide if desired.

VI. To the filtrate (f) add a slight excess of ammonium sulphide to precipitate the zinc and manganese. Nickel and cobalt would also be precipitated at this point, but as they are of rare occurrence their treatment will not be considered.

Dissolve the precipitate in hot dilute HCl and boil until the H_2S is completely expelled. Cool and add ammonia in slight excess. Add bromine water until the solution is well colored by this reagent, and boil. Manganese will be precipitated and may be determined by the method given in the first edition of Fresenius' 'Quantitative Analysis.'

The zinc will remain in the filtrate. Acidify with HCl, add 3 c.c. in excess, and evaporate down to 250 c.c. It may then be determined as outlined in Low's 'Technical Methods of Ore Analysis.'

Platinum Deposits in Mongolia

St. Petersburg Correspondence

The condition of the platinum market is firm but inactive and there is practically no change in price to be reported, nor has there been for a considerable time. The same influences are active in maintaining the market at its present level, notwithstanding the remarkable absence of demand from western Europe, and speculators are quite willing to add to their holdings. It is stated that rich deposits of platinum have been found near the town of Alkobek in Chinese Mongolia. A. L. Shmykoff, who has had experience in the gold industries of central Siberia, has started to take the necessary exploration for detailed investigation of this deposit.

It should be stated here that in 1904, E. N. Korotkoff, while exploring in central Siberia, obtained from the Sapota, a race of Mongolians, a nugget of platinum weighing over 2½ zolotniks. Such nuggets of platinum, as in the Urals forty to fifty years ago, are used by the Sapota as shot when they hunt game and wild animals. The nugget acquired by Mr. Korotkoff was sent to Ekaterinburg, but the Urals platinum authorities did not regard it as significant, presuming that it had been found in the Urals. Now, in view of the recent discoveries in Mongolia, this occurrence is remembered, and it is believed that platinum will be found in the mountain lands of Sayansky.

Copper has been discovered in the island of Burray, Orkney, the property of Lord Zetland. Samples which have been tested have given generally satisfactory results. Steps are now being taken to ascertain whether copper exists in workable amounts.

Mexican and California Petroleum

The two oil-producing companies, California Petroleum Co. and Mexican Petroleum Co., whose securities were listed on the New York Stock Exchange this fall, have a total authorized capitalization of $85,000,000, of which $73,500,000 has been issued. The *Boston News Bureau* gives the details of their financial structure. The following table shows the manner in which this stock is divided:

	Cal. Petrol. Co.	Mex. Petrol. Co.
Preferred:		
Authorized	$17,500,000	$12,000,000
Issued	12,000,000	12,000,000
Common:		
Authorized	17,500,000	38,000,000
Issued	13,500,000	*36,000,000
Total issued	$25,500,000	$48,000,000

*Including $4,000,000 set aside for bond conversion.

Outstanding bonded indebtedness of the two companies and their subsidiaries is as follows:

Six per cent bonds	$3,604,200	†$2,913,200

†Including $1,300,000 Mexican Petroleum Co., Ltd., first lien and refunding sinking fund bonds.

Both corporations are holding companies, Mexican Petroleum Co., Ltd., owning 95% of the capital stock of Mexican Petroleum Co. of California, and the entire capital stock, excepting directors' shares, of the Huasteca Petroleum Co., the Tamiahua Petroleum Co., and the Tuxpam Petroleum Co. The operating companies own or control about 600,000 acres, or nearly 1000 square miles, 75% being held in fee and the remainder under long-time leases. The value of these properties has been placed at $73,000,000 by I. C. White, state geologist of West Virginia. Development is as follows: 26 completed oil wells with a capacity of 60,000 to 70,000 bbl. per day, 15 km. of railroad line, 212 km. of 8-in. pipe-line with a capacity of 80,000 bbl. of oil per day, about 1000 acres of terminal property at Tampico harbor, steel tanks and storage reservoirs with a capacity of 5,750,000 bbl. and an additional storage capacity of 2,016,000 bbl. ordered or completed, power-plants and refineries, and four tank buildings with a capacity of about 220,000 bbl. of oil. Earnings have been as follows, before interest and depreciation, but after deducting proportion of earnings applicable to stock not owned by the holding company:

1911	$2,648,544
1910	1,667,487
1909	794,591
1908	853,748
1907	757,384

The Mexican Petroleum Co., Ltd., is now earning at the rate of about 9% per year on the common stock, and indications for much larger earnings next year are excellent. The common will probably be placed upon a 6% basis in the first quarter of 1912. The California Petroleum Co. owns stocks of the following companies as indicated below:

	Authorized.	Issued.	Owned by Cal. Pet. Corp.
Am. Pet. Co., common	$12,500,000	$12,468,000	*9,974,720
Am. Pet. 6% preferred	2,500,900	2,095,000	*1,676,720
Am. Oil Co.	25,000,000	18,303,800	*14,643,040
Am. Oil Co. 6% bonds, due 1930	10,000,000	2,646,100	.....
Am. Pet. 6% bonds, due 1910	2,000,000	956,100	.....

*These securities and $3,400,158 cash were acquired in exchange for $11,992,024 preferred stock and $13,513,081 common stock of the California Petroleum Corporation, the latter now being represented by voting trust certificates.

As indicated above, the California Petroleum Corporation for its present outstanding stock, acquired 80% of the stocks of the American Petroleum Co. and the American Oilfields Co. and will acquire $1,000,000 of the $2,646,100 outstanding 6% bonds of the American Oilfields Co. The companies in which the holding company has an 80% interest have land holdings of about 18,000 acres, of which over 3000 acres are proved lands. There are prospects for proving up a substantial portion of the remaining 15,000 acres. These companies have 103 producing oil wells with an average production of 15,400 bbl. per day. Ralph Arnold, consulting geologist, places a valuation on the properties in excess of $32,000,000 and estimates they contain 295,000,000 bbl. of oil. Earnings for the year ended December 31, 1911, after interest and provision for bond sinking funds, were $1,943,000, and for seven months ended with July 1912, $1,236,000.

The Wallaroo and Moonta

MELBOURNE CORRESPONDENCE

In all the vast area of South Australia there is but one mining property of any importance. This consists of two mines, the Wallaroo and the Moonta, belonging to a single company, the Wallaroo & Moonta Mining & Smelting Co., Ltd., with an issued capital of $1,000,000 in 160,000 fully paid shares, and additional 40,000 shares of $10 being unissued. The amalgamation of the two mines was effected in 1890, but operations date back to 1860; and since then copper to the value of about $75,000,000 has been produced, and dividends paid amounting to more than $10,000,000. For a long time past, however, the state of the ore reserve has been anything but satisfactory, but nothing was declared officially until a statement was issued prior to the half-yearly meeting of shareholders to be held on September 24. This statement confesses that the underground operations at the Moonta have been gradually curtailed, "owing to the working out of the remnants of ore found, and the declining value of the ore being won from the mine," and goes on to say that, "the time has arrived for giving serious consideration to the advisability of closing down the mine." The statement, that the value of the ore has been declining, is not quite in accordance with facts, for the assay value of the ore handled was greater last year than it had been for some years previous. But this year has seen a decline of nearly 20%, so that there can be no doubt as to the correctness of the statement so far as concerns the present, nor is there any doubt as to the decrease of the ore reserve. This is estimated at 40,000 tons, assaying from 2 to 4% copper. This will give 18 months' work, and yield 1000 tons of copper, or thereabout. There is some prospecting to be done below the 1200-ft. level, but the general manager leaves it to the shareholders to express an opinion in regard to the undertaking of the work, since it is of a speculative character, and involves an expenditure of $35,000. Concerning the outlook at the Wallaroo mine, no such definite statement is made; but it is remarked significantly enough that should copper remain at anything over $350 per ton, "the Wallaroo can be worked profitably for a good many years to come." The inference is, of course, that with copper below that figure, work would be unremunerative. The total amount of ore and precipitate smelted from the two mines during the past year was between 30,000 and 31,000 tons, yielding about 2900 tons of refined copper. At the Wallaroo mine, cementation has been tried, but without much success, the copper being more easily recoverable by a flotation process. Fine-grinding machinery is being erected, and is expected to earn a net profit of $150,000 with copper at $350. At Moonta, tailing and slime has yielded from cementation a net profit of over $900,000, after the entire cost of erection of the works had been met.

COLORADO river drains an area of approximately 300,000 square miles. The annual maximum flow varies from 50,000 to 150,000 second-feet in May, June, and July; the minimum flow varies from 2500 to 5000 second-feet in January and February; and the mean flow from 1894 to 1903 was 10,700, and from 1904 to 1910 was 25,400 second-feet.

The Hendryx Agitator on the Rand

JOHANNESBURG CORRESPONDENCE

The Mines Trials Committee has been recently testing the Hendryx agitator and an interesting account of the results has been published in the local mining journal, from an authoritative source, but clearly not from the Mines Trials Committee, because, unfortunately, it has decided not to published the results of the tests.

The following table gives results of actual tests made by the Mines Trials Committee at the Wolhuter G. M. Co. plant.

Test No. and date.	1—March 11, 1912.	2—March 20, 1912.
Product	Sand and slime.	Slime only.
Quantity and ratio.	Ore, 35 tons; Sol., 70 tons } 1 : 2	Ore, 35.03 tons; Sol., 70.00 tons } 1 : 2
Grading:		
+ 60	9.4%	
+ 90	19.3%	0.1%
+120	11.3%	0.4%
−120	60.0%	99.5%
Average assay of charge	2.55 dwt.	1.65 dwt.
Solution strength per ton of ore:		
Start	0.136	0.042
Finish	0.132	0.040
Loss	0.004	0.002
Extraction by solution:		
Hr.	Assay ratio, dwt.	Dwt.
1	1.25	1.0
2	2.00	1.16
3	2.20	1.38
4	2.30	1.52
5	2.30	1.52
6	2.40	
7	2.40	
Extraction by KCN solution	94.1%	92.0%
Washed residue assay.	0.281 dwt.	0.05 dwt.
Comparative extraction:		
Residue assue	93.06%	97.0%
Solution assay	94.1%	92.0%

The above figures represent the exact results obtained by the Mines Trials Committee (Johannesburg, Transvaal) in the Hendryx agitator upon residues after amalgamation. The following figures show the total extraction from the original ore, including amalgamation in the mill:

Total extraction by amalgamation and KCN solution:		
Figured from residue..	97.9%	99.0%
Figured from solution.	97.9%	98.0%

H. Stadler who was in charge of the trials on behalf of the Mines Trials Committee, states that there are other important facts not published in the results, but which ought to be taken into account. He goes on to explain that in the tests the cyanide had been added in the form of salt, thereby ensuring greater efficiency than by using the ordinary stock solution, while the consumption of cyanide quoted only refers to that used during agitation and excludes losses incurred in the extractor boxes and that going to the dump. The fact that the pulp was heated to a temperature of 90°F. is not made sufficiently plain in the published results of the tests, while it must not be overlooked that the percentages of extraction were calculated from the values of washed samples. Mr. Stadler further states that he considers the statement pulished in the official report, that "as much or more of the gold and silver can be dissolved in one hour by the use of the Hendryx agitator as can be dissolved in 24 hours by the usual methods of percolation as somewhat misleading, and explains that in the Hendryx 18-ft. agitator only about 35 tons of mixed sand and slime is agitated during 7 hours, while in every day practice on the Rand, up to 400 tons of sand is treated in 5 to 7 days including the subsequent operations of transfer of sand, settling, washing, re-settling, and emptying of the treatment vat which are not included in the 7 hours mentioned as required by the Hendryx agitator. Mr. Stadler considers that figures relating to the costs should also have been supplied, and goes on to express regret that the results of various tests made by the Mines Trials Committee, particularly those relating to tube milling made during the last three years do not appear. The apparent reason for the non-publication of the results of the tests made by the Mines Trials Committee is the desire that they should only be available to those contributing to the cost.

Progress in the Joplin District

Extensive development in all districts has brought old mines back again. While there is more or less new development, and new fields are producing a portion of the heavy shipments that are going out of the district, old ground is likewise playing a conspicuous part in the era of renewed activity. From the New Century Zinc & Lead Co.'s land at Galena, Kansas, heavy production is being made, and it is interesting to note that this ore comes, not from present-day mining operations, but from old dump piles that were discarded as worthless by pioneer operators who could mine only the richest ore at the prices which then prevailed. This is only one instance of many similar ones. In the Galena district, especially, where numerous shallow hand-jig operations were conducted, rich boulder heaps accumulated, and the reworking of these is now netting a profit to the operators.

Higher ore prices make it possible for mining companies to handle thinner ore, and as a result the demand for sand jigs and slime tables has been heavy recently. New tables have been installed at the Wilson mines at Duenweg, Missouri, at the Harmon mill, Galena, Kansas, and at many other plants throughout the district. Clean-ups from slime tables now command a fairly good price, and much of the fine ore that formerly was wasted is now finding its way to the smelters.

Dvelopment of exceptional importance has been launched by O. W. Sparks, of Galena, Kansas, in the old Klondike district, northwest of Joplin. He has constructed large concentrating plants at two new mines, which are known as the Yellow Jacket and the Yellow Pup. Both mines are exceptionally rich at this time, the aggregate production being about 650,000 lb. of blende concentrate weekly. This is a phenomenal output, but whether it will long continue is problematical. The ground in that region is 'pockety,' and just how long a big orebody will continue cannot be foretold. Sparks claims to have drilled the ground thoroughly and to have found ore in many of the holes. Other examples of rich pocket mines, which are holding the limelight in the district at this time for their heavy production, are the Pocahontas, yielding 150 tons of blende per week, and the Sitting Bull, yielding about 175 tons per week. The average mill of the district cleans up about 30 to 40 tons per week.

THE Scott expedition to Baffin Land in search of gold has returned to St. Johns without meeting with success. It reports having discovered enormous deposits of coal and iron, and has brought back the survivors of the Munn expedition. Munn is a British army officer who was in command of an expedition to the same place and on the same errand. He lost his ship in Ponds inlet. It was crushed by ice floes. Munn found gold, but his search was discontinued owing to the loss of his ship. When he was saved, only seven barrels of bread and two barrels of beef remained, and no clothes.

The Miami Concentrator

*The new concentrator of the Miami Copper Co. is one of the largest in the world as well as one of the most complete in labor-saving equipment, and it is correspondingly efficient in its operation. The plant is designed to take every advantage of natural conditions, such as the lay of the ground and, at the same time, it has incorporated a most complete conveying system into its design. The importance of the mechanical handling of ore is recognized in all modern ore-treating plants, and most cases the development of the ore deposits would not be commercially possible without the use of conveying machinery. The economy of conveyors lies not only in the great saving in labor, but it also permits accurate sampling and mixing, as well as allowing uniform feeding.

The shaft, crusher building, and storage-bins are all situated on a ridge. In line with the bins and upon the side

ELECTROMAGNET TO REMOVE STEEL FROM ORE.

of the hill is the concentrating plant. Under this arrangement, the ore, during the concentration, is constantly being carried downward by gravity, thus passing through the process with no further necessity for mechanical handling.

Ore is hoisted in 7½-ton skips, which are dumped automatically into bins above the crushers. From the bins the ore is drawn out by 48-in. rotary feeders and delivered to two No. 7½ gyratory crushers. From the crushers the ore passes upon a 30-in. inclined Stephens-Adamson belt conveyor, 257 ft. between centres of end pulleys. This conveyor rises in an inclined gallery to a point above the storage-bins, where it discharges upon the horizontal distributing conveyor. This is necessarily of the same width and capacity, and is 329 ft. between centres. This conveyor is carried horizontally in a gallery above a row of six cylindrical steel storage-bins of 1000 tons capacity each. The conveyor is equipped with an automatic tripper, traveling back and forth on a track along the conveyor line and serving the various bins through openings in the gallery floor.

On delivering the crushed ore to the concentrator for treatment, a separate conveyor leads from each bin to the plant. An automatic disc feeder and sampler regulates the feed from the bin to the conveyor and, at the same time, it is arranged that of the ore delivered by every fifth revolution of the feeder disc, a small percentage is automatically diverted as a sample. Under this arrangement, an analysis of the ore may be made at the time the ore is delivered for treatment and the nature of the treatment is thus determined. The conveyors, leading from the bins to the concentrator, are each 14 in. wide and 24 ft. between centres, leading directly to the reducing rolls in the concentrator building.

As a protection for the reducing rolls, a power electromagnet is suspended above the first conveyor, which removes all scraps of iron which have become intermixed with the ore. This is a precaution which should be taken in all cases where bits of iron or tools dropped by the workmen are apt to get in the ore, cause serious damage to the crushers or rolls, and consequently delay to the entire plant.

On account of the high position of the plant, it was not practical to place the concentrate-bins near the plant and to bring the railroad to them. The method adopted was to place the bins a considerable distance from the concentrator at a level more easily accessible by the railroad. In order to supply the bins under this arrangement, it was necessary to construct a long tunnel through which the concentrate is delivered from the plant to the bins.

The general construction of the concentrator buildings is concrete, steel, and corrugated iron. In this connection, a feature which immediately strikes a visitor to the plant is that all buildings and galleries are absolutely and scrupulously clean. This is a feature which is more easily possible in this plant than in those where the material handled produces a quantity of dust, but nevertheless the result is attained only by means of a certain amount of work, and the contrast presented to other plants is very pleasing. The various levels of the concentrator are connected by iron stairways for the convenience of guests and employees, and all parts and equipment of the plant are easily accessible.

Electric drives are used throughout the plant, the power being generated in the company's own power-plant. This is near the loading bins, beside the railroad, so that fuel is easily supplied. The building and equipment of the power-station are also thoroughly modern and efficient and in keeping with the character of the main plant.

The capacity of this concentrator is 3000 tons of ore per day. The concentrate is all shipped to the Cananea smelter, at Cananea, Sonora, Mexico. At this Cananea plant there is also a system of Stephens-Adamson conveyors for bedding and reclaiming the concentrate and delivering it to the roasters. This system was illustrated and described in the *Mining and Scientific Press* of May 4, 1912.

The Miami plant was designed and constructed under the supervision of H. Kenyon Burch and is now operated under the management of B. Britton Gottsberger, general manager for the Miami Copper Co. All conveyors for this plant were furnished by the Stephens-Adamson Mfg. Co. as well as a large amount of the equipment used in the concentrator, including over one hundred conical settlers.

*From *The Labor Saver.*

Lead Production in 1911

The final figures of lead production in the United States in 1911, just issued by the United States Geological Survey, shows an output of 486,976 short tons of refined lead, which is 16,596 tons ahead of the best preceding record—that of 1910. Missouri was the largest producer, furnishing nearly 45% of the domestic pig lead. The growth of the lead industry in the United States in recent years has been continuous and rapid, as is shown by the following figures:

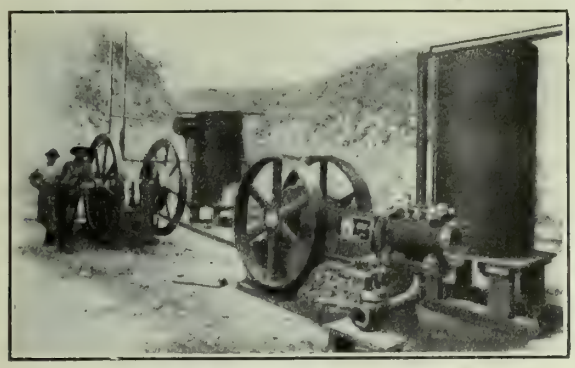
PRODUCTION OF REFINED LEAD IN THE UNITED STATES, 1880-1912

1880	97,825
1890	161,754
1900	377,679
1910	470,380
1911	486,976

The total production of lead since the beginning of mining has been 10,040,704 tons. In 1911 the gain in lead production was made wholly by domestic lead, the output of foreign lead smelted or refined in this country having decreased 14,419 tons.

Natural Circulation of Cooling Water

At the mines in the vicinity of Battle Mountain, Nevada, the scarcity of water has made it necessary to use it as sparingly as possible. The water is made to circulate through the jackets of the gas-engine and compressor naturally, thus eliminating the trouble and expense of pumps. A large water tank is placed beside the engine and beside the compressor. The water enters the cooling jackets at the bottom. It quickly becomes heated, and as it consequently becomes lighter in weight it rises from the jacket up through the discharge pipe and enters the water tank near the top, the water-level being always kept above the discharge.



ARRANGEMENT FOR CIRCULATING COOLING WATER.

Goldfield Consolidated Report

During September 1912 the total production of the Goldfield Consolidated Mines Co., Reno, Nevada, according to the report of J. F. Thorn, general superintendent, was 29,752 tons, containing $433,938, or an average of $14.58 per ton, of which 28,800 tons was milled with an average extraction of 89.52%, and 952 tons was shipped of an average value of $22.38 per ton, the net recovery from all ore being $13.13 per ton. The total net realization was $200,833, or $6.75 per ton. During the month 4612 ft. of development work was performed. The total cost of mining, development, transportation, milling, office and general expense was $6.45 per ton, distributed as follows:

Mining (including stoping and development)	$3.78
Transportation	0.11
Milling	1.98
Marketing	0.05
General expense	0.48
Bullion tax	0.02
Marketing ore shipped	0.13
Total cost of operation	$6.55
Miscellaneous earnings	0.10
Net cost per ton	$6.45

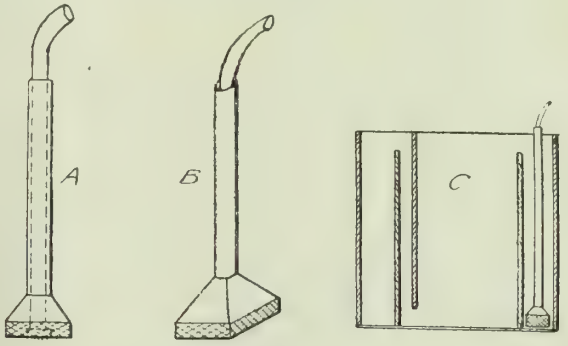
Several discoveries of considerable importance were made during the month. In the Combination mine the 136 BX stope on the second level was considerably extended and produced 700 tons of ore that averaged $18 per ton. The 136-T raise through the western extension of the 136 orebody disclosed ore, and 150 tons, averaging $32 per ton, was mined. The 246-C, between the third and fourth levels, 450 ft. east of the shaft, produced 237 tons of ore averaging $140 per ton. While not very large, this orebody will produce several hundred tons of good ore. The 414-C raise produced 76 tons of $31.20 ore. In the Mohawk the No. 3 stope through the Sheets-Ish workings produced 3258 tons of ore averaging $12.20 per ton. The 170-stope on the 250-ft. level, and under the Sheets-Ish orebody, produced 1395 tons of ore averaging $15.40 per ton. The 348 stope, between the third and fourth levels, was extended south and produced 340 tons of ore averaging $90 per ton. The 490-R sill being cut on the intermediate, between the third and fourth levels, and about 200 ft. south of the 354 stope, produced 611 tons of ore averaging $100 per ton.

In the Clermont the downward extension of the 510 orebody in 571 drift, between the 900 and 750-ft. levels, produced 36 tons of ore averaging $38.20 per ton. The 700-F stope, between the 1200-ft. level of the Grizzly Bear and 1000-ft. level of the Clermont, produced 448 tons of ore averaging $42.40 per ton. The 603 stope, between the 1000 and 900-ft. levels of the Clermont, produced 329 tons of ore averaging $26.20 per ton. The 802 stope on the 1300-ft. level produced 302 tons of ore averaging $25 per ton. In the Jumbo No. 2 the 220 drift on the 200-ft. level was extended 100 ft. north, through ore that averaged $50 per ton over a width of 5 ft. A raise in this orebody produced 100 tons of ore averaging $72.80 per ton. On the 300-ft. level the south drift is being extended to connect with the downward extension of the 220 orebody. In the Red Top the raise through the 115 orebody from the No. 1 level has been extended to the surface, and a glory-hole started, which produced 1150 tons of ore averaging $25 per ton.

The estimated October production of the company is as follows: total tons mined, 30,442; gross recovery, $401,000; operating expenses, $185,000; net realization for the month, $216,000.

Portable Suction Rose

This is a useful acquisition to the clean-up outfit for pumping the solution out of the extractor-boxes. It is inserted into the down-take compartment and the suction hose is put inside when pumping out solution during the clean-up. As a general practice a piece of screen is improvised as a rose by wrapping and tying it to the end of the suction hose, which generally annoys the operator because of its confined area getting choked.



PORTABLE SUCTION ROSE.

With the rose shown in the illustration it will be seen that the screen area is comparatively large and the end of the hose is free, being supported on a wire frame. The funnel is made of stout galvanized iron large enough for the hose to slip in easily, the dimensions of the one described being 3 ft. long, diameter of pipe 3 in., size of rose 9 by 12 in. with a screen area of 48 sq. in. Mill screen say 25 mesh may be used, is easily soldered on the frame, and lasts about 12 months.—*Jour.* Chem., Met. & Min. Soc. S. A.

COPPER production from Alaska in 1911 was 22,314,889 lb., as compared with 4,311,026 lb. in 1910. The large increase in the output for 1911, according to the United States Geological Survey, is due to the entrance of the Copper River district into the producing list. The mine production of copper for 1911 was 27,267,878 lb., but a considerable portion of this had not been smelted at the close of the year. Important production of copper from Alaska began about 1903, since which time it has been a steady contributor of that metal. To the close of 1911 the total production of blister copper has been 59,126,334 pounds.

Discussion

Readers of the MINING AND SCIENTIFIC PRESS are invited to use this department for the discussion of technical and other matters pertaining to mining and metallurgy. The Editor welcomes the expression of views contrary to his own, believing that careful criticism is more valuable than casual compliment. Insertion of any contribution is determined by its probable interest to the readers of this journal.

Pacific Smelting

The Editor:

Sir—My attention having been called to a brokers' circular stating that the Pacific Smelting & Refining Co. (meaning the Pacific Smelting & Refining Co.) has signed a contract for the treatment of its ores, and that shipments will begin on November 1, I hasten to say for the benefit of those whom it may concern that said statements are premature. As consulting engineer for that company and as president of its Mexican subsidiaries, I have been investigating the possibilities of doing what has been erroneously announced as a *fait accompli*. The physical position of the company is excellent, and under certain circumstances, involving some further capital expenditure, it can shortly enter the ranks of the producers. When this end may be in sight, due notice will be given by the officers. I make this statement now in vindication of my own position.

COURTENAY DE KALB.

Tucson, Arizona, October 19.

Hydrometallurgy of Copper

The Editor:

Sir—In your issue of September 14, in a review of W. E. Greenawalt's 'Hydrometallurgy of Copper,' you find fault with the amount of space Mr. Greenawalt has devoted to roasting. In this I do not agree with you. The entire success of most wet processes for copper depends upon the preliminary roast. The lixiviation part of the program is difficult enough, anyway, but is rendered almost impracticable if the roasting has been improperly conducted. Hence, roasting is the key to all subsequent treatment, and demands the most minute study and attention. It is just enough dissimilar to the ordinary careless roasting for smelting purposes to require the most careful differentiation, and I esteem the portion of his book that he has devoted to this subject as the most valuable part of the entire work.

As regards the portion devoted to lixiviation, I think I may say that no man living is competent to write a satisfactory manual on this subject, for the simple reason that no man has yet practised satisfactorily a considerable number of the more important of these processes upon a commercial scale. Consequently, the personal element is lacking, and this is what is needed to make such a book readable, convincing, and authoritative. Failing this impossible requirement, I think that Greenawalt has given us the best book on the subject that we have as yet.

EDWARD D. PETERS.

Dorchester, Massachusetts, October 22.

When reviewers, or doctors, disagree, it not uncommonly results from a concentration of attention upon different phases of the topic. That the special features of roasting preparatory to lixiviation deserve careful attention and study, no one can deny; and it would have been well to devote even more space to pointing out exactly in what way roasting for this purpose differs from ordinary roasting and what variations in construction and operation are necessary to ensure successful work. Mr. Greenawalt has given much of this, but it is obscured in a mass of material treating of the general principles of work, and the ordinary metallurgist is unable, without much study, to pick out what is significant from what is not. It is obvious, of course, that the type of book most useful and interesting to an engineer does not necessarily coincide with the one most interesting to the distinguished professor of metallurgy in Harvard University, who can at once see for himself the significance of the data presented. The ordinary engineer who is endeavoring to solve his own problems will be grateful if the data is discussed by the author from the standpoint of its significance, thus relieving the reader of work which he is often ill qualified to perform. For this reason, I believe it would have been better if the author had curtailed his discussion of the general principles of metallurgical work and had discussed in more detail those special principles and features which are peculiar to this field of work. It is safe to assume that practically everyone who reads this book with care and attention will previously have read with equal care and attention several or perhaps all of the standard treatises on metallurgy. It would seem safe, then, to presuppose this knowledge and concentrate upon what is new. If the hammer falls on your thumb as well as the nail, its useful work is lessened, and, conversely, if the mental energy of the reader is concentrated upon what is significant and useful, he secures the highest intellectual efficiency. Modern life demands the maximum of useful result from the minimum of effort, in the field of literature as well as elsewhere, and, for example, such a novel as Manzoni's 'I Promessi Sposi,' if it were rewritten nowadays would probably be condensed into the compass of a short story. The same considerations apply to technical literature with even greater force. In our basal views, Mr. Peters and myself are in essential agreement, we merely consider the matter from a different point of departure. It is unnecessary to add that Mr. Greenawalt has given us a highly useful treatise, since otherwise it would not evoke such an amount of critical attention and comment.

THOMAS T. READ.

San Francisco, November 4.

Sticking to the Job

The Editor:

Sir—In your issue of October 19, I read with glee the pictographic communication from Señor Don Joven de Todos Lugares. His ability to accent the humor of the condition confronting callow graduates makes more clear to the engineer possessed of an insight into the mining the overmanned state of the profession today; a state recognized by your editorial of October 12 remonstrating against the establishment of new and scantily equipped mining schools, such as that in Weir City, Kansas.

Not to dilate upon this matter unduly, I will only say that to my personal knowledge three mining engineers of a number of years standing have engaged in the automobile and automobile supply business in the United States, one coming from Mexico City. Another, after a personally successful mining career in Mexico (state of Chihuahua) has given it up almost entirely to engage in lumbering in California. A fifth is manager of a citrus fruit exchange in southern California. A sixth has found real estate and building operations in Los Angeles more attractive than squinting through a transit or putting his *firma* on pay-checks down in Velardeña, Durango.

A multiplication of such instances would be easy, but although furnishing supplementary proof of the exceedingly long and hard row of stumps in which the young graduate engineer finds himself, would no doubt annoy those among your subscribers who adhere to E. P. Mathewson's views on this subject; hence, I hope the space thus saved will be filled by communications from them. I cannot refrain, however, from pointing out that this condition is not confined to North America, as an Australian acquaintance, a graduate of the School of Mines at Adelaide, South Australia, has assured me that a great many of his classmates there were 'going on the land' in West Australia (the equivalent of homesteading in the United States) and raising golden wheat at a greater profit than from seeking golden metal, apparently.

SONORENSE.

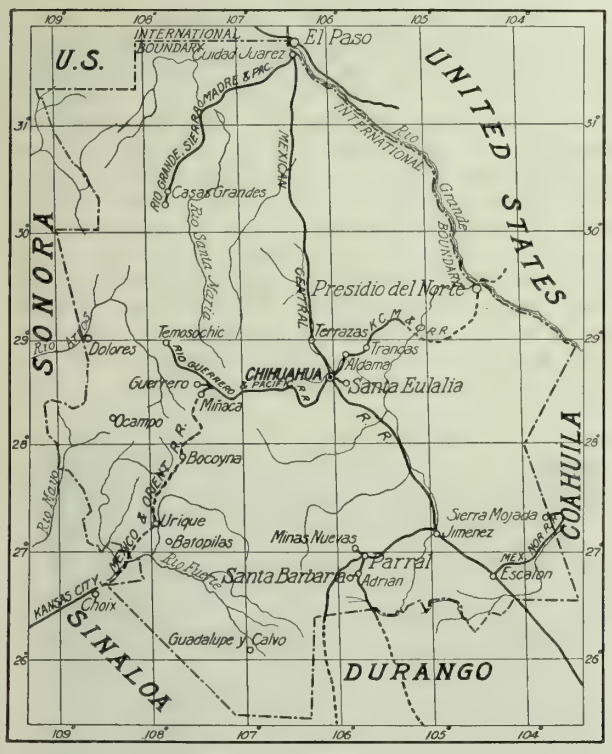
Yzabel, Sonora, October 23.

Special Correspondence

CHIHUAHUA, MEXICO

THE MINING SITUATION.—DEPREDATIONS BY REBEL BANDS.—THE OUTLOOK FOR QUIET.

The situation continues to be one of great uncertainty for the mining interests. The Mexican Northwestern railroad is out of commission north of Pearson, thus cutting off the mines of western Chihuahua from direct communication with the United States, and stopping shipment of American coke and coal for the smelters. The old Central line is not yet repaired, there being a length of about 40 km. to rebuild. Rebel bands infest the country on both sides of the line and it is believed that as soon as an attempt is made to open the road they will put it out of commission again. In fact, several of the new bridges have


U.S.
INTERNATIONAL BOUNDARY
Ciudad Juarez
El Paso
UNITED STATES
SONORA
COAHUILA
CHIHUAHUA
DURANGO
SINALOA
Casas Grandes
Presidio del Norte
Ojinaga
Terrazas
Temosochic
Dolores
Guerrero
Minaca
Ocampo
Bocoyna
Santa Eulalia
Aldama
Trancas
Urique
Batopilas
Minas Nuevas
Sierra Mojada
Jimenez
Parral
Adrian
Escalon
Santa Barbara
Choix
Guadalupe y Calvo
Rio Conchos
Rio Grande
Rio Santa Maria
Rio Florido
Rio Mayo
Rio Yaqui
Rio Fuerte
Rio Verde
Rio Nazas
Rio Aguanaval
Rio Nadadores
Rio Sabinas
Rio Salado
Rio Alamo
Rio Salinas

mill at the head of Wolf creek. A large amount of good ore has already been blocked out by the owners, as the vein widened considerably as the adit was driven into the hill. The first few runs should pay for the mill. Competent judges put this property in the front rank of promising prospects. An ideal millsite is one of the assets of the owners. Near this property, Gus Balzimer is still crosscutting to intersect the vein found on the surface. The cross-cut is in over 600 ft. and so confident are the owners that they are near the vein that one of the partners is now outside negotiating for a mill. If intersected at more than 700 ft. from the portal of the adit there should be 400 ft. of 'backs' at the face.

JOHANNESBURG, TRANSVAAL

DECREASED AUGUST OUTPUT.—WORK OF PRINCIPAL COMPANIES.

Although August contained the same number of working days as July, the gold output for the Rand for August shows a decrease of 377½ oz., in value £15,901 when compared with the preceding month. But this decline is of no significance, and is more than accounted for by the Crown Mines decrease of £23,099 in the value of the output, caused by the transition of mining operations in connection with the concentration scheme at that property. This operation has not only affected the total value of the gold output of the Rand, but temporarily placed the Crown Mines in the third position among the producing mines of the Rand instead of the first position as formerly. This cannot last long, and unless the Randfontein mine can bring more of its idle stamps into operation the Crown Mines will probably soon take the position of the premier producing gold mine of the world, and maintain that position with greater ease than in any previous period of its history. Knights Deep has had 20 stamps put out of operation, due to the destruction by fire of the crushing plant, and its August output fell off to the extent of £9281. The mines controlled by the Consolidated Gold Fields of South Africa accounted for a considerable proportion of the fall in output, and we must look to the following increases over July, Village Deep £9464, New Modderfontein £9315, Randfontein £7612, Bantjes £3059, as showing perhaps more correctly the gold output tendencies of the Witwatersrand, and this in face of a decrease, as compared with July, of 3814 natives employed in the gold mines. The total gold production of the Transvaal during August was 764,737 oz., valued at £3,248,395, to which the mines situated outside the Witwatersrand only contributed £138,219, leaving the Rand with an output valued at £3,110,176. Those companies producing over £100,000 per month are given below, along with their respective equipments and results:

	Stamps	Tube-mills	Tons crushed	Value
Randfontein	700	29	206,037	£265,585
East Rand Proprietary Mines	820	25	153,650	254,783
Crown Mines	660	25	158,600	246,738
Ferreira Deep Deep	225	6	51,440	105,505
Robinson	250	6	51,200	102,489
	2655	91	620,927	£975,100

It may be pointed out that at one time the Robinson mine occupied the position of the premier gold producer of the Rand, but has now to be content with fifth position, all the producers by which it has been superseded being the result of amalgamations rather than increased capacities. Eighty stamps scattered over the Rand were hung up in August as compared with July, but 25 others were dropped, leaving a net decrease of 55, while 254 tube-mills were at work as against 261 in the previous month. One feature for congratulation in the August returns is the fact that group profits were £1,028,515, as compared with £1,018,880 in July, a feature all the more welcome when it is remembered that, despite the steady increase in the production of gold on the Rand, profits and dividends have for some time declined. It is to be feared, however, that even this small increase of group profits, amounting in all to no more than £10,000, does not speak as well as it ought for the mine; for at the last meeting of the Chamber of Mines the president estimated that the reduction in the carriage of coal by rail to the gold mines which came into force on August 1, would mean a saving to the gold-mining industry of £200,000. Surely such a saving ought to be represented in increased profits to a far greater extent than £9635.

LONDON.

RESULTS AT THE CAUCASUS COPPER.—SUCCESS AT ZAAIPLAATS.

The Caucasus Copper Co. has had a long fight for existence, and immense sums have been spent on the mine and smelting works, much of it to no purpose. The venture is of interest to Americans, as a large amount of the money was provided by the J. P. Morgan group, while James Colquhoun, once manager of the Arizona Copper Co., came to the rescue in solving the mining and concentration problems, and W. R. Van Liew, once of Butte, reorganized the smelting plant. Things seem to be brightening now, and prosperity is in sight. The property is near Dzansul, in the Russian Caucasus. The report covering the year ended May 31 last (Russian style) shows that the production was equivalent to 3030 metric tons of refined copper. The sales brought an income of £256,195, and the working cost was £166,019. Out of the profit, £70,044 was paid as debenture interest, and £23,779 was allowed for depreciation. Mr. Colquohoun is the chairman of the board of directors, and spends a large part of his time at the mine. At the meeting of shareholders he gave many details of the operations. The concentration plant is at present treating 500 tons of ore per day. A third unit of 250 tons capacity is being erected and should be at work early in 1913, while the order has been given for further plant that will bring the daily output to 1000 tons. A new aerial tramway is being built, having a capacity of 2000 tons per day. The methods of mining have been revised. In the first place, the overburden, consisting of loose soil varying in thickness from 10 to 100 ft., is now removed by hydraulicking; second, the ore is mined from the great opencut by the 'glory-hole' system, thus eliminating all shoveling. A new reverberatory furnace has been built, measuring 19 by 89 ft., and the waste heat is used for steam production. As regards ore reserve, the estimate seven years ago was 3,600,000 tons, and since then development has about kept pace with extraction. The finances have recently been rearranged. The whole of the outstanding profit-certificates, amounting to £500,000, together with £299,900 in options, have been surrendered and cancelled. The £579,000 6% second debentures have been scaled down to 5%, and £440,000 loans have been satisfied by 5% second debentures. The issued capital of the company consists now of £500,000 ordinary shares, and there are £45,280 5% first debentures, £500,000 convertible 5% second debentures, and £745,900 non-convertible 5% second debentures. The position of the ordinary shares is therefore greatly improved. It will be remembered that the company has the advantage of the higher price of copper ruling in Russia.

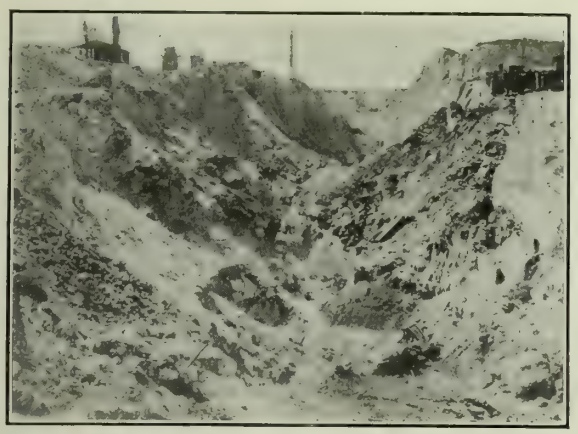
Last week I gave some particulars of the tin deposits of the Northern Transvaal and instanced the progress of the Rooiberg mine. The Zaaiplaats is doing even better. Milling commenced in February 1909 and large profits have been made. During the year ended July 31 the mill of 15 stamps crushed 29,330 short tons of ore, from which 1647 short tons of concentrate was recovered, averaging 67%

tin. The average yield was 3.76% of metallic tin per ton of ore. During the year, the 750-lb. stamps have been replaced by new ones weighing 1500 lb. and additional dressing plant has been erected. Re-treatment of accumulated slime is to commence shortly. Developments at the mine continue to be satisfactory. Although the lodes vary in width and content, very rich patches are found here and there. The vertical depth of the workings is now 450 ft. Extensive areas are still unprospected, as also is an alluvial deposit in the valley below. The ore reserve actually blocked out is estimated at 24,622 tons, averaging 3.42% metal; not including ore in branch veins. The accumulated sand and slime awaiting re-treatment amounts to about 60,000 tons. Power is generated by suction gas, and is distributed electrically. During the year, the income from the sale of concentrate was £159,680, and the profit was £108,364. Out of this, £90,000 has been distributed as dividend, being at the rate of 150% on the capital, £60,000, and £14,397 has been spent on new plant.

MELBOURNE, AUSTRALIA

THE BARRIER'S AUGUST OUTPUT.—LABOR IDEAS OF LEGALITY.—VICTORIAN MINING BILL.

The greatness of the New South Wales silver-lead-zinc field, which is known sometimes as Broken Hill and sometimes as the Barrier, is being further exemplified. Its August output amounted to 25,362 tons of silver-lead concentrate. The actual value cannot be given, but the net mine value, which is very much below the actual and excludes the value of copper, tin, and gold, runs to nearly $1,900,000. The one drawback at present is the want of men to enable the mines to produce the quantity of which they are capable, and so take full advantage of present prices. They could employ some hundreds of men more.



OPEN-CUT AT BROKEN HILL.

It is indeed a marvelous field, and should be good for many years.

The Australian mine-worker is an extraordinary person. After the recent trouble between the Mount Lyell company and its employees an agreement was made settling the rates of pay for workers and conditions of employment. A ballot is now being taken among the employees to ascertain whether they wish the agreement canceled, on the score that the company has broken some of its promises. Some of the arguments used are funny enough for musical comedy. One ground of complaint is that the company undertook to pay men working in the open-cut $2.16 per day, and is actually paying them $2.28. That constitutes, in the eyes of these individuals, a breach of the agreement. One does not usually regard a working miner as a pettifogging lawyer, destitute of scruple; but it is plain that many of the Mt. Lyell men are of this order.

The new Victorian mines bill, the second reading of which was moved on September 11, contains three sections, the first dealing with miners' rights and business licenses, residence areas, leases and licenses, mining on private land, prospecting, and reserved areas, regulation of employees, mine managers' certificates, and those of engine-drivers and boiler attendants, and a variety of other matters. Part II deals with drainage boards, and Part III with provisions for the abolition of mining boards whose functions have been undertaken by officers of the Department of Mines. If the bill becomes law, the cost of miners' rights will be reduced from $1.20 to 60c., and the provision is that every agreement for mining in or on private land shall cease at the expiration of the mining lease. Boys under the age of 17 years must not be employed underground in a mine, and boys under the age of 14 cannot be engaged about any mine. Another provision prevents any person from being employed for more than 48 hours in any week as a topman, nor more than eight hours, inclusive of 30 minutes for lunch, in any 24 hours, except in cases of emergency. Eight consecutive hours is the maximum period in which persons can be employed below ground. Clause 36 provides for periodical inspection of mines on behalf of workmen, the provision of water jets or sprays in connection with drills, and this and the following section relate in other respects to the health and safety of the miners. Scholarships are granted for working miners anxious to quality as mine managers; the restrictions on dredging are increased, the quantity of earthy or mineral substance permissible, in suspension or solution, being reduced from 800 to 500 grains per gallon. Should a company be dissolved, the miners' wages are to be a first charge on the assets. The bill also provides that when a majority of the owners of adjacent mines agree that, in order to prevent an influx of water, action should be taken by and at the expense of all concerned, the Governor in Council may constitute the area embracing the mines a drainage area and a board may be appointed for every drainage area proclaimed.

BOSTON

FLUCTUATIONS IN BUTTE & SUPERIOR.—PROSPECTS FOR SOUTHWESTERN MIAMI.

That 'variety is the spice of life' holds good in the realm of stock speculations as elsewhere. The antics which the Boston market has been exhibiting in some of the most active specialties during the past few months bears out the old truism. The Hayden-Stone group, which has a large following among both traders and investors, is an example of this. When Butte & Superior was first brought out on the Exchange here by this house, there was a noticeable shifting of speculative accounts from Chino, Ray, and other stocks with which that house is identified, to the Butte issue. This was in anticipation of the steady rise which came with that stock after its appearance for trading. After awhile the wise ones thought they saw Butte & Superior getting top-heavy and they shifted back to some of the less active stocks which were yet scheduled for advances. When the Alaska Gold Mines Co. announcement was made there was for some time a marked recession in Butte & Superior, which could only be attributed to the desire to get into the new issue, which promised quick profits. Still later there was selling of Butte & Superior going on for conversion into Chino, which is in line for an advance, in the opinion of wise ones, because of earnings and dividend prospects. Take the element of speculation out of the market and but very little is left. Not long ago I had occasion to go out to Haverhill, Massachusetts, to meet a few bankers, merchants, and manufacturers who were tied up in a Colorado gold mining investment. I was surprised to find that these grave and reverend gentlemen were giving a large part of their business hours over to watching the New York and Boston stock markets and were nibbling at them all the while. When, in a burst of temerity, I remarked that they were 'dead game stock gamblers,' they showed their pleasure, rather than displeasure; in fact, the soft impeachment was acquiesced in with more or less glee. It is the participa-

tion of people like these, riding one stock awhile and then shifting to another, that makes up a large part of the business of the stock market.

A report from an apparently reliable source states that Southwestern Miami, the youngest of 'the porphyries,' which is now being sponsored by Paine, Webber & Co., has already developed ore enough to pay $12 per share on the stock. Southwestern Miami is the first property of this kind in which the Paine company has become interested and is being given a good opportunity to prove its merit. Besides the developed ore, which is all on the boundary of the Live Oak, the company has acquired under option on favorable terms additional territory to the extent of 259 acres, known as the Prospectors group, on which it plans to begin drilling. This new group was formerly under option to the Guggenheims for $250,000, but the option was relinquished by them on the theory that the property did not contain an extension of the ore-zone. The abandoning of their option by the Guggenheims threw the property on the market again on a lower basis, and it was natural that inducements should be held out to the Paine interests to take it over. They are to begin drilling as soon as possible and will have no money to pay out on the option until next March, by which time they should be better able to tell whether they wish to buy or not. Since the Guggenheims relinquished their option the South Live Oak has proved about 70 ft. of 2½% ore within a few feet of the Prospectors boundary line. Southwestern Miami has ample money in the treasury to keep up development work until well into next year. It will be interesting to watch the progress going on in the Miami district for the next few years, both in the old and new divisions, which are of about equal area, as it will show whether the Paine or the Guggenheim organization is better served as to its advices on the territory known as the Prospectors group. Boston thinks—its wish being father to the thought—that the Paine interests, though new to 'the porphyries,' will win out in precisely the same way that they have in the Lake country and in Butte. At any rate, Southwestern Miami has recently gained a couple of points on the development news reported.

BUTTE, MONTANA

BUTTE PRODUCTION. — EAST BUTTE FLOURISHING. — THE BRADLEY PROCESS.

The mines of the Butte district produced 26,000,000 lb. of copper in October. Of that amount, the two Anaconda smelters furnished 24,600,000 lb. This latter included 2,100,000 lb. of North Butte copper and 493,000 lb. of Tuolumne production. The output of the East Butte was about 1,200,000 lb., including Alex Scott production, and the remainder was contributed by miscellaneous shipments. At the rate of production during the past ten months, an estimate of 49,800,000 lb. for November and December is made, which will bring the total production of the Butte mines for 1912 to 320,850,000 lb., a record for the district. Of this great total, the Anaconda smelters will have turned out 306,350,000 lb., East Butte 13,500,000, and 1,000,000 lb. will represent the small miscellaneous production from ore shipped out of Butte. The two Anaconda smelters and the East Butte plant handle practically all the ore of the Butte mines. Owing to the fact that several of the Anaconda mines have been shut down for a month or two, the report has gone out again that the company had entered upon another period of curtailment, but the fact is that the mines of the company have been shipping more ore than the two smelters have been able to handle. The Buffalo mine was closed for three weeks while repairs were being made to the shaft and the hoisting plant was overhauled, but the mine resumed operation a few days ago. The Buffalo employs about 400 men. The West Colusa has been shut down for two months while the change from steam to air power was made, but when that was completed it was decided to make some extensive repairs in the shaft and mine, and the property will probably not resume work in another two months. The Original has also been closed several weeks for repairs, which will not be finished for another month.

The East Butte Copper Mining Co. has resumed sinking its shaft and will continue to the 2000-ft. level, which will be 800 ft. deeper than the present lowest working. Some of the best ore yet mined from the property comes from the 1200-ft. level, the average content in copper being about 11%. The largest orebody is on the 800-ft. level, upon which the company has been mining for several years, and the largest portion of it has been taken out on that level. The grade of ore on the 800-ft. level is 7%. Shaft-sinking does not interfere with mining, and the production will be maintained around 1,225,000 lb. per month. The East Butte smelter is operating two furnaces, but plans were made long ago for an enlargement of the smelter. Steel has been ordered and received, but as the work would necessitate a suspension of mining for some time and the company would lose the benefits of the present high copper price, it was decided to postpone the smelter changes. The East Butte owns mining properties at Elkhorn, Austin, and Pittsburg, Montana, besides its 265 acres of mineral ground on the east side of the Butte district, and these are to be developed when the smelter is enlarged.

The success of the Heinzes in New York in getting a jury verdict against the Barnes-King company for money subscribed for stock of the company during the flotation came as a surprise to the officers of the company in Montana. Attorneys for the company in New York say there is no doubt that the verdict will be set aside by the Court of Appeals. The Heinzes claim they bought the stock under misrepresentations by employees of the company, for which they seek to hold the company responsible. The company being made up of stockholders, all in the same boat with the Heinzes, the Western stockholders are wondering what sort of justice there is in New York that prefers the Heinzes over other stockholders in the company and doubly mulcts the people who subscribed for the stock by making them pay back the Heinze subscriptions. It was also brought out at the trial that the Heinzes sold part of their stock and want to be reimbursed for the stock they didn't sell and which they still hold, not even having offered to turn it back to the company. The Barnes-King company is pushing work on its new properties in the Marysville district and the Kendall country. Production will be started next month from the North Moccasin property.

The report from Anaconda is that the Bradley system of treating slime by the Bradley-Burrage-Lawson method has so far been a failure. The syndicate from Boston, which promised to revolutionize the methods of copper recovery, spent about $300,000 in building and rebuilding a plant in which to employ the Bradley process, but they still have faith in the inventor. After several attempts to operate the plant, it has again been shut down and another lot of changes are being made. The Butte & Superior company expects to have its rebuilt concentrator completed in another month. A lot of new machinery has been received and is being put in place. The plant as originally constructed was a failure, and it is yet to be proved that the new plant will make profits for the company. It is stated that the company is still engaged in gathering in other properties under options, which seems to indicate a faith in the country adjacent to the Butte & Superior mines. The last of the machinery for the Butte Central Copper Co.'s mill is on the way, and will be installed by the latter part of the month. It is announced that the mill will be working by the first of December, and that by the first of January the stockholders may expect profits on operations. Western stockholders of the Butte Central regard it as unfortunate that some of the Boston shareholders and the underwriting syndicate have gotten into a controversy among themselves, which is not likely to help the market end of Butte Central.

General Mining News

ALASKA

Fairbanks

(Special Correspondence.)—After a visit of three weeks, in which most of the quartz claims were inspected, P. Smith, government geologist, left Fairbanks on the last boat. Before leaving he spoke in a very optimistic tone of the future of the district in lode mining to the members of the Commercial Club. While Mr. Smith could not give the results of his investigations in full, his observations left a favorable impression on his audience. His paper on the lode mines of the district will be awaited with much interest.

Fairbanks, October 3.

The Teddy R. quartz claim, on Moose creek, a tributary of the Fairbanks, has been bonded to G. Wheeler for $100,000. The property is between the claims of Crites & Feldman, who have good prospects, and have uncovered two parallel veins about 12 in. wide each for 500 ft. in length, and the Teddy R. lies between these claims. The dredge on Mastodon creek got into frozen ground and has been shut down for the winter. A thawing plant will help operations next season. The steamers *Tanana, Delta,* and *Reliance* have been docked for the winter.

Iditarod

It is stated that the Guggenheim dredge, on Flat creek, is doing remarkable work, and the average daily yield is $18,000. Weather conditions have been favorable, and work may be continued longer than was expected.

Juneau

During September the 120-stamp mill at the Alaska Mexican mine worked 29.70 days and crushed 19,593 tons of ore yielding $24,823 in free gold, and $30,088 from 379 tons of concentrate. Operating expenses were $26,998, and construction $4066, leaving a net profit of $23,296. Development covered 332 ft. and the stock of broken ore increased 9842 tons.

The two 120-stamp mills at the Ready Bullion and 700-Ft. Claim of the Alaska United worked 29.52 and 29.71 days, respectively, crushing 17,990 and 19,656 tons of ore, yielding $111,397 from free gold and 964 tons of concentrate. Operating expenses were $52,232, and construction $6831, and the net profit was $52,334. There was 187 ft. of development done in the Ready Bullion, and 313 ft. in the 700-Ft. Claim, and the stock of broken ore increased by 4933, and decreased by 110 tons, respectively.

Nome

(Special Correspondence.)—The Nome Montana dredge shut down for the winter on October 14, and others are following suit on account of the recent freeze-up. All sluicing operations are also stopped for the season. C. T. Merlson has taken options on some claims on Solomon river, and has two drills at work prospecting. It is reported that when one of the new dredges on the American river started work recently, the ground was found to be too low grade to pay expenses, so the owners are now looking for workable ground to move the dredge to. In this connection, it is interesting to note the contentions of Charles Janin, in the *Mining and Scientific Press* of September 28, when he stated that dredges were often erected in Alaska before the ground was thoroughly prospected, and this seems to be an instance of such work.

Nome, October 16.

A freight steamer recently carried 16 miners from Candle to Nome, and the company was fined $1000 for violating marine laws which forbid freighters carrying passengers.

Valdez

The Bluebird group of six claims, situated near the water on the outside of Shoup bay, have been bonded by D. Anderson and C. Swanson for $75,000. Considerable work has been done on the property, and a vein over 6 ft. wide, averaging $12 per ton, has been opened. It can be traced for 600 ft. on the surface. Being near the sea, a drift can be driven into the mountain and ore handled cheaply.

ARIZONA

Cochise County

In the Tombstone district operations at the Tombstone Consolidated mines are being carried on by about 50 lessees, who are shipping ore to the smelters at Douglas and El Paso. Owing to the new miner's lien law, the number of lessees has decreased considerably. Local opinion states that the Tombstone Consolidated company, which is now going through the bankruptcy court of this state, would be sold and work resumed on a small scale next year, but now it is thought that this may be postponed, as a deal has been considered in which the whole property will be leased to well known mining men.

The steelwork of the blast-furnace stack at the Calumet & Arizona smelter is completed. It is 305 ft. high, being 5 ft. higher than that of the Copper Queen. The stack is now being lined. The sample mill machinery is being installed, also 12 Herreshoff roasting-furnaces, and waste heat boilers to utilize the heat from the reverberatory furnaces.

Mohave County

The molybdenite mine, owned by Smith, Sawyer & Co., is situated in Copper canyon and Deluge Wash, five miles north of Cedar. Drifts have been driven over 140 ft. on the veins, which are 72 in. wide in parts. About 300 tons of ore is on the dump, and samples return 24% of molybdenite and 3% of copper. The Gold Road company has installed a gasoline hoist at the Jupiter group of claims, and is sinking below the 114-ft. level. Samples taken from a depth of 50 ft. in one of the claims owned by M. Carr, at Cedar, have given high results in silver, over a width of 48 inches.

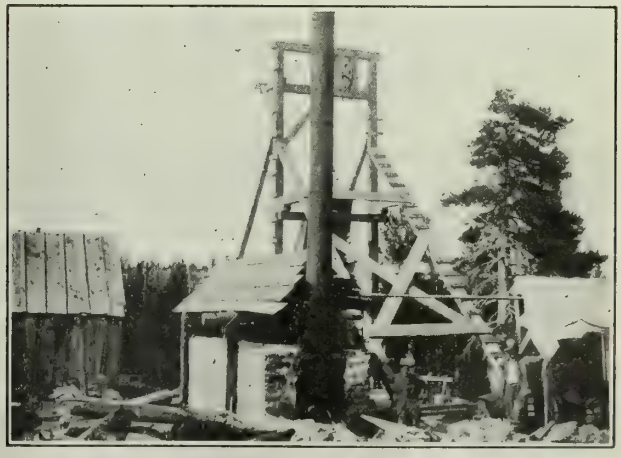
Yuma County

The dump of tailing, containing about 2000 tons, at the Billy Mack, has been sold to the Humboldt smelter and will be hauled to Parker to be loaded into cars, at a rate of 200 tons per month.

CALIFORNIA

Modoc County

(Special Correspondence.)—The Modoc Mines Co. has its shaft down 100 ft., and is sinking 100 ft. farther. Fair-grade quartz is reported to have been opened. The sale of the Ft. Bidwell Consolidated mines, by the sheriff, has been postponed. Advice from Detroit is to the effect that the directors have promised to pay off the claims against the company. The Spearmint company is sinking on the Lucky Dutchman lease of the Yellow Jacket. The shaft is over 40-ft. depth with fair-grade ore showing. A. L. Arnold and Colorado associates are chiefly interested. On the Sunshine, the Twin Leasing, Bruner, and other leasing companies are



MURDOCK MINE, HIGH GRADE.

still working. In most instances operations are proceeding on a small scale.

Ft. Bidwell, October 29.

H. V. Meloy, formerly of Salt Lake City and Ely, has secured a bond and lease on the Dandy property at High Grade, of which district little has been heard of late. After a little prospecting had been done, a 10-ft. quartz lode was uncovered, carrying fair gold content. Mr. Meloy has spent some time in the district during the past summer.

Nevada County

At the Champion mine, in October, 248, 245, and 262 ft. of drifts was driven on the 1000, 1600, and 2400 north drifts respectively. This is believed to be a record for any mine in Nevada City or Grass Valley, the best previous work being at the Empire mine, where 244 ft. was accomplished, against 262 ft. on the 2400-ft. drift of the Champion. Water Leyner No. 8 air-drills were used during three 8-hour shifts per day. During one week 71 ft. was driven in one drift. One hundred and seventy rounds were blasted, breaking 4½ ft. per round, which averaged eight holes and 13 tons of rock.

Plumas County

An option has been secured on the old Kennebeck quartz mine by P. H. Daily. It is situated about 1¼ miles from Greenville, in North canyon. Three veins were cut on the top level, which was driven 600 ft. many years ago; and about eight years ago another level was driven 300 ft. lower than the former, and at 500 ft. another shoot of ore, worth $15 to $40 per ton, was cut. There is a good millsite near the lower adit, while water-power and timber are cheap. Samples from the Moonlight creek copper claims have returned gold 0.14 oz., silver 39.66 oz., and copper 18.34%, similar to a sample sent to the Selby works in 1885. The property has been opened by a 64-ft. shaft and 70-ft. drift at that depth. The Providence Hill placer deposits are being worked by ordinary mining methods, the hydraulic method having been abandoned owing to the depth of overburden being too great.

Sacramento County

A contract has been let to the Natomas Consolidated company by the California State Highway Commission for about 500,000 tons of crushed rock for the great highway scheme. This rock comes from the dredges of the district, and the above company has rock-crushing plants at Natomas near Folsom, Fair Oaks bridge, and at Oroville, each having a capacity of 1000 tons per day.

Santa Clara County

The owner, C. A. Nones, of the quicksilver mines at New Almaden, has been in San Francisco, and states that he will build a railroad from San Jose to the mines. The annual output of mercury is about 2000 flasks of 75 lb. each.

Sierra County

At the Original Sixteen to One mine, near Alleghany, a compressor plant costing $10,000 has been erected, and development is under way at No. 1 and 2 adits. An ore-shoot has been opened in No. 2 adit, which is being driven toward the Tightner property. Sinking will be started in a few days. The present company, consisting of California men, acquired the Sixteen to One in October 1911.

Trinity County

(Special Correspondence.)—Erection of a plant to recover gold and platinum from the black sand in gravel is proposed. Victor Zachett and William Klink, understood to represent Shreve & Co., the San Francisco jewelers, have recently interviewed local mine operators on the advisability of installing such a plant. The San Francisco men state they have perfected a process for the recovery of gold and platinum from black sand on a commercial basis and are ready to erect a centrally-located plant if operators guarantee the desired quantity of material. The rainy season has resulted in increased activity by the hydraulic mining companies. La Grange, the leading producer in the county, is increasing its force, and the normal number of giants will be in commission shortly. The Hupp, Union Hill, and other properties in the Weaverville district are also increasing operations.

Weaverville, November 2.

COLORADO

Gilpin County

The main shaft at the Topeka mine is down 1500 ft. On the 1300-ft. level, the vein averages 2 ft. in width and $12 per ton. At a depth of 32 ft. the Golden Gate lode shows 2 ft. of ore worth 1.4 oz. gold and 5.5 oz. silver per ton. An adit will be driven to connect with the shaft where this ore was cut. Rich ore has been opened on the 800-ft. level of the Alps mine, on Quartz hill, and 7 cords, equal to about 60 tons, is being treated at the Polar Star mill. The Gilpin Orion shaft is down 265 ft., and high-grade ore has been opened from 200-ft. depth.

Lake County (Leadville)

Efforts are being made to unwater the down-town district, that is, the Penrose and Coronado shafts, and prospect for carbonate of zinc. Arrangements are being made with lessees for this purpose. About 20 tons of ore is being shipped daily from the Sugar Loaf Consolidated adit, which is being steadily driven into the hill. Twelve men are employed. Lessees at the Ella Beeler tunnel have again opened high-grade lead-silver ore in the lower adit, and are shipping regularly. A fair quantity of native silver is mixed with the ore. At the McRae shaft, Iowa gulch, Cucumber gulch, Modoc, New Vinnie, Lime adit, and other claims, owners and lessees are busy at development or shipping ore.

Saguache County

(Special Correspondence.)—The 6235-ft. development and drainage adit of the Rawley Mining company at Bonanza, has just been completed. The bore is 7 by 8 ft. in the clear, and work was started on May 11, 1911. The primary object at the adit was to cut the principal vein of the Rawley mine at the 1200-ft. level, 600 ft. below the deepest of the old workings. The adit work was completely successful, a 6-ft. vein of good silver-copper ore having been cut 4 ft. from where it was expected. The ore has changed somewhat in character from that found in the upper workings, the lead and zinc having almost entirely disappeared. The total length of the old workings amounts to 7416 ft., most of which is in ore. Little stoping has been done on the property, it having been the policy of the company for the past six years to develop ore, and a large tonnage is now blocked out. The total time taken in driving the adit just completed was 17 months and 12 days, the work having been finished about a month ahead of the estimated time. The country along the course of the adit varied greatly in hardness and friability, it having been necessary to timber a total of 1618 ft. Considerable water was encountered, and about 1000 gal. per minute is now issuing from the portal. In the work of construction, the company consumed 41 tons of 16-lb. T-rail, 38 tons 241 lb. of powder, 33,819 caps, and 51 miles of fuse. An average of 42 men were employed in the work. Messrs. Simonds and Burns, of New York, were the consulting engineers in charge of the adit work, and Will C. Russell is manager.

Bonanza, November 1.

Teller County (Cripple Creek)

Recent development at the 1600-ft. level of the Portland has proved a fine orebody, and shipments are going out from this level. Local expectations are high as to the recent sampling of El Paso mine. Although the Cresson management does not publish the results of its work, a long rich shoot of ore has been opened on the 1260-ft. level.

The Cripple Creek district, according to the figures given by the various treatment plants, made a total production in October of 75,476 tons of ore having a gross value of $1,182,954 and an average value of $15.67, which maintains the average production so far this year.

The feature of the month was the record run at the Portland company's low-grade mill, which exceeded all pre-

vious records, handling at a big profit a total of 16,240 tons of ore averaging $3.23 per ton. The figures for the month in detail follow:

Plant.	Tons.	Average Value.	Gross Value.
Smelters	3,896	$65.00	$253,240
Golden Cycle	31,000	20.00	620,000
Portland (Colorado City).	9,899	22.00	216,778
Portland (Victor)	16,240	3.23	52,445
Stratton's Independence...	10,591	2.92	30,726
Kavanaugh	1,700	2.20	3,740
Gaylord (Dante)	1,400	3.50	4,900
Isabella (tailing)	750	1.50	1,125
Total	75,476	$15.67	$1,182,954

IDAHO

Bonner County

The Idaho Gold & Radium Mining Co. owns 1500 acres of ground, consisting of five quartz and 70 placer claims, about five miles from Leonia, on the Great Northern railroad. A dam has been built on Boulder creek, and a ditch 20 ft. wide at the top, 7 ft. wide at the bottom, and 5 ft. deep is being dug by a steam-shovel. This will take the creek water to a penstock, which will be 20 ft. above a power-plant capable of developing 5000 hp. From this plant the water will be conveyed in a flume to another intake, from which it will have a fall of 400 ft. to the giants, by which placer mining is to be done. It is stated that there is 1¾ miles of gravel to be worked on the creek bed, and plenty of fall for the tailing.

Idaho County

The shaft at the Colonel Sellers claim, of the Mineral Zone group, has reached the No. 2 level, and a station is being cut. The east drift on No. 1 level has been driven 100 ft. in good ore. Generally the mine is in good condition. At the Mascot mine, the Huntington mill is extracting a fair percentage of the gold and a concentrating table is being installed. Everything is satisfactory at the South Fork, and a 100-ton mill, driven by water-power, will be erected in the spring. Fair progress is being made at the American Eagle, North Star, and Penn-Dixie mines.

Shoshone County

In the suit between the Stewart and Ontario companies, in which the former applied for an injunction to prevent the latter from further mining ore from its property, the Stewart was denied the right to an injunction. This is another case of the law of the apex.

The Bunker Hill & Sullivan company paid, on November 4, dividend No. 182, amounting to $65,400, making a total to date of $13,846,350. The Engineering Construction Co. of Spokane will replace the timbers recently burned in the Bunker Hill mine, and other woodwork, with concrete, which will cost about $7000.

ILLINOIS

Crawford County

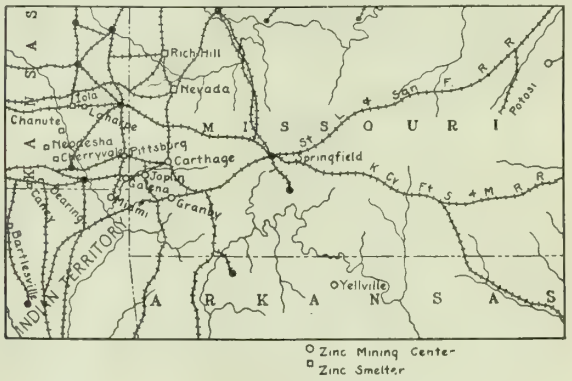
(Special Correspondence.)—Production in the Illinois oilfields is not holding up to consumption, and stored oil is being drawn on at the rate of a tank per day. Maps made by the Geological Survey offer little hope for important extensions of the local field in the Carboniferous horizons; but oil has recently been found in the Trenton below. At present there are three wells drawing oil from that horizon in the old Casey field. A fund of $100,000 is being raised by the oil companies for joint prospecting of the deeper horizons. It is proposed to expend this money in determining the geologic structure rather than with a view to finding oil immediately. The wells will be drilled under direction of a committee working in cooperation with R. S. Blatchley of the State Geological Survey. The structure once being outlined, it will be comparatively easy and economical to test the territory. Mr. Blatchley's general report on the district has been completed and is about to go to the printer.

Robinson, Illinois, October 27.

MISSOURI

St. Francois County

(Special Correspondence.)—No. 1 mill of the Doe Run Lead Co., after many years of service, was closed on October 26 and milling will be concentrated at No. 3, at Flat River. The old mill was built to handle ore from the original mine at Doe Run, and after that mine was worked out, ore was sent down from the Flat River mines to keep it going, more on account of the people living at Doe Run, than for any other reason. As compared with the newer mills, No. 1 was wasteful and inefficient, and considerable economy will result from the change.



MAP OF MISSOURI.

The opening of a new mine two miles south of Doe Run furnishes employment for the men, as it also marks a considerable extension of the district. The Federal Lead Co. has found disseminated ore near Festus, also some distance south of present workings. On October 24 the magnetic separator plant at the Federal mill was burned, though the loss will be slight. The plant was used for dressing the copper sulphide, which is found in small amounts with the lead ore. All the mines in the Flat River district are working to full capacity, though there is some labor shortage.

Flat River, Missouri, October 27.

MONTANA

Cascade County

(Special Correspondence.)—The Florence Mining & Milling Co., recently organized by Duluth capital, has overhauled the Florence mine at Neihart. The new company has installed hoisting and drilling machinery, and has erected new surface buildings and ore-bins. The shaft has been continued to the 500-ft. level, and at that depth ore is being opened. The Great Northern Railway Co. has put in a spur-line to the mine.

Neihart, November 2.

Fergus County

(Special Correspondence.)—Finch and Campbell, of Spokane, have permanently closed down the famous Kendall gold mine, at Kendall, after a successful run of 13 years. The mine has paid $1,500,000 in dividends on an original purchase price, from Harry T. Kendall, of $400,000.

Lewiston, November 2.

Missoula County

(Special Correspondence.)—The Butler Creek Coal Co. is prospecting the Neocene semi-bituminous coals on Nine Mile creek, west of Missoula. If the coal is found to be satisfactory in quantity and quality, a local market will be found from Missoula west.

Missoula, November 2.

Silverbow County

(Special Correspondence.)—The Buffalo mine of the Anaconda company has resumed work after a three weeks shutdown for shaft repairs. About 400 men are employed at this mine. The new hoisting system at the Original mine is being rapidly installed. The mine should be operating full time again by December 1. The West Colusa mine will be

closed for some time yet. Besides the installation of air hoisting engines, the main shaft is being overhauled, and a head-frame erected.

The combination concentrating and cyanide plant of the Butte Central and Boston Copper companies is something new to Butte. It is about ready to begin operations, and the outcome of the venture is being watched with interest.

Butte, November 2.

Yellowstone County

(Special Correspondence.)—Considerable interest is being taken in oil and gas in the Cottonwood district, 25 miles southwest of Billings. Two companies have been formed, the Yellowstone Oil & Gas Co. with Texas capital, and the Billings Oil Co. with Butte capital. Machinery has been ordered and drilling will be under way before the beginning of next year.

Billings, November 2.

NEVADA

Clark County

At the Yellow Pine mine, at Good Springs, the vein has been found beyond the fault, and in 20 ft. of driving has widened from 15 to 78 in., of fair grade. The mine has been opened by a 500-ft. incline shaft, and ore reserves are worth $700,000. The equipment consists of a 60-hp. Fairbanks-Morse hoist, compressor, and concentrating plant, which showed a production of $39,000 in September. Dividends of 2c. per share are paid monthly to the shareholders, who are Los Angeles people.

Esmeralda County

During the quarter ended September 30, the Goldfield Consolidated company has treated 94,145 tons of ore worth $1,245,861. Operating costs were $581,923 and construction $2079, leaving net profit at $661,859. Dividend No. 17, of 30c. per share, was paid on October 31. The San Francisco transfer agency has been closed, owing to the small amount of business done, and transfers will be made either at Goldfield or New York.

Lyon County

Over 40% of the ore smelted at the Thompson plant is mined from the Mason Valley property, the balance coming from customs shipments. During the eight days from October 7 to 14, No. 2 furnace smelted an average of 1019 tons per day, producing 66.3 tons of matte containing 42.32% of copper. A. J. McNab, superintendent of the smelter, has been inspecting the Boston & Montana plant at Great Falls, and probably two Great Falls type of converters will be installed at the Thompson plant. At present no converters are used here, matte being shipped to the Garfield smelter, in Utah.

Nye County

The fire at the sub-station of the Nevada-California Power Co. caused damage of about $20,000; and the plant will be rebuilt at once. The mines at Tonopah were shut down for about 40 hours. The week's production from all mines was 10,395 tons worth $259,895.

During October the White Caps company, of Manhattan, treated 1500 tons of ore averaging $18 per ton, at the Associated mill. Placer mines are doing well in the gulch, taking out gravel yielding over $10 per yard.

Storey County

The Mexican company has acquired a controlling interest in the Keyes-Graessler group and the Monte Cristo properties in the Sevenmile canyon, and an aerial tramway will be built from them to the Mexican mill. During the week ended November 2, the mill worked 94% of the time, and crushed 565 tons of ore averaging $29.82 per ton. The 2300-ft. level yielded 164 tons worth $66.56 per ton. At the Consolidated Virginia, the north drift on the 2300-ft. level produced 21 mine cars of ore worth $7.51 per ton. A fault has been cut on the 2500-ft. level of the Sierra Nevada northeast drift, while from the southwest drift 2½ cars of ore worth $100 per ton and 100 lb. of specimens were mined. No. 6 pump has been removed from Ward shaft.

White Pine County

The bullion tax report of the Nevada Consolidated company, as sent to the County Assessor, gives the following details:

Ore treated, tons	812,084
Gross yield	$3,297,376
Cost of mining	$534,354
" transport	212,079
" treatment	1,331,419
Net returns	1,221,524
Bullion tax	25,651

At the McGill plant No. 4 and 5 furnaces are running, and No. 1, 2, and 3 are shut down. No. 2 is being remodeled, and when finished will be 135 by 19 ft. The crown of No. 3 reverberatory collapsed during the strike, when cooling, due to shortage of ore and concentrate. Concrete work for the new roaster stack is in, and bricklayers will be at work in a few days. The centrifugal pump installed at No. 1 and 2 ponds is pumping slime, which is being treated on the Craven tables. Since the strike it is stated that many men have not been reinstated, but C. B. Lakenan reports that "there has been no case of refusal to re-engage any former employee who had quit the service of the company under intimidation, or under other circumstances controlling his individual desires, save only for reported inefficiency."

NEW MEXICO

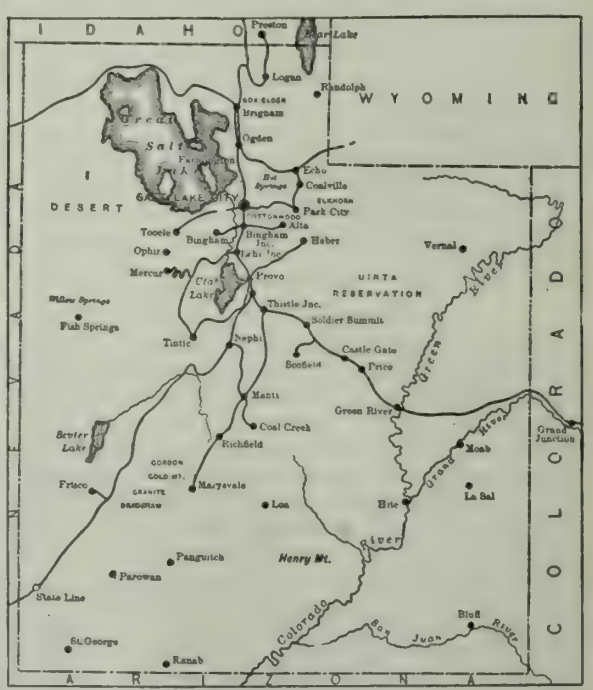
Lincoln County

The suit between the California Industrial Co. of Los Angeles and the New Mexico Mining & Milling Co., involving title to iron mines near Capitan, in this county, has been decided in favor of the former. These mines were purchased by the Los Angeles people, with the intention of using the ore in their furnaces, while the other company filed placer locations on the property, hence the suit. These large deposits are near coal deposits suitable for coke making and smelting. After spending a good deal of money in investigating the iron properties, the California company will now erect a smelter and produce pig iron.

UTAH

Beaver County

A report issued by the Horn Silver Mining Co. for the



MAP OF UTAH.

nine months ended October 1, states that ore sales, etc., realized $110,107, while mining, freight, and other expenses

totaled $93,090, leaving a balance of $17,017, which, added to the previous surplus, makes a total surplus of $39,608.

Juab County

The May Day mine shipped 18 cars of zinc ore during October, which will average $1000 per car. The mine is reported to be opening in a satisfactory way. The Chief Consolidated sent out 10 cars of ore during the week ended November 2, and as soon as the Tooele smelter is able to handle more ore, the Chief company will move a larger tonnage. The electric pumps have been taken out from the 2200-ft. level of the Centennial-Eureka, and that part of the mine will fill with water. It is stated that the pumps meant an expense of $4000 per month.

Salt Lake County

The Utah-Apex Mining Co.'s revenue from sales of 82,064 tons of ore, 15,854 tons of concentrate and royalty, during the year ended August 31, was $654,752, and mining, milling, freight, and smelting totaled $402,806, leaving a profit of $251,946, out of which $85,305 was charged to depreciation. The debt of $66,102 has been paid and bonds valued at $45,000 were bought at 10% discount. No important additions were made to surface equipment. Development included 2927 ft. of driving and raising. Reserves are estimated at 100,000 tons, and generally the prospects of the mine are satisfactory.

Conditions at the Utah Copper Co.'s mines are fast approaching a normal state, and on October 31, about 14,500 tons of ore was sent to the mills. It is estimated that the October copper yield will be about 3,000,000 pounds.

The Monetaire company, of the Little Cottonwood district, is suing the Columbus Consolidated and Extension companies, and other persons, for $500,000, being the value of ore wrongfully mined from the Haskell claim. It is estimated that 25,000 tons of ore was taken out of the disputed ground.

Summit County

It is reported that ore shipments from the Prince Consolidated from January 1 to September 30 were worth $201,914, and there is $60,000 worth of ore in transit. During the period mentioned, nearly $145,000 has been spent on permanent improvements. Shipments for the week ended November 2 were 479 tons from the Daly West, 364 from the Daly-Judge, and 344 from the Silver King.

WISCONSIN

Grant County

(Special Correspondence.)—The Grasselli Chemical Co. is about to enter this field as an important buyer of zinc ores, and is negotiating with the Vinegar Hill company. Since the Grasselli has a large business in acid making, it is especially well prepared to handle the lower-grade ores of the district.

Platteville, October 27.

CANADA

British Columbia

The Granby company shipped 26,104 tons of ore from the Phoenix mines during the week ended October 26, making a total to date for the current year of 993,205 tons. The smelter at Grand Forks dealt with 26,167, and 1,022,043 tons for the year. Shipments of blister copper to the refinery in New Jersey amounted to 18,333,500 pounds.

Cobalt

The Nipissing has paid its 27th dividend, amounting to $450,000, making a total of $9,090,000 since June 1906. On October 1 the surplus account stood at $1,523,049, consisting of cash $1,082,000, ore in transit and smelters $101,204, and ore ready for shipment $339,372. The new mill is nearly finished. Some interesting samples of dyscrasite, an antimonide of silver, containing 78 to 85% of silver and 15 to 22% of antimony, have been brought in from a group of 10 claims west of Sudbury. During the quarter ended September 30, the Wettlaufer mine produced 195,273 oz. of silver valued at $125,841, or 64.44c. per ounce. The ore reserves contain about 341,330 oz. of silver, and the mine has not shown satisfactory results from development of late. Ore shipments during the week ended October 26 were 287 tons, and bullion shipments 53,064 oz., valued at $33,846. Work has been started at several claims at the Gillies Limit. A French-Canadian syndicate has bought four claims in Gauthier and McVittie townships, owned by three French prospectors, for $250,000.

Dawson

A. N. C. Treadgold, who is greatly interested in numerous properties in this district, has begun the construction of a large ditch on lower Dominion creek, for the purpose of supplying water to sluice overburden from the claims, which will be afterward worked by dredges. The work will require the expenditure of a large amount of money. The autumn has been very mild and it is thought that the Yukon may not freeze over. The average temperature for September was 45°F., ranging from 18 to 74°.

The *Dawson Weekly News* discusses the winter mail service for the Yukon and considers that they are not getting proper treatment in the matter. Dredges in the Forty-mile district have had a good run this season. The dredge on Walker's Fork is to be taken over the hill by teams to Miller creek, as soon as sleighing becomes favorable. About 14 men will be prospecting on the Britannia and Canadian creeks during the winter. Prospects are encouraging, and the gravel on the latter creek is 150 to 250 ft. wide, while the average depth on both creeks is 14 ft. Work has been done by open-cut. The gold recovered assays $17.50 per ounce. News of rich placer gravel on Walhalla creek has come into Dawson lately, and many claims have been staked.

Porcupine

The power-plant at Waiwaitan Falls will probably be ready for trial by November, and the mines should receive power about 30 days later. The Vipond management finds that plain amalgamation will not give a high extraction on its ore, so a cyanide plant is to be erected. The Merrill process of direct treatment in presses, without agitation, will be experimented with. Operations have been resumed on the Deloro claim of the Porcupine Consolidated company, and contractors are sinking a shaft on one of the veins in the property.

MEXICO

Chihuahua

The Helena mine, situated in the Cusihuiriachic district, is shipping ore to the smelters. C. F. Sturtevant has been appointed superintendent. La Fe mine, situated at kilometre 105 on the Orient road, has five cars of copper ore ready for shipment.

Jalisco

During September, El Favor Mining Co. shipped 267 tons of ore to the smelter and milled a similar quantity, the total yield being ₱48,813. Operating expenses were ₱26,496, and profit ₱22,317. The mill lost 58% of the available running time through accidents. Work has been started on the east side of El Favor mountain, where a vein was cut on the Constancia claim. The September output of the Mololoa company was valued at ₱28,942, and profit only ₱3543, due to heavy development expenses. The Amajac company is resuming work at its Refugio and Las Animas mines, in the Hostotipaquillo district, and will erect a cyanide plant. W. J. Pentland, formerly with the El Oro company, at El Oro, is general manager. A good deal of development has been done, and experimenting on old tailing in the Amajac patio; but the revolution has hindered general operations.

During September the Esperanza mill worked 27 days and crushed 7891 tons of ore, and treated 11,402 tons of tailing, while 203 tons of concentrate was sent to the smelter. The total yield was valued at $115,168, and expenses were $89,050, leaving a profit of $26,118, of which $2500 was spent on construction and London expenses. Development covered 685 feet.

Personal

Professional men are invited to send news of their engagements and travels. Such news is interesting to friends.

S. H. Ball is in Nevada.

C. E. Virden is here from Butte.

Albert Burch has gone to Arizona.

H. P. Henderson is in San Francisco.

Jesse Poundstone was in town recently.

George E. Farish is in British Columbia.

H. Foster Bain has returned from the East.

Charles Kimball has returned from Alaska.

C. A. Nones has returned from Calaveras county.

Lionel Lindsay is on a six weeks trip to Arizona.

C. F. Tolman has returned from the Coeur d'Alene.

Edmund Juessen has returned from the Southwest.

D. M. Shanks was in San Francisco during the week.

A. Y. Smith has returned to Salt Lake City from Pioche.

J. P. Hutchins has been examining mines in northern Finland.

Gelasio Caetani is in the Southwest on professional business.

C. W. Purington sailed from New York for London on November 6.

Kirby Thomas has returned to New York from a visit to Sudbury, Ontario.

H. E. Symons has returned to Semipalatinsk in Southern Siberia, from Nicolaievsk and Vladivostok.

E. M. Wilkinson has returned from Tuolumne county and will be near Fallon, Nevada, for a month.

W. W. Tiner, who has been prospecting alluvial ground on the Lower Amur, Eastern Siberia, is returning to San Jose, California.

W. S. Keith has severed his connection with the F. B. Keener mining companies and will open an office as consulting mining engineer at Dutch Flat, California.

The following members of the American Institute of Mining Engineers were in attendance at the meeting at Cleveland, October 28: Robert Abbott, M. A. Ammon, A Arluck, A. O. Backert, H. Foster Bain, H. A. Barren, E. H. Benjamin, C. A. Bever, R. P. Bowler, W. H. Blauvelt, A. I. Braid, J. H. Byrne, C. S. Carey, H. O. Chute, Thomas H. Clagett, W. W. Coe, George L. Collord, E. I. Cook, C. R. Corning, J. S. Cox, Jr., W. N. Crafts, S. W. Croxton, A. T. Croxton, H. G. Dalton, A. E. Danforth, E. V. D'Invilliers, L. E. Dunham, F. A. Emmerton, W. E. C. Eustis, A. H. Eustis, A. I. Findley, E. L. Ford, P. A. Fruehauf, C. H. Fulton, H. F. Fullton, James Gayley, S. L. Goodale, H. C. Hale, A. V. Hansell, J. W. Hamilton, H. T. Harrison, Elwood Haynes, H. H. Hindshaw, H. D. Hibbard, G. S. Humphrey, R. W. Hunt, J. D. Ireland, L. E. Ives, Zay Jeffries, F. G. Jewitt, J. E. Johnson, Jr., Nason Johnson, William Kelley, J. F. Kemp, Charles Kirchhoff, William Koehler, H. M. LaFollette, Frederick Laist, E. F. Lake, H. W. Lash, A. R. Ledoux, I. P. Lihme, J. B. Livingston, E. J. Longyear, D. A. Lyon, W. W. Macon, James W. Malcolmson, H. A. Marting, Samuel Mather, S. McMarshall, Paul O. Menke, H. G. Merry, P. N. Moore, C. B. Murray, E. W. Parker, H. H. Parrock, William Pecanka, J. S. Pelton, G. W. Pfeiffer, S. H. Pitkin, Franklin Playter, J. D. Price, John M. Price, Charles F. Rand, William Rattle, Jr., J. B. Read, J. C. Reitz, F. B. Rich, G. A. Reinhardt, C. S. Robinson, E. F. Roeber, W. N. Sawyer, F. Schniewind, W. Schumacher, R. B. Sheridan, J. M. Sherrerd, A. W. Smith, E. Gybbon Spillsbury, H. S. Stebbins, S. C. Stillwagon, H. H. Stoek, Bradley Stoughton, Joseph Struthers, Knox Taylor, Oscar Textor, R. B. Textor, J. E. Thropp, Jr., F. H. Treat, B. W. Vallat, F. R. Van Horn, Karl E. Volk, Fred F. Walther, C. M. Weld, S. T. Wellman, Edmund Wendel, C. L. Wood, Walter Wood, H. B. B. Yergason, Carl Zapffe.

Market Reports

LOCAL METAL PRICES

San Francisco November 7.

Antimony	11—11½c	Quicksilver (flask)	$41.50
Electrolytic Copper	18—18½c	Tin	52—53½c
Pig Lead	5.00—5.05c	Spelter	8¼—8½c

Zinc dust, 1400 lb. casks, per 100 lb., small lots $9.50—9.75; large $7.50—8.00

METAL PRICES

(By wire from New York.)

NEW YORK, November 6.—Copper is quiet, since buyers are still holding off. Lead is also quiet and weaker, since there now is some pressure to sell. Spelter remains quiet but steady. Average daily prices for the past week, in cents per pound, based on wholesale transactions, standard brands, are given below.

Date.	Electrolytic Copper.	Lead.	Spelter.	Silver, per oz.
Oct. 31	17.12	4.98	7.20	62⅞
Nov. 1	17.10	4.98	7.20	62½
" 2	17.10	4.89	7.20	62½
" 3	Sunday.	No market.		
" 4	17.10	4.85	7.20	62⅜
" 5	Holiday.	No market.		
" 6	17.12	4.73	7.20	62⅜

LONDON QUOTATIONS

(By cable, through the courtesy of C. S. Burton & Co., New York.)

	November 7.
Camp Bird Ltd	£ 6½
El Oro	4⅜
Esperanza	9⅜
Oroville Dredging	1½
Santa Gertrudis	6⅝
Tomboy	6⅞

COPPER SHARES—BOSTON

(By courtesy of J. C. Wilson, Mills Building.)

	Closing prices, November 7.		Closing Prices November 7.
Adventure	$ 7	Mohawk	$ 65½
Allouez	42	North Butte	36½
Calumet & Arizona	79	Old Dominion	59
Calumet & Hecla	575	Osceola	109
Centennial	20½	Quincy	85
Copper Range	56⅜	Shannon	14½
Daly West	3⅜	Superior & Boston	2
Franklin	10⅜	Tamarack	41
Granby	69½	Trinity	5⅜
Greene Cananea, ctf.	9⅛	Utah Con	12
Isle-Royale	34½	Victoria	2⅜
La Salle	5	Winona	4½
Mass Copper	6⅜	Wolverine	77

NEVADA STOCKS

(By courtesy of San Francisco Stock Exchange.)

San Francisco, November 7.

Atlanta	$ .18	Montana-Tonopah	$2.12
Belcher	.29	Nevada Hills	1.50
Belmont	9.30	North Star	.36
Big Four	.42	Ophir	.55
Con. Virginia	.33	Pittsburg Silver Peak	.88
Crown Point	.40	Round Mountain	.36
Florence	.75	Sierra Nevada	.33
Goldfield Con.	2.50	Tonopah Extension	2.55
Halifax	1.60	Tonopah Merger	.97
Jim Butler	.70	Tonopah of Nevada	6.37
Jumbo Extension	.31	Union	.49
MacNamara	.21	Vernal	.10
Mexican	2.27	West End	1.62
Midway	.45	Yellow Jacket	.40

MINING STOCK QUOTATIONS—NEW YORK

(By wire from C. S. Burton & Co., New York.)

	Closing Prices. November 7.		Closing Prices. November 7.
Alaska Mexican	$ 14½	McKinley-Darragh	$ 1⅞
Alaska Treadwell	38½	Miami Copper	29
Alaska United	23½	Mines Co. of America	2⅜
Amalgamated Copper	86⅜	Nevada Con	22½
A. S. & R. Co.	84½	Nipissing	8⅛
Braden Copper	7⅜	Ohio Copper	1⅜
B. C. Copper Co.	4½	Ray Con	22⅜
Chino	49	Tenn. Copper	41⅜
First National	2⅜	Tonopah Belmont	9⅜
Giroux	4⅛	Tonopah Ex	2½
Goldfield Con.	2⅜	Tonopah Mining	6½
Greene-Cananea	10	Trinity	6⅛
Hollinger	15	Tuolumne Copper	2⅜
Inspiration	20	Utah Copper	64½
Kerr Lake	2⅜	West End	1⅜
La Rose	2⅜	Yukon Gold	3⅜
Mason Valley	12⅛		

Company Reports

SIMMER & JACK PROPRIETARY, LTD.

This company was reconstructed in 1896 and has an authorized capital of £3,000,000, all issued and fully paid. The following table shows the results for the year ended June 30, 1912:

Development done, feet	4,566
Ore reserves, tons, at $6.20 per ton	2,680,000
Ore mined during year, tons	922,624
Percentage of waste sorted out	7.15
Average number of stamps working	320
Average number of tube-mills	7
Ore crushed, tons	863,500
Stamp-duty, per day, tons	7.45
Costs: Mining, per ton	$1.70
Development, per ton	0.07
Ore transport and crushing, per ton	0.09
Milling, per ton	0.22
Tube-mills, per ton	0.14
Sand treatment, per ton	0.23
Slime treatment, per ton	0.11
General charges, per ton	0.24
Renewals, etc., per ton	0.02
Total cost per ton	$2.84
Total cost	$2,555,000
Working profit	2,646,000
Dividends	2,240,000

The report states that sand-filling of worked-out areas has been so successfully carried out on a comparatively small scale during the past two years it has been decided to extend the system, and new plant for this purpose is in course of erection. A magnetic separator was installed in the tube-mill circuit, the slime plant enlarged, and sundry improvements made to plant.

GRANBY CONSOLIDATED MINING, SMELTING & POWER CO., LTD.

The annual report of this important company for the year ended June 30, 1912, shows the following details:

On account of a strike, working time was only 237 days.

Ore smelted from Granby mines, tons	721,719
Ore smelted from other mines, tons	17,800
Average recovery per ton:	
Copper, pounds	18.39
Silver, ounces	0.29
Gold, ounces	0.043
Metal production:	
Copper, pounds	13,231,121
Silver, ounces	225,305
Gold, ounces	33,932
Cost per ton, excluding marketing blister copper	$2.90
Revenue	$2,874,760
Expenditure	2,291,381
Net profit	583,379
Depreciation, etc.	600,562
Assets:	
Fuel and supplies	164,191
Cash and copper	791,789
Liabilities:	
Dividends held	1,603
Accounts payable	19,539
Surplus	2,516,121

At the annual meeting of stockholders the number of directors was reduced from 15 to 13, and by-laws were amended to the effect that officers' salaries should be fixed by the board instead of by shareholders, as formerly. The report states that, since resuming operations at the smelter on December 21, 1911, general results have been satisfactory except for the excessive cost of coke. The plant is in excellent condition, and there is no reason why as good or better results may not be expected in the future. A good deal of prospecting has been done in the country around Grand Forks and Phoenix for a radius of 200 miles, and several claims have merit, but will be considered later on. Already $200,000 has been spent at the Hidden Creek property, and it is estimated that about $1,600,000 more will have to be spent on development and equipment. There is 5,000,000 tons of ore actually opened, averaging 2.2% copper, against the Phoenix average of 1.25%. The Bonanza group of claims, about one mile from the Hidden Creek smelter site, are under option by the Granby company, and a large deposit developed, assaying from 3 to 11% copper. If development continues favorable, the property will be taken over, the option price being low.

EL ORO MINING & RAILWAY CO., LTD.

Compared with the year ended June 30, 1911, the last annual report of this company shows a decrease of $171,000 in profit, due to the smaller output for the six months ended June 30, 1912. It was decided, at the beginning of the current year, on account of the state of the San Rafael vein in the upper portion of the mine, to reduce the annual profit to about $730,000. Under this policy the quantity mined was limited to 20,000 tons of ore per month, in addition to the treatment of 15,000 tons of accumulated tailing; and since the end of March 35,000 tons has been handled. In A. F. Main's report it is stated that on the San Rafael vein very little ore may be expected from the 286-ft. level to the andesite capping, between the north shaft and boundary. The 386 and 486-ft. levels in this section will yield a small tonnage of low but workable grade ore, while development in the northern part of the 550-ft. level has added to the reserves of $7 ore. About 20,000 tons of ore has been opened in the southern orebody between the incline and San Rafael shafts. On the 1150-ft. level north of the Somera shaft, the Branch vein is 4 ft. wide, averaging $25 per ton, and there will be a stoping length of 700 ft. of $20 ore on this orebody. At the 1300-ft. level the San Rafael vein shows a width of 30 to 50 ft. of poor ore. The Branch vein, on the intermediate drift, between the 1150 and 1300-ft. levels, shows 250 ft. of $25 ore, 4 ft. wide. On the 1450-ft. level the cross-cut from the Somera shaft passed through a lode 12 ft. wide, but of little account, at 115 ft. west; and at 190 ft. from the shaft, cut another poor lode, 23 ft. wide. On the 1600-ft. level the cross-cut, at 320 ft., cut a lode 18 ft. wide, but valueless. Development in the Somera claim has added considerably to the reserves above the Zero level. The shaft on the Carmen property is to be used to prospect the southern portion of El Oro claim, which is at present unexplored. On the 1600-ft. level a 500-gal. capacity electric pump has been installed, and another one is to be placed on the same level. Ore reserves total 301,934 tons averaging $9.26 per ton. The following table shows the results of the past year's work:

Ore treated, tons	302,698
Tailing treated, tons	84,459
Average stamp-duty per day, tons	8.88
Extraction:	
Gold, per cent	87.51
Silver, per cent	74.23
Assay value, per cent	85.14
Bullion recovered	$2,228,190
Costs:	
Mining, per ton	$1.47
Treatment, per ton	1.12
Development, etc.	1.10
Total	3.69
Total expenditure	$1,430,119
Profit from railway	120,220
Total profit	910,000
Dividends paid	715,000
Carried forward	398,000

The report is presented in the usual lucid style customary with many English and few American mining companies.

Concentrates

Most of these are in reply to questions received by mail. Our readers are invited to ask questions and give information dealing with the practice of mining, milling, and smelting.

TREATMENT at the Cam & Motor mine, in Rhodesia, will consist of crushing, roasting, fine grinding, and cyaniding about 15,000 tons of ore per month. One of the metallurgical troubles in this country is antimony.

DIAMONDS valued at $27,320,000 were produced by the De Beers company during the year ended June 30, 1912. The stocks of 'blue ground' on the floors at that date totaled 10,416,429 'loads' of about 1800 lb. each. The yield is from 0.23 to 0.41 carat per 'load.'

DYNAMITE manufactured by the Cape Explosives Works, owned by De Beers diamond company, of South Africa, amounted to 423,799 cases during the year ended June 30, 1912. This is mainly used at the diamond mines, and the gold mines on the Rand.

CYANIDE RASH may be relieved by applying a mixture of 3 oz. of camphor dissolved in one pint of olive oil, by heating. This complaint is mainly external, that is, the condition of the blood has little to do with it, as perfectly healthy men are troubled, and medicine is not necessary. Another treatment is the application of a fairly strong solution of potassium permanganate, which dries up the rash in quick time.

EXPERIENCE has shown that, to a large extent, the safety of workmen and the efficiency of mine management depend on the length of term of office of mine officials. No advantage can be gained by frequent changes of the personnel of a mine. At the same time, there have been numerous cases in which mine officials are 'married to the job,' so to speak, and get very careless unless given an occasional shake-up.

MINE fires, like most other fires, start in a small way, only excepting those starting from explosions of gas or coal-dust. A large proportion of them, like other fires, are caused by carelessness, particularly in metal mines. In coal mines, and in some sulphide-ore mines, fires may originate from spontaneous combustion in the filled or broken ground; yet even such a cause often may be attributed to improper and preventable conditions, or to a wrong system of mining.

URANIUM in the United States excites popular interest on account of its connection with radium, the properties of which appear so marvelous when compared with those of more familiar materials. But very little uranium is mined in this country except as it is incidentally taken out in mining carnotite for vanadium, according to the United States Geological Survey. In 1911 the uranium mined amounted to about 21.2 tons. A few hundred pounds of pitchblende was mined from the German mine, at Central City, Colorado, but this material was not sold, as it was said to have been used in experimental work. The extraction of radium has been attempted in the United States by several persons and firms. Some of these have given up their efforts, but others are still at work, with what success is unknown. The uses of uranium and its compounds are comparatively few. It is employed principally for making yellow glass, for yellow glazes on pottery, and in a less degree as a chemical reagent. Yellow glass made with uranium oxide is known as opalescent. Direct light shining through it gives a yellow color and indirect light a greenish yellow. Some of the firms which have attempted to use uranium in the manufacture of steel have abandoned such experiments, the claim being made that it apparently imparts about the same properties as tungsten and is very much more expensive.

Recent Publications

GEOLOGIC ATLAS OF THE UNITED STATES. LLANO-BURNET FOLIO, TEXAS. By S. Paige. U. S. Geological Survey Folio No. 183. 23 pp., ill., maps. Washington, 1912.

REPORT ON THE BUILDING AND ORNAMENTAL STONES OF CANADA. Vol. I. By W. A. Parks. Department of Mines publication. 376 pp., ill, maps, plans, index. Ottawa, 1912.

THE COKING OF COAL AT LOW TEMPERATURE, WITH A PRELIMINARY STUDY OF THE BY-PRODUCTS. By S. W. Parr and H. L. Olin. University of Illinois Bulletin 30. 46 pp., ill. Urbana, June 1912.

THE COAL FIELDS OF KING COUNTY. By G. W. Evans. Washington State Geol. Survey, Bulletin No. 3. H. Landes, Geologist. 247 pp.; ill., maps, index. Olympia, 1912. This publication contains eight chapters under the following heads: (1) Geology of Coal; (2) General Geology of the King County Coalfields; (3) Detailed Geology of King County Coalfields; (4) Classification of Coal Lands; (5) Coal Mines of King County; (6) Coal-Mining Methods; (7) General Character of King County Coal; and (8) Markets for King County Coal. In the above chapters, every detail has been carefully discussed, while there are numerous maps of the districts and photographs of plants connected with the mines.

OUTLINE OF THE SMOKE INVESTIGATION. Bulletin No. 1, Department of Industrial Research, University of Pittsburgh. 16 pp. Pittsburgh, August 1912. The soot question in large, and especially in industrial cities, is one of considerable concern. Besides several million tons of coke and large quantities of natural gas, 16,500,000 tons of coal is used in Pittsburg annually, with the result that the smoke thus produced is a nuisance. The staff of the University of Pittsburgh in charge of the investigation includes R. C. Benner and 26 engineers, botanists, chemists, physicians, meteorologists, and others, who have two problems to decide, the analytical or diagnostic, and the constructive or remedial. This bulletin contains short discussions on the first problem, and is of considerable interest to all inhabitants of cities.

PROCEEDINGS OF THE SYDNEY UNIVERSITY ENGINEERING SOCIETY, 1911. Edited by J. P. V. Madson, R. J. Boyd, F. D. Power, and E. W. McKeown. 163 pp.; ill., diagrams. Sydney, New South Wales, 1912. This publication deals with the proceedings of the 1911-12 session, and contains the following interesting papers and other matter: Presidential address by W. E. Cook, who discussed 'The Biological Purification of Sewage'; 'Metallurgical Treatment at Mt. Morgan, Queensland,' by G. J. Saunders, in which chlorination of the sulphide and smelting of the copper ores was fully explained; 'The Design of Storm-Water Drains,' by J. Vicars; 'Notes on Harbor Engineering,' by H. D. Walsh, a valuable discussion on construction of wharves, sheds, etc., of wood and reinforced concrete; and 'The Artificial Lighting of Buildings,' by H. G. Carter and J. B. Campbell.

PORTLAND CEMENT RESOURCES OF ILLINOIS. By A. V. Bleininger, S. F. Lines, and F. E. Layman. State Geological Survey Bulletin No. 17. 115 pp.; ill., index. Urbana, Illinois, 1912. The production of portland cement in Illinois in 1910 was 4,459,450 bbl., out of the total in the United States of 76,549,951 bbl., averaging 89c. per barrel. This report is of value and interest, in that it contains a thorough description of the raw materials for, and the processes of, manufacture of cement. In a not too technical manner the former is described, while the latter is of interest in the details given of mining or quarrying limestone and clay; crushing by Gates or Blake breakers; drying in rotary driers; intermediate grinding in ball or other mills; fine-grinding in Griffin or tube-mills; and calcining in rotary kilns, the clinker being ground in a variety of mills. A short chapter is given on testing cement. Chapter IV deals with the stratigraphy of Illinois with reference to portland cement materials.

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EDITORIAL

ATTEMPTS by China to borrow $50,000,000 from London bankers have furnished 'copy' for journals the world over for months; the $50,000,000 bond issue for state highways voted on in New York state on Tuesday of last week was given only a couple of lines at the bottom of the column in financial and technical journals.

RESULTS at Stratton's Independence, as noted in our news columns, are peculiarly gratifying. Not only are the low-grade ores being treated at a surprisingly low cost, but the figures realized, $1.503 per ton, are even slightly better than the estimate of $1.52 made by Mr. Philip Argall before the work was undertaken. Such an outcome is of direct benefit to the members of the profession everywhere, since they give renewed confidence in the ability of an engineer to forecast results.

PROTEST against increase of the rate of pay of shovelers in Arizona mines to $4 per shift is another evidence of the slight regard in which his important activity is held. Designated as a 'mucker,' 'mullocker,' or 'bogger-out,' epithets which contain little of compliment, his work has an important influence on the total cost of operation, and its many unpleasant features deserve a corresponding wage. The fundamental criterion is to pay such a wage as will operate to get the most work done at the least total cost per ton.

FUN of good wholesome sort is to be generously mingled with the serious sessions of the American Mining Congress at Spokane, November 25 to 29, inclusive. In particular an old-time mining camp, 'Taylor Gulch,' is to be reproduced two nights of the week in a large building available for that purpose. Following the meeting proper there will be a two-day excursion to the Coeur d'Alene, affording opportunity to visit the Bunker Hill & Sullivan, Morning, and other of the great mines of that district. In the program prominence is being given to Alaskan problems and a large delegation from the North is anticipated. Land laws, miners' compensation, taxation of mines, and other topics of direct and live interest will be discussed, and every mining man who can do so should arrange to attend and take part.

CABINET-MAKERS are busy volunteering advice to Mr. Wilson. One of the most sensible suggestions is that an engineer should be chosen as head of one of the departments, preferably that of Interior. In view of the large amount of engineering work that the Government always has under way, the President should have among his closest advisers one who is thoroughly familiar with engineering procedure and practice. If such a man be placed at the head of the Department of Interior, it would be particularly appropriate to have a mining engineer chosen, since the greater problems of the West are intimately connected with mining. In the past there has been too much of a disposition to leave everything to lawyers, and we are firmly persuaded that results will be much more satisfactory if men of many lines of training be made responsible for administration of our common affairs.

HUNT for new avenues for consumption of copper sometimes verges on the absurd. Our New York correspondent refers to the computations regarding the cartridge cases required in the war now in progress in the Balkans. It is, of course, unkind to suggest that empty cartridge cases may be picked up and sold as scrap, especially in a country where labor is cheap and abundant. The beneficial effect of the presence of copper in steel rails has also been widely commented upon as a possible demand for copper. Many iron ores contain small amounts of copper, the ore from Ta-yeh, China, contains 0.05 to 0.25 per cent copper, while ores from Cornwall and other places contain perceptible amounts of that metal. Even if the use of copper-bearing steel should become general in railroad practice, it is only reasonable to suppose that a part of the copper necessary will be secured by the utilization of ores containing it, and in any case the amount necessary would not exceed a small fraction of one per cent of the present annual production.

COMPARISON of the crushing effected by stamps and grinding pans in the article on Huntington mills at Kalgoorlie is of much interest. That the stamp-mill does its best work upon rather hard brittle ores, while machines which depend upon pressure and trituration for their crushing effect make a correspondingly good showing upon softer oxidized ores ought to be generally known, but, like most truths, will bear repetition. There is often too much of a tendency, especially among those of limited experience, to adhere to a single type of machine, in the mistaken belief that better results will be obtained in this way than by attempting to learn the 'kinks' of an unfamiliar type. Reasoning of this sort appeals more strongly to the shift-boss than to the manager, and while it has a certain amount of force in some cases, it should not be allowed too much emphasis. When machinery is carefully chosen, in view of the work it is called upon to perform, the best results will follow in the end. The stubbornest workman can eventually be trained, or at any rate discharged, but a tube-mill can never be altered into a coarse-crushing device, nor a gyratory crusher adapted for all-sliming.

BORROWING money is a difficult task, as many individuals have found. It is now reported that the attempt to secure funds for the new Chinese republic outside the international group of bankers who have the support of their respective governments, has proved a failure and negotiations with the six-power group are to be resumed. Not improbably they will be quickly carried to a conclusion, since China has shown sufficient spirit so that impossible terms will not be asked, while the strength of the group of bankers is so evident that further attempts to secure large sums without their coöperation will be discouraged. It is impossible to unravel the threads of diplomatic intercourse, but it has all along been evident that a string of political privilege was at first tied around the foreign banknotes. China properly resented this, but, on the other hand, she is not in a position to stand upon her dignity in regard to foreign supervision of the accounts of the salt gabelle which was to form part of the security for the new loan. It is even doubtful if it is wise for her to object to this; the Imperial Maritime Customs, which has for years been under able foreign supervision, has been the greatest and most effective educational institution in the nation, and the present excellent post-office, telegraph, and telephone systems which China enjoys are the direct outgrowth of its influence and activity. Chinese autonomy did not suffer in this case by utilizing the skill and experience of the foreigner, and it is not improbable that history would repeat itself were a similar course of action now followed.

Taking Care of the Workman

Care for the welfare of employees is an essential phase of the business management of large enterprises. Quite aside from any humanitarian aspects of the matter, it is good business to see that workmen are well fed, well housed, well clothed, and free from causes of worry and discontent, since under these conditions the laborer is able to do more work of better quality. The careful study given this matter during the last two decades is one of the most important features of modern social progress. The relations of employer and employee have exhibited a pendulum-like swing since medieval times. In feudal times the overlord looked after every phase of the welfare of his retainer, in theory, but in practice so neglected his responsibilities and abused his powers that industrial revolution followed and the relations of the laborer and the *entrepreneur* were sharply defined by being put upon the simple basis of a money return for labor performed. Now that the rights of the individual are clearly established and we are making encouraging progress in the control of large aggregations of capital, with their collateral power for good or ill, it is becoming evident to all that so simple a relation between employer and employee does not completely fulfill the condition of securing the maximum of desirable result from the minimum of expenditure of energy, conveniently represented by money. The *entrepreneur* can, in many ways, perform much greater service for the laborer with ten cents of his wage, than the laborer can do for himself, just as a street-car company can operate its lines at a profit from the nickels collected from the passengers, whereas the individual passengers could not individually buy the service even for a many times greater sum. The profits made by insurance companies have served as an educational agency, and their significance cannot be gainsaid. As a result, progress toward providing for insurance against sickness and accidents, and even the pensioning of superannuated employees in those cases where the number employed is great enough to make it practicable and desirable to undertake such service has been rapid. Pensioning of state and Federal employees under certain circumstances has been practised for some time, while private corporations often make provision for insuring employees against loss of earning power through sickness or accident. The most recent application of this method of increasing the welfare of the employee is its adoption by the affiliated companies which make up the Bell telephone system. From the funds of the corporate enterprise, which employs 175,000 men, the sum of $10,000,000 has been set aside to provide the income necessary to pay sickness, accident, and death benefits, and to provide pensions for all employees over the age of 60 years, who have been over 20 years in the employ of the company. This fund is to be administered by a committee of five employees appointed by the Bell company, and, if well administered, as no doubt it will be, the benefit to the employees of the company will be many times greater than if the same amount of money were expended in increasing the individual wage. Provision against want in old age has not the atractive clink of a little extra money in the pay envelope, and education of the employee as well as of employer is necessary to secure the full realization of the usefulness and importance of progress in this regard.

Equally useful service for the employee can be secured in other ways, and it is interesting to notice that the Great Cobar, Limited, in the enterprises under its direction in New South Wales has undertaken to provide employees with food at a reasonable rate and maintains for that purpose a bakery and butcher shop. It is obviously an exhibition of better business management for the company to expend small amounts in providing its men with bread

and meat of good quality at the minimum price than to increase wages and have the increase go to swell the profits of the local merchant, who, though his enterprise is legitimate enough, does not directly benefit either employer or employee. A similar system has been employed for many years by several of the principal mining companies of Japan. Company stores there sell rice, the chief article of diet, to the workman at a uniform rate throughout the year; the rate being slightly less than the average price for the year, and the slight loss thus accruing to the company is charged to the wage account. The workman, on the other hand, is protected from sudden variations in the cost of food; in other words, the industry protects the individual from fluctuations which affect his welfare, but over which he has no control. A similar practice is followed by some American companies, and the Alaska Treadwell, for example, maintains a company store in order to keep the price of the necessaries of life in that district at a level which will prevent the exploitation of workmen by local merchants, and has recently put in force a system providing for inspection to secure the safety of employees and the payment of compensation for accidents. Theorists may object that this is paternalism, but the average workman is a pragmatic philosopher, and when he realizes the best results for himself can be secured by methods such as these, is not likely to be frightened by a name.

Patents and Litigation

Announcement was made last week by the United States Circuit Court of Appeals for the Third District, of its decision in the case of The Moore Filter Company *v.* Tonopah Belmont Development Company, heard on appeal from the Circuit Court of the United States for the District of New Jersey. The questions at issue involved the validity of the Moore patents and their infringement by the Butters Patent Vacuum Filter Company, which concern, in accordance with its agreements with users of the Butters filter, has been defending the suit. The result of protracted and expensive litigation is a sweeping decision sustaining the Moore patents, and the cause is remitted to the lower court with instructions to enter a decree adjudging infringement and for such action in the way of injunction and accounting as it shall deem fitting. Faulty wording of a telegram led us to announce the decision last week as from the Supreme Court, though the difference is not, for present purposes, material. The full text of the decree of the court will be printed next week, and we shall reserve until that time a specific discussion of the matter. The occasion seems appropriate, however, for taking up one defect of present practice as regards patented articles and its effects on machinery users.

In considering the litigation over filters, roasting furnaces, concentrating tables, or any one of a dozen other devices used in mining or metallurgy, the engineer is impressed most of all by the enormous amount of time, energy, and money required under existing conditions to establish and defend a patent to even the most useful invention. To men employed in mining and treating ores, this expenditure appears to be nothing but economic waste. Whatever may be the individual profits or losses, it is difficult to see any adequate return to the industry that the inventions were designed to serve; and in the long run the cost of all such litigation must be borne by the mines. In one case a company has spent nearly $150,000 in defending patents on one of the most useful machines given to the miners in recent years, and even yet is far from having a clear field. Probably much larger sums have been spent by others, and the total amount involved in court expenses, attorneys' fees, and preparation of expert testimony forms a staggering total. It is only the work of the technical expert in preparing for a case and in giving testimony, that is likely to be of any economic service to industry, and even then the money and time could be expended to greater advantage in impartial research. The buyer of machinery is wholly at sea. He no sooner purchases his mill and begins operations than he is served with an injunction or a notice that royalties will be claimed by a rival patentee. He is constantly exposed to the danger of paying double for the use of a piece of apparatus. It is impracticable for each buyer to personally investigate the rights of rival claimants and he could in any event come to no valid conclusion, since the inventor himself does not know his own rights until they have been adjudicated by the courts. Often patented articles are sold under guarantees of protection by the selling company, but the latter is usually a limited liability concern and protection adequate in a specific case breaks down before a general onslaught. Insurance companies in San Francisco, for example, had always afforded adequate protection against fire losses, but the conflagration of 1906 bankrupted many and left policy-holders unprotected. It would take much less to sweep away the protection given many buyers and users of patented articles.

There is a general and mistaken impression as to the protection afforded by a patent. Cynical observers say that a United States patent merely affords the holder the right to go into court, and there is entirely too much of truth in this assertion. In patent cases too many matters are now left to the courts, and in these, as other cases, complexity of procedure leads to practical denial of justice. In a specific case now being litigated where the validity of a particular patent had already been adjudged, suit for infringement with application for injunction, was brought before an able and impartial judge. He asked that the application for injunction be withdrawn because, as he said, the case was so simple that the whole matter might well be decided in sixty days. In fact the case is still before the court, after two years, despite the best efforts of the prosecution to secure trial. In the meantime the presumable infringers have manufactured and sold the competing device. In many cases the infringer is not so much mistaken as dishonest, and there is a lucrative business for patent experts and attorneys who care for such practice, in devising means whereby a client may 'get around a patent.' Owing to the law's delay an infringer of no financial standing can manufacture and sell for years, making enough to keep up pretense of a fight, and eventually leaving his victims to account later with the successful litigant.

There is abundant room under existing conditions for honest differences of opinion, as exemplified by the Moore-Butters and other famous cases, and a reasonable burden of expense in such connection is probably unavoidable, but between the defects of the patent law, the inadequacy of patent examinations, and the growing tangle of court procedure, there is a far heavier burden of unjustifiable expense due to dishonesty and fraud. We are not concerned here with assessment of blame so much as recital of facts, nor are we attempting to discuss all the defects or any of the remedies. We would, however, insist that the condition is serious, and we would emphasize the fact that every user of a patented article has a direct financial interest in seeing that a simpler method be devised for securing even justice between rival patentees. The mining and metallurgical industries in particular need the best efforts of the best men to improve practice, if the output of metals is to keep pace with the world's increasing demand, and neither industry is so rich as to permit it to submit tamely to continued and unnecessary waste of time, energy, and capital.

Huntington Mill Practice at Kalgoorlie

By M. W. von Bernewitz

It is doubtful whether a better insight into the working of the Huntington mill can anywhere be obtained than on the Kalgoorlie field, where at the present time there are ten mills at work. In the outside districts there are ten more, and at Ora Banda a large plant with four mills has just started. While this article deals chiefly with Huntington mill practice, an attempt has been made to discuss the treatment of low-grade oxidized ores at the small mines and a comparison is made with stamps on similar ores around Kalgoorlie, more especially at the north end, about three miles from the 'Golden Mile.'

To give an idea of the ores handled at these plants, a quotation from Larcombe's 'Geology of Kalgoorlie' will suffice: "In ores from the zone of oxidation much iron oxide is present, varying from ochreous varieties to hard compact ironstone, with which is associated much ferruginous clay or kaolin, resulting from the decomposition of the country rock. Quartz is also present, representing the silica remaining after the breaking up of the small veins characteristic of the deeper zones." The ore deposits of the north end are somewhat different from those at the south end of the field, however, but no doubt the oxidized product is similar, with the exception of containing less quartz. The veins at the north end are generally small, and in consequence much clay and ironstone can be expected in the oxidized product. An analysis of this ore shows:

	%		%
SiO_2	50 to 65	Al_2O_3	10
$CaCO_3$	7	Fe_2O_3	12
$MgCO_3$	5		

In these small mines the workings are by open-cut, or from depths of 150 ft. The Golden Dream, for example, in its last half yearly report, gives the width and average assays of three veins; 30 ft. of $1.80 ore, 15 ft. of $2.16 ore, and 30 ft. of $2.60 ore, 7000 tons worth $2.60 per ton being ready to mine. At several of these small mines the ore is hoisted by means of Taylor friction hoists. This machine consists of a single drum driven by a grooved or friction pinion, in turn driven by a motor. The man on the surface, by means of a long lever of 1-in. pipe, controls the hoisting of ore, or lowering the bucket or cage, as the case may be; therefore the expense of a hoisting engineer is eliminated. The ore is trammed to the mill. In some cases a crusher is used, while at others the ore is broken by hand to the size for milling.

For driving the machinery, either gas-engines or electric motors are used, costing 2 cents per brake-horse-power-hour for the former, and up to 5c. per unit for electricity. The Huntington mills are fed by Nelson (improved Challenge) feeders, belt or eccentric driven from mill shafting. The pulp flows over one long, or several short copper plates, and then to either spitzkasten or collecting vats, the slime going to dams. The clean sand is then shoveled into vats for a seven-day treatment with cyanide solution. The plants are farly well designed, and certainly costs show much technical skill. Such mines cannot afford to have idle directors, and large staffs. Everybody works hard, and the owners are able to doctor their engines and motors, repair mills, cyanide the sand, clean up, and generally get satisfactory results. Every man I met on several rounds of inspection was always busy, but ever ready to impart any data needed, if available. At such mines the owners do not deem it necessary to go into exact refinements of tonnage, grading analyses, and costs. Those cited here are as given me, though many lack full details. The earliest Huntington mill plants on the Kalgoorlie field were erected on the Associated, Oroya, and Hannan's Proprietary mines, which had three mills each. They stopped work in the order given, the latter working till last year, having a run of about 14 years, mostly on customs ore. When I came to Kalgoorlie, toward the end of 1899, the Oroya plant was crushing 100 tons daily of oxidized ore from an open-cut. This only averaged $6 per ton, and the company paid a dividend on such low-grade ore, at the time of high returns from the large mines.

The Huntington mill, generally of the 5-ft. size, is an excellent machine for crushing and amalgamating all soft ores, similar to those described, or those of a fairly quartzose character; and probably no machine will beat it at this work. Crushing is done by pressure largely, and impact slightly; say pressure-impact. A certain amount of crushing is also done by grinding, as the rollers must exert some rubbing action while pressing against the die-ring, revolving at the same time. On this class of ore, fully 50% is slimed, yet the machine does not make an excessive quantity of slime, throwing out the pulp as soon as it is the required size to pass the screen, which always tends to efficient duty. It has been found on the field that, on the average, the slime assays lower than the sand, just the reverse of stamp-mills on the same ore.

The erection of a Huntington mill is very simple. A good concrete foundation is necessary, upon which the 12 by 12-in. wood frame, supplied with all mills, is bolted. The mill bottom is then bolted to the frame, and then the false bottom is fitted in and cemented up. The die-ring is lowered in place and wedged up evenly all around, wood wedges being procured locally from one of the timber mills. The pinion-shaft, vertical spindle, and gear are next fitted and lined up. The housing is bolted on to the bottom of the mill, not forgetting the jointing. The disc driver, which carries the rollers and scrapers, is keyed to the vertical spindle. The roller shells are wedged on, and the spindles carrying these are fitted into the yokes, which hang from the disc driver. The rollers should be 1 in. from the bottom of the mill, and the top of these should be level with the die-ring. The scrapers are set about ¼ in. from the pan bottom. Mills are made with three or five openings for discharge of pulp, and are fitted with punched screens.

The table below shows the dimensions of Huntington mills as supplied by Fraser & Chalmers.

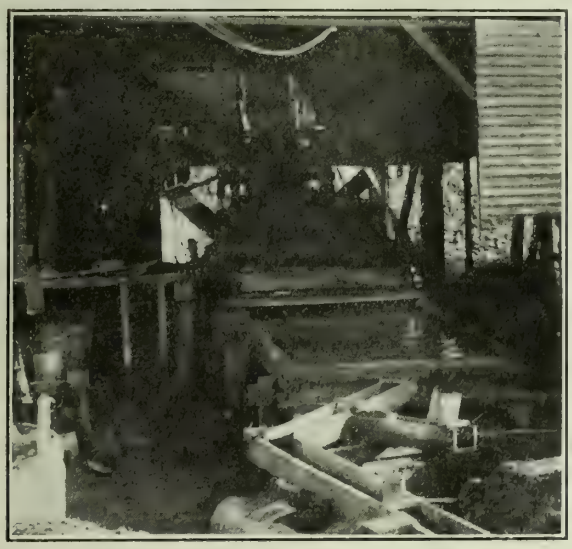
The mill is a good amalgamator, and on this class of ore, the gold being rather fine, amalgamation varies from 25 to 60%. The mercury fed into the mill gets well mixed with the pulp by the action of the rollers and scrapers, causing a general violent circulation. A short lip plate is generally used. Some plants have a single copper plate about 12 by 5 ft., while others have two or three short plates covering that length, with a well between each. The owners argue better results are obtained by the latter system. The former also appear to be satisfactory, so each works on experience gained. The Huntington need not be fed with as

Details of Huntington Mill Construction

Diam. of mill.	Width of frame.	Length of frame.	Height of frame.	Total height of mill.	Height from floor to discharge.	R.p.m.	Hp.	Weight.
3½ ft.	49½ in.	79 in.	27 in.	56¾ in.	35½ in.	90	4	8,000 lb.
5 ft.	66 in.	120 in.	34 in.	68 in.	40 in.	70	6	15,000 lb.
6 ft.	78 in.	132 in.	37 in.	77½ in.	47¾ in.	55	8	20,000 lb.

much mercury as a battery, as it is being continually brought into contact with the pulp in circulation.

In a 5-ft. mill the pinion or pulley shaft revolves at 140 r.p.m., and the vertical spindle 70. The step-bearing of the latter requires plenty of good oil, and the gear should be well greased, thus prolonging the life for years. The bushing of the bearing, and the steel toe and button do not require renewing very often. The rollers should



HUNTINGTON MILL AT LAKE VIEW SOUTH.

be regularly oiled. The Nelson feeders are driven by an eccentric or belt from the mill pulley shaft. The average size of feed is 2 in. The ore as fed in is immediately caught by the scrapers which throw it in front of the rollers, which in turn crush it against the die-ring. The four scrapers are placed staggered in the disc driver, and it is important that these be kept in good order, renewing the shoe as soon as worn to any extent, especially the one nearest the die-ring. If the scrapers are not attended to they will not throw up the ore to be crushed. By the sound of the mill, the attendant can judge how it is crushing. When fed just right, a rumble is heard; but when overfed, there is a swishing sound, and ore is to be seen scattered over the bottom of the mill toward the centre. This is bad work, as the rollers drag the ore about, throw out mercury, and the capacity of the mill falls off greatly.

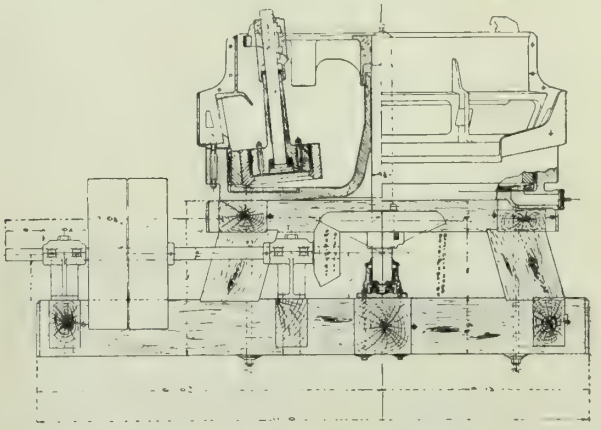
The die-ring should be of uniform steel, else there will be soft patches in it which cause uneven wear, so much so that they have to be replaced at times. Some of the millmen prefer a small 'hump' to form, arguing that the rollers thus swing about more, giving more impact action, but this scarcely seems correct. The makers supply a grinding tool for turning up die-rings. This consists of a spindle, fitted to a yoke similar to the roller, to which is fitted a segment of a circle the same radius as the die-ring, and about 24 in. long, 6 in. wide, and 1½ in. thick. To this is bolted a shoe, which may be renewed when worn. The grinder is put in the place of one of the rollers, and presses hard upon the die-ring, wearing off the uneven spots, this being done when the mill is crushing. Generally, the apparatus is not used here. It must be a great brake on the mill, and add considerably to the power used, although only in for an hour or so. The millmen apparently consider that when a die-ring wears badly, truing up is only a temporary job, and the uneven wear will occur again, so it is best to renew the ring.

Punched screens of 250 holes, equal to about a 30-mesh wire screen are used in all cases, being the best to stand the heavy splash of the mill. To prevent sand being splashed up into the hub of the roller head, and getting down into the friction rings, all mills here have a piece of 5-in. iron pipe shrunk on, thus preventing the pulp from splashing up. From the tables given it will be seen

ORA BANDA MILL WHILE UNDER CONSTRUCTION.

that the 5-ft. mill crushes from 30 to 80 tons daily, and tests by the Associated Northern showed 120 tons. The former tonnage is on quartz and the second on ordinary oxidized ore, while the last is on a soft kaolin with small ironstone seams in it. The table below gives details of the principal Huntington mill plants.

At most of these plants no proper record is kept of costs, so the table is lacking in details. Some definite costs are promised in a few months from the new plant at the North Boulder, and Gimlet South Extended.



CROSS-SECTION OF HUNTINGTON MILL.

The latest Huntington mill plant to be erected in Kalgoorlie is on the North Boulder property. This is a well designed plant, and has been well built. It consists of a

OPERATION OF HUNTINGTON MILLS, KALGOORLIE.

Name.	No. of mills.	Size, ft.	Speed, r.p.m.	Hp.	Drive.	Hp. of engines.	Daily capacity, each mill, tons.
Golden Dream	1	5	68 to 71	10	Crossley gas	32	54
Cassidy Hill	1	5	70	6	A. E. G. motor	12	50
Lone Hand	1	5	68	6	A. E. G. motor	12	80
Hannan's Consols	2	5	74	6	A. E. G. motor	18	30 to 45
Adeline	3	5	70	6	Hornsby gas	29	30
Lomassney & Co.	1	5	74	6	Crossley gas	24	48
Lake View South	1	5	70	8 to 12	Tangye gas	25	50 to 70

grizzly, 7 by 9-in. Dodge breaker, 100-ton bin, Challenge belt-driven feeder, one 5-ft. mill, one long copper plate, and several pumps, all driven by a 35-hp. Campbell gas-engine. In the cyanide department are several collecting-vats, and four percolating-vats for the clean sand, the slime flowing to a dam. Costs will be very low here.

Name.	Class of ore.	Water used per ton, gal.	Life of die-rings, days.
Golden Dream	average oxide	250	240
Cassidy Hill	fair per cent quartz.	200	180
Lone Hand	kaolin	250	210
Hannan's Consols	fairly hard	180	160
Adeline	mixed	200	150
Lomassney & Co.	iron and quartz.	...	...
Lake View South	iron and quartz.	200	150-270

The cost of water at these mills is 48 to 87c. per 1000 gallons.

Plates.	Amalgamation.	Life of roller, days.
12 by 5-ft.	30% inside	120
12 by 5-ft.	varies	70
(2) 5-ft.	varies	120
(2) 5-ft.	varies	60
(2) 5-ft.	25 to 60%	120
(2) 5-ft.	20 to 50%	...
12 by 5-ft.	low %	180-270

Costs of milling are given, in cents per long ton, as follows:

Name.	Water.	Power.	Labor.	General.	Total.
Golden Dream	23	5	30	8	66
Cassidy Hill	..	..	..	..	80
Lone Hand	18	8	12	2	40
Hannan's Consols	8	..	..	..	72
Adeline	18	3	..	..	..
Lomassney & Co.	8	8	..	..	..
Lake View South	..	8	..	..	..

Probably the most interesting and up-to-date plant using Huntington mills, and one which must show record costs for complete treatment, is being erected on the Gimlet South Extended at Ora Banda, 40 miles from Kalgoorlie, by the Associated Northern Co. A description may be of value, and a progress photo of the plant is shown. I had supposed this to be one of largest installations of Huntington mills for primary crushing; but there is a plant of six mills at work at the Zuiho mine in Formosa, crushing 100 tons daily of an ore consisting of slate and limestone. The Associated Northern has developed 160,000 tons of oxidized ore assaying $5.25 per ton, and was bought for $110,000. To check the sampling a Huntington mill was erected, and several lots of ore crushed, confirmed this. The mill dealt with 5 tons per hour, or 120 tons daily. The ore is kaolin with intermixed seams of ironstone which carry the gold. The 350-ton plant, now in full operation, consists of: One jaw-crusher driven by a Tangye gas-engine; 14-in. belt conveyor to mill storage bins, Nelson feeders; four 5-ft. Huntington mills with 30-mesh wire screens; inside amalgamation but no plates; pulp flows down a cement launder to a large two-plunger pump which elevates to spitzlutte; underflow to two 5-ft. grinding pans, pan overflow and that from the spitzlutte to the thickening-tanks; slime to four ordinary style agitators, then to three new type Ridgway machines for filtration of gold-bearing solution, these to deal with 120 tons each daily; residue to be pumped to dam. Two other Tangye gas-engines drive the main shafting. The water used is salt, and costs 87c. per 1000 gallons. It is expected that the complete treatment of this ore will cost $1.50 per ton. Details of the mill's performance will be given later.

There are a number of stamp-mills at other mines crushing oxidized and customs ore. Of these, the mills on the Hannan's Reward and Hidden Secret are of some note, in that they are fairly well designed. With reference to one of the others, it may be said that five 1000-lb. stamps only crushed 28 tons daily of ore from the Lake View South, as against 50 to 70 tons by the Huntington mill. A few details of these two mills are given below.

As these mills are on customs work at times, costs could not be procured. The Hannan's Reward gets about 50 tons of sand out of 100 tons of ore crushed. The Hidden Secret had a No. 4 Krupp ball-mill working for a time, with a daily capacity of 80 tons through a 25-mesh screen, which compares well with the 100 tons daily crushed by the No. 5 mill at the Chaffers. The wear in the Hidden Secret mill was not very heavy, but for some reason a good extraction could not be secured from the sand. Nine years ago the Eclipse mine, now belonging to the Oroya Links, had twenty 900-lb. stamps crushing the usual class of oxidized ore. These averaged 9 tons daily each, but made a good deal of slime.

In the treatment of the oxidized ore the Associated Northern mill at Kalgoorlie first weighs the ore and takes moisture samples. The ore then passes a No. 5 Gates crusher into bins by distributing belt. Shaking feeders feed the No. 5 Krupp mills, which have a 9-mesh screen, the crushed ore dropping upon a 14-in. belt. Under the mill it is automatically sampled continuously. The belt elevates the ore to a small mixing pan, where it is mixed with 0.04% KCN solution, and then the pulp flows into three 5-ft. pans, the overflow going directly to agitators. It is agitated for 8 hours, pumped into presses, and washed as usual, the residue being trammed away. The total cost of this complete treatment is $2.25 per ton, being somewhat high on account of the variable tonnages dealt with, common to all custom mills. Manufacturers and text-books on Huntington mill practice cite the following points in their favor, which seem to be pretty well borne out in practice, though perhaps I have failed to prove them.

Reduced first cost, say two-thirds that of stamps; saving in power, or one-third per ton crushed; wear and tear and cost of renewal less; less flouring of mercury; less freight; erection, one-tenth that of stamps; wearing parts easily duplicated; better discharge, and pulp in a

Details of Stamp-Milling at Kalgoorlie

Name.	No. of stamps.	Weight, lb.	Drop	Per minute	Screen, mesh	Crushed daily, tons.	Plates	Drive.	Treatment of sand.
Hannan's Reward	10	1100	5	114	26	100	1 long	30-hp. G. E. motor	Not all the time.
Hidden Secret	5	1200	6	110	25	45	1 long	25-hp. Crossley gas-engine.	7 days' percolation with 0.08 and 0.06% solution.

better condition for concentrating; better amalgamation; less sliming, as pulp is discharged immediately on reaching the proper size.

The whole question of Huntington mills may be summarized by saying that if a soft to moderately hard ore is to be crushed, install one; drive it and other machinery with any good suction gas-engine; treat the sand by ordinary percolation methods, and perhaps the slime with vacuum plant. Cheap and good results should follow. This is an admirable arrangement for any small mine which has to deal for a considerable time with oxidized ore only.

Mining in the Urals

ST. PETERSBURG CORRESPONDENCE

The metal report from Ekaterinburg is favorable for practically all classes of metals produced in the Urals, including the base metals. The copper situation is excellent. Notwithstanding the fact that the production of copper in the district is increasing rapidly, smelters are not in a position to satisfy all the demands made on them, for the present at all events. No reserves of copper exist at the smelters, and the moment it is produced it has to be sent to the buyers. Nevertheless, there does not appear to be any serious increase in prices.

The production at the Kyshtim works is increasing, and it is proposed to extend the copper-smelting operations in the Syssertsk mining district. With the development of the copper-smelting business there is, of course, a big demand for copper ore, which is available only in limited quantities. In the Vertch-Isset mining district the managers, experiencing a difficulty in keeping their Pyshminsk-Klyuchieff copper smelter at work for want of ore, have set aside some land near the smelter for exploitation by free laborers, the condition being that they shall not sink below a certain level for the ore, and that in case the ore should be found deeper than the maximum permitted, the company retains the right of working the deeper lying measures for itself. The free laborers are operating pretty extensively in the Vertch-Isset district in the production of copper ore, which they are delivering to the Pyshminsk-Klyuchieff concern.

The demand for iron ore is also strong, being required to satisfy an insistent demand. Chrome iron ore and pyrite are in good tone. The production of these minerals continually increases and is easily absorbed by a greedy market. There is no stock left either of chrome iron ore or of pyrite. Ground malachite remains at the old prices. The platinum market is somewhat more lively than it has been for some time. There is inquiry for large parcels, but still no big deal has gone through; because generally buyers are not offering satisfactory prices, and sellers simply will not give way; so the price remains at 9 rubles 80 kopeks but stands firm. The free laborers are offering fair quantities, which speculators are buying readily enough in small parcels at prices above the official quotation of 9r. 80k. There is a considerable extension of platinum production by the free laborers for the reasons already given in previous notes on this subject.

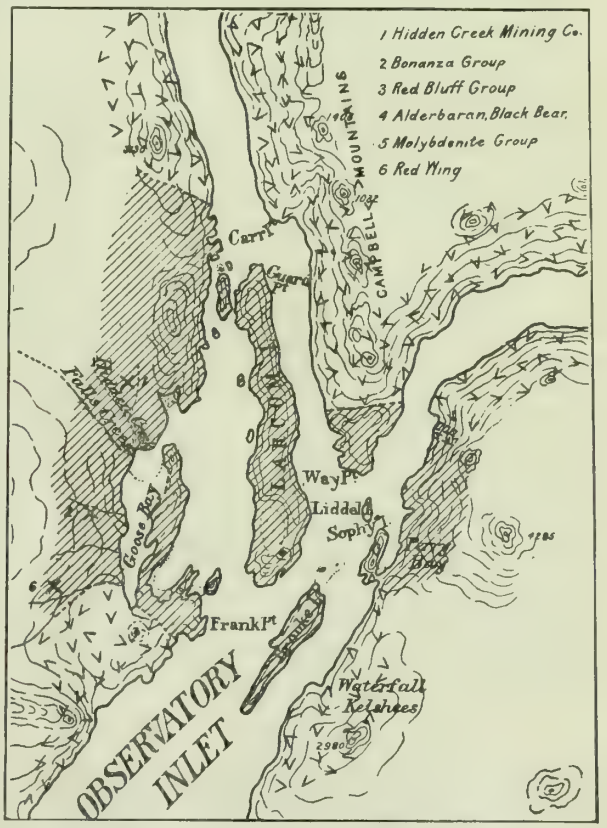
ANALYSIS of natural gas from Clay county, Texas, shows the following composition, according to the U. S. Geological Survey:

	%
Illuminants	0.3
Carbonic oxide	None
Hydrogen	0.8
Marsh gas	47.2
Ethane	12.5
Carbonic acid	0.2
Oxygen	0.4
Nitrogen	38.6
	100.0

Hidden Creek Copper Deposits

By R. G. MCCONNELL

*The claims now controlled by the Granby company were staked about ten years ago, and a considerable amount of surface and underground work was done on them by the Hidden Creek Copper Co. under the direction of M. K. Rodgers. Recently the claims were bonded to the Granby Consolidated Mining, Smelting & Power Co., operating at Phoenix, British Columbia, and a diamond-drill test of the property proved so satisfactory that the bond was taken up and preparations are now being made to work it on an extensive scale. My thanks are due to O. B. Smith, general mines superintendent of the Granby company, and Mr. MacDonald, local manager of the Hidden Creek mine, for permission to examine the workings, for information, and for other courtesies.



VICINITY OF OBSERVATORY INLET. GOOSE BAY HAS BEEN RENAMED GRANBY BAY.

SITUATION

The claims are staked on the summit and sides of a hill 920 ft. high, enclosed between two branches of Hidden creek, and situated 8500 ft. north of Goose bay, near its outlet into Observatory inlet. A good wagon-road, planked where necessary, about two miles in length, has been built from the portal of the main adit to a wharf at Anyoux on Goose bay, the shipping port of the mine, and a tramway, partly gravity and partly traction, to the same point, was commenced some years ago, but never completed.

ROCKS

The rocks in the vicinity of the mine consist of dark and dark-gray argillites, with occasional light-colored, coarse-grained feldspathic beds and rarely some limestone. Beds and bands of greenstones, probably largely of pyroclastic origin, occur with the argillites, but are not prominent in the vicinity of the mine. Both argillites and greenstones are always more or less altered, and in places pass into

*From the annual report of the Canada Department of Mines, 1911.

mica, quartz mica, and chloritic schists. The bedding is coarse, and while a strong cleavage is developed in spots, the bedding planes over most of the area constitute the principal partings. The beds have been compressed into several folds, and in places dip steeply, but are seldom, in the section examined, overturned, and no large faults were observed. The strike, while generally east and west, shows considerable variation in places.

The argillites and associated rocks are exposed over an area about 9 miles wide, where cut by Observatory inlet. They are surrounded by the granite rocks of the Coast range, and are considered to be an undestroyed and deeply sunken portion of the old roof of the Coast Range batholith. The basin they occupy is of great depth, as the sedimentary rocks of the inclusion are exposed from base to summit of mountains over 5000 ft. in height, and they must extend for a considerable depth below the present surface.

The argillites are cut by numerous dikes, one set being older than the mineralization of the region and genetically connected with the enclosing granitic rocks. These vary widely in character and include granitic, dioritic, quartz-porphyry, aplitic, and pegmatitic types. In addition to these, a second widely distributed set occurs, the members of which were intruded after the mineralization of the region. These are fine to medium-grained basic dikes, often of a lamprophyric character. Thin sections from the dikes cutting Mammoth bluff showed laths and occasional phenocrysts of feldspar, mostly plagioclase, with abundant brown hornblende in long prisms, and occasional plates of mica. Rounded irregularly bounded quartz grains, possibly of foreign origin, are also present, and large calcite areas probably representing original olivine are of frequent occurrence. A second type obtained from a dike crossing the main adit of the Hidden creek mine between the two orebodies, contained large olivine and augite phenocrysts in a fine-grained hornblende-feldspar base, and is classed as an olivine basalt. A third type, represented by a dike crossing the Redwing, consists mainly of hornblende and plagioclase, and possesses a well marked ophitic structure. The later dikes may be connected with a basaltic flow which caps the hills south of Alice arm. They do not appear to affect in any way the orebodies they cut.

Workings

A large amount of surface and underground work has been done on the Hidden Creek mine. The mineralized area is very large and was first outlined roughly by long trenches running in various directions. Subsequently a working adit was started below what is known as Cabin bluff, at an elevation of 530 ft., and has been driven straight into the hill in a northwesterly direction for 950 ft. A drift to the left from the main adit, starting 85 ft. from the face, has been carried in for a distance of 300 ft., and several shorter drifts from points along the main adit serve to explore the ground bordering it.

Besides the main working adit and its branches, a number of shorter adits have been driven at various elevations into the iron-stained slopes of Cabin and Mammoth bluffs. One of these, commencing in a depression at the foot of Cabin bluff, is connected by a raise with the main adit. In addition to the numerous trenches and adits, the mineralized area has been further extensively explored with the diamond-drill by the Granby company, the present owners of the property. A number of long bore-holes, starting from various points along the main adit and from the surface, have been drilled and have yielded valuable information in regard to the general character of the deposit.

Size and General Character of the Deposits

The mineralized area, as shown by the various surface and underground workings, is of great extent, although it has not as yet been fully defined, both ends being still unknown. In shape it forms a right angle. The smaller arm, known as the first orebody, has a northeasterly strike and dips to the northwest. It has been traced from the main adit in a southwesterly direction for over 600 ft., the width averaging about 160 ft., or, including a silicious band which borders it on the northwest, of nearly 200 ft. The longer arm holding the second orebody has been traced in a northwesterly direction for a distance of 1500 ft., with an average width of about 400 ft. The deposit has been proved by a bore-hole to a depth of 514 ft. below the main adit or approximately 900 ft. below the surface outcrops on the hill. While only a part of the large area described contains valuable minerals in sufficient quantities to constitute workable ore, the original rocks are everywhere either completely altered into greenish or less commonly brownish micaceous schists or replaced by quartz and iron and copper sulphides. The transition from the dark, slightly altered argillites which constitute the country rocks, to ore is usually fairly abrupt, often occurring in a few inches.

A conspicuous feature of the deposit is the presence of a zone of whitish quartz schists, practically strongly silicified argillites, traceable partly around it. This silicious zone forms the northwestern boundary of the southwestern or smaller arm, crosses the deposit, then bending at right angles continues to the northwest as the northwestern boundary of the larger arm. It was not observed on the southwest border of the larger arm or the southeastern border of the smaller one. The rocks in the silicious zone vary in the amount of silicification undergone. In most places they are nearly pure quartz schists, but occasionally the zone consists of alternating dark and white bands. The width of the zone ranges from 30 to 60 ft. and more. The dip where it skirts the smaller arm and crosses the deposit is to the northwest, but after bending to the northwest the dip, as shown by the bore-holes, changes to the northeast. It thus forms the hanging wall of both arms.

Mineralogy

The metallic minerals present consist mainly of iron pyrite, some of it cupriferous, pyrrhotite, and subordinate quantities of chalcopyrite. A little bornite, evidently secondary, was found at one point. The principal non-metallic constituents are quartz, some calcite, a greenish micaceous schist, probably largely chloritic, some brownish micaceous schists, and occasionally some hornblende.

Pyrite is the most abundant metallic mineral present. It usually occurs in a granular condition, and in places near the surface breaks down into an iron sand. It is always associated with more or less quartz, and large areas consist of pyrite grains separated by a thin silicious matrix. It also occurs in grains and small bunches distributed through the secondary schists. Its distribution through the mineralized area is irregular, some portions containing only a small percentage, while others consist almost entirely of sulphides and quartz. The main adit started some distance down the slope from the mineralized area to gain depth, passes through 380 ft. of argillites, all somewhat altered and containing occasional grains and small bunches of pyrite, then through a pyritic zone 200 ft. wide, becoming very silicious toward the northwest border, then through a greenish schistose zone with some quartz and pyrite 240 ft. wide, beyond which is a second pyritic area which continues to the end of the adit 120 ft. A drift to the left from a point near the end of the adit running about north for 300 ft. shows the continuation of the pyritic area for that distance, the breast being in granular sulphides mostly pyrite, embedded in a silicious matrix. A drift to the left passes through sulphides and quartz for 100 ft., then through greenish chloritic schists only slightly mineralized for 120 ft. The comparatively barren interval separating the two pyritic areas in the adit is not apparent on the surface, some of the ground overlying the lean portion being well mineralized with sulphides.

Pyrrhotite, while much less abundant than pyrite, is common throughout the greater part of the mineralized area. It occurs intermingled with the pyrite and also forming comparatively large masses usually specked with chalcopyrite. Chalcopyrite in grains, small aggregates of grains, and in thin layers usually accompanies the iron sulphides where the replacement is complete or nearly so, and also

occurs in small quantities scattered through portions of the schistose areas. The proportion present, while variable, is always small and in certain areas seems to be absent altogether. The chalcopyrite is associated so intimately with the iron sulphides that there is little doubt that both are the products of the same period of deposition.

Bornite was found at one point, but only as a surface alteration mineral, and it does not occur, so far as known, as a primary mineral of the deposit. Among the nonmetallic minerals, quartz is the most prominent. A wide silicious zone crosses and bounds portions of the mineralized area, and the large sulphide areas are all more or less silicious. Calcite occurs occasionally, but is not prominent. Portions of the area included in the mineralized zone on the accompanying map consist of greenish micaceous schists often highly silicious. These carry significant quantities of sulphides in some places and are nearly barren in others.

Ores

The iron sulphides in the Hidden Creek mine have a low content in the precious metals. Out of a number of samples assayed in the laboratory of the Mines Department, one showed 0.02 oz. gold to the ton, one 1.65 oz. silver, and the rest only traces. The commercial value of the deposit must, therefore, depend mainly on the copper content. Chalcopyrite usually accompanies the iron sulphides, but in variable amounts. Some areas are nearly barren, while others contain sufficient quantities to constitute a low-grade copper ore; that is, ore carrying up to 3% copper, and over limited areas an even higher percentage.

The most important body of workable ore so far outlined in the boring operations of the company occurs southeast of the silicious zone previously described as bordering the shorter arm of the deposit on the northwest and continuing along the longer arm. The silicious zone is fringed by a band of ore usually from 20 to 25 ft. in width, and already traced for a distance of nearly 1400 ft. A vertical bore-hole from the main adit apparently proves it to a depth of 514 ft. below that level, and it extends to the surface above, a variable distance, depending on the contours of the country, but probably averaging about 200 ft. The huge tonnage expected from this orebody will undoubtedly be greatly supplemented from other portions of the mineralized area. Workable ores are known to occur at a number of points, but the definition of their extent and quality awaits further exploration.

The mineralized area at the Hidden Creek mine occurs in a larger predominantly argillaceous area surrounded and doubtless underlain, although at a considerable depth, by granitoid rocks, and cut by dikes and stocks belonging to the same period of igneous intrusion. The argillites were irregularly compressed and folded at the time of the invasion, and the deposit probably occupies an area more than ordinarily crushed and fractured, although this has been masked by subsequent alteration and deposition and is not apparent. A wide broken zone, rather than a single fissure, is conceived to have afforded the means by which heated silicious waters carrying iron and copper sulphides in solution ascended from the underlying batholith, altering the argillites in their upward passage and replacing them with silica and sulphides as the pressure and temperature conditions become less severe. An origin of this kind would ally the deposit genetically with the loosely defined contact metamorphic group, although the ordinary contact metamorphic minerals, including the iron oxides, were not observed.

Deposits of the contact metamorphic group, that is, deposits situated on or near the contact of igneous masses with sedimentaries and formed by ore-bearing solutions, either aqueous or gaseous, emanating from the cooling intrusive, vary widely in character. Ordinarily they are described as bunchy irregular masses, made up mostly of iron oxides, and iron, copper, lead, and zinc sulphides, in a gangue of secondary silicates, mostly garnet, epidote, augite, and tremolite. An examination of numerous occurrences at various points along the west coast indicates, however, that neither shape nor the presence of any or the majority of the compounds mentioned are essential features. The shape is dependent on the channel followed, and in a broken region perfect vein forms produced by the complete replacement of the country between parallel fissure are not uncommon. The constituents are also dependent on the character of the parent intrusive, on conditions of deposit, and possibly on the aqueous or gaseous character of the emanations, and gradations occur from masses of pure or nearly pure magnetite to others made up largely of tremolite and iron and copper sulphides, and in some instances of quartz and sulphides. The present classification, based only on a broad genetic relationship, is far from satisfactory. The name of the group is also misleading, as it includes deposits distant from actual contacts.

Work on the Hidden Creek mine has so far been altogether of an exploratory character, but plans for working and equipping it on a scale commensurate with its importance and for transportation of the ores to the beach are now being made. A smelter will be erected to treat the ores, but the site of this was not decided on at the time of my examination, or at least was not announced. The present equipment includes a power-plant situated on Falls creek and operated by water furnished by that stream, and a compressor and diamond-drill plant.

Bonanza Group

This group is situated about three-fourths of a mile up Bonanza creek, a small stream emptying into Goose bay about two miles below its mouth. Bonanza creek is a rapid stream about 20 ft. wide, confined in a deep narrow valley terminating below in a rock canyon 20 to 30 ft. deep, excavated since the glacial period. The Bonanza group of claims, six in number, were the first claims staked in the district, and were explored to some extent by M. K. Rodgers before the discovery of the Hidden Creek group. Very little work has been done on them in recent years.

The general character of the deposit on which the claims are staked is similar to that of the Hidden Creek group. The country rock is a dark, somewhat altered, argillite cut by pegmatite and dioritic dikes before it was mineralized, and by a later set of basic dikes after it was mineralized. The argillites are altered over a wide area into biotite and chloritic schists, some of it quite coarse, holding variable quantities of pyrite, pyrrhotite, and in places chalcopyrite. The sulphides are accompanied by some quartz, but this mineral is much less abundant than in the Hidden Creek mine. The altered and mineralized area has a width of over 500 ft., and is opened up by short adits for a distance of 600 ft. along its strike.

The workings consist of three adits, one over a hundred feet in length, north of Bonanza creek, near the creek level, and two adits and some surface work on the south side. The most westerly of the adits north of the creek cuts 10 ft. of granular pyrite near its mouth, beyond which are micaceous schists holding only a small percentage of sulphides. Little copper is present. A sample of the granular pyrite gave on assay 0.48% copper, 1.25 oz. silver per ton, and traces of gold. Some pyrrhotite holding specks of copper occurs in the middle adit. The east adit passes through micaceous schists sparingly mineralized with pyrite. The two adits south of the creek expose schists holding pyrite in scattered grains and bunches, and occasionally some chalcopyrite. Some good-looking chalcopyrite ore is exposed in a cut near the creek, but further exploration is needed to determine whether it occurs in workable quantities or not.

The Bonanza ground looks promising enough to warrant a diamond-drill exploration, such as that in progress with such favorable results in the Hidden Creek property. The area of altered schists carrying iron, and occasionally copper sulphides, is very large, and the present workings cover only a small portion of it. A large quartz vein, fully 10 ft. wide in places, occurs on the North Star claim, one of the Bonanza group. It carries some pyrite and chalcopyrite. A sample assayed yielded only 0.48% copper and 0.20 oz. silver per ton.

Investigation of Feather River Black Sands

By Edwin A. Sperry

In the spring of 1909 I was called upon to make an exhaustive examination of the sands along the Feather river, California, to determine (*a*) what precious metal content they might have, (*b*) by what method, if any, the metal content could be recovered at even a small profit. The principal object of the investigation was to determine whether the overburden of sand could be removed from the bars of gravel which apparently formed the original river bed. The investigation extended from Marysville, Yuba county, to a point about six miles above the confluence of the Feather and Sacramento rivers.

The Yuba river flows into the Feather river at Marysville, and has played a large part in depositing the sand. This river was important in the production of gold in the early history of the state, and extensive hydraulic operations were carried on along the gravel bars at Smartsville and other places. These operations filled up the Yuba with débris and by action of the current the sand was carried for considerable distances down the Feather river. The sand lies 20 to 30 ft. deep in places and in no place along the entire 25 miles of river examined was the natural bottom found uncovered.

Some idea may be formed of the immense quantity of sand and gravel which has been deposited in both rivers when it is stated that after a careful estimate of the débris in the Yuba alone, the State Board of Public Works placed the amount at 385,000,000 cu. yd., and, according to rough estimates, it may be stated that there is probably not much less than the same amount in the Feather river which has come directly from the Yuba. The coarser material has, of course, remained in the Yuba, but in places in the Feather, especially near the mouth of the Yuba, the sand is coarse and at times contains much fine gravel. The first work done was to make a fairly accurate survey of the river for the 25 miles under investigation, determining the position of the bars of sand which were to be sampled. After this was platted the work of sampling began. This was done by blocking the bars off in squares (100 to 200 ft. on a side) and sampling at the corners. In some cases the sample was taken for a depth of 6 or 8 ft., by shovel; in others it was taken to considerably greater depth by the use of a sand pump made from a length of brass tubing with a valve at the bottom. This was worked down into the sand and the core for the entire depth was taken.

Each of these samples was thoroughly mixed and cut down to about 5 lb. in weight and put in sacks which were properly numbered. They were then taken to the field laboratory, shown in the illustration, and assayed. Four consecutive samples were usually combined, and as each sample charge was one assay-ton in weight, the results, which, of course, were very small, were weighed from the four assay-ton charge. The assay outfit consisted of a gasoline furnace of the Braun combination type, one set of portable balances consisting of a bead balance sensitive to 1/100 mg., and a pulp balance sensitive to 1 milligram.

At the beginning the reports of the United States Geological Survey were used as a guide in making estimates, and in all these the theory was accepted that the precious metals were associated in direct combination with the black sand. It was some time before enough evidence had accumulated in sufficiently conclusive form to make the fact clearly manifest that this was not the case. It was almost as a shock that this fact dawned upon us, but when once it did a great many puzzling results and baffling discrepancies were easily correlated and explained. These will be taken up in their proper order.

In the first part of the work the black sand was always taken as a gauge of prospective gold content, and in almost every case this showed quite abundantly. Starting in on the bars immediately at the mouth of the Yuba, the average precious metal held at about 14c. per ton. The content very gradually decreased until at the lowest bar sampled, about 20 miles below, it reached 12½c. The investigation was discontinued at this point, as sufficient quantity and value had been developed to assure many years work in case the sand could be handled at a profit.

After the average content in gold was established the next step was to determine what method, if any, could be adopted to recover it. Naturally the first thing to consider was the possibility of concentrating the sand and by recovering the black sand alone to thus reduce the bulk of the material to where it could be profitably shipped to the smelter. It should be noted that at this stage all experiments and tests were made with the thought in mind that the gold was contained directly in the black sand.

Several average samples of 100 oz. were taken and carefully panned. As a result, it was found that the crude sand was composed of ½ to 1% of black sand (which was very heavy, of course); 2 to 3% of a red sand, which hung between the black and the gray sand; and the gray sand which made up the remainder. In panning, the ordinary pan was used, and each sample was panned three times, making a good recovery of the black sands, but with much of the red sand with it, as it stayed close to and even mingled with the black.

At this point the first baffling results were obtained. In the first case of panning and when considerable red sand remained in the concentrate the value of the concentrate reached $28 per ton, and the results of several similar tests ranged most erratically between $4 and $30. If the sample was panned down to a cleaner product of black sand the content at once fell. The red sand was then isolated and tested and the content shown to be practically nothing. This proved that the red sand held no gold and that the black sand was erratic; or so it appeared from the results. On one trip up the river, along toward the very last of the field work, a bar was found on which had been deposited a bed of clean black sand which afforded a sample of 3 or 4 lb. This was assayed carefully and showed a gold content of less than $2, which, of course, made much greater confusion.

On finishing up the field work, about 300 lb. of the sand remaining from the original samples was carefully sacked and shipped to San Francisco, where a large amount was treated on a full-sized concentrating table, and the following results were obtained:

In the table below concentrate No. 2 contained a large proportion of red sand which by assay showed but a trace

Results by Concentration of Black Sand

Product.	Weight. lb.	Concentration. %	Value.	Extractional. %
Crude sand	256	.....	$0.11	....
No. 1 concentrate, black sand	0.67	367 to 1	26.00	61.86
No. 2 concentrate, black and red sand	1.43	178 to 1	6.00	30.47
No. 3 concentrate, red sand	3.46	74 to 1	trace	....
No. 4 concentrate, red and gray sand	...	.....	trace	....
Tailing, gray sand	...	.....	trace	....
Saving in concentrate, No. 1 and No. 2	2.10	122 to 1	$13.00	92.33

of gold. By panning this product it was reduced by 50% as to quantity and increased to $11 in gold content. Combining this with concentrate No. 1 gave 1.38 lb. of a product which showed a content of $18.80 per ton, or 89.5% of the total. The concentration then showed a proportion of 185 tons into one, agreeing very closely with the results in the field.

It was at first planned to ship the concentrate to the smelter for treatment, but it was ascertained that the smelting charge was excessive and practically prohibitive. On this, experiments were therefore made to determine the possibility of recovering the gold by the use of some simple and economical method, and as a result the cyanide process was adopted as most closely meeting all conditions. Assayton samples were treated in duplicate as a preliminary test, and, basing results on the gold content of the concentrate as $23.70, the result of a number of assays, the extraction obtained was 71.7% by a 48-hr. contact with a 1% solution. A similar test was made, using 96-hr. contact with a ½% solution, which gave an extraction of 91.5%. In practice, according to general experience, this extraction could probably be increased. Owing to the entire absence of cyanicides, such as acids, copper, as well as ease with which the solution may be brought in contact with the entire mass, due to its coarseness and uniformity of size, the concentrate presented ideal conditions for economical treatment both in the consumption of cyanide and facility of operation.

Several tests by concentration were made and the results were so erratic that doubts as to the true position of the gold began to be entertained. On sand which assayed almost exactly the same, the gold content of the concentrates varied from $6 to $26, and one confusing element was that the cleaner the black sand the lower the content, in the face of the fact that the red sand showed no ascertainable value, usually assaying a trace of gold. One test in particular, where the concentrate was re-run on account of being too dirty, the final product contained about $6 and was very clean black sand.

This result seemed to be so conclusive that a test was made to see if the gold was not free and uncombined with the black sand. A sample was taken and placed in a 100-mesh laboratory screen and a strong jet of water was directed upon it in such a way as to wash out vigorously all the fine material and thoroughly detach any particles which might be adhering to the coarser particles. The sample taken assayed 20c. gold per ton. It was found that 10% of the sample passed through the screen, and on assay the value of this was shown to be $2. This may have been merely a coincidence, but was quite sufficient to indicate that the gold was, in point of fact, wholly unattached to the black sand. On examination of a portion of the fine material which passed through the screen by the aid of a microscope it was found that the gold occurred in very minute particles apparently well rounded and not scaly but evidently independent.

From this it was supposed that by a system of jigging, the gold, with the finest of the sand, could be brought down into the hutch. A test was made on the bars themselves and a large quantity of material was treated. The result was very disappointing as the screen was somewhat coarser (60 mesh), and about one-third of the sand went through, making but little increase, if any, in the gold content. The method used was to place about 10 lb. of sand on a screen and then to work this in a tub of water much the same as in jigging, washing all the finer stuff through. This being found inefficient, it was next determined to try separation by a certain kind of classifier based on washing the gold out by a strong rising jet. While the classification of the sand as to size was excellent, the gold did not seem to part from the black sand.

It may seem as though the method indicated by the washing test on the screen should have been developed, but it was quite evident that in order to treat the sand in that manner would probably require expensive methods of handling. It was thought best to work on lines which promise more economical treatment, basing on the probability that in being so very fine it would be easily washed. This and other reasons demanded consideration and prevented following out the first work at that time. When the experiments had reached this stage I was called away, and further experimental work was suspended. As shown by the results of the long series of tests made, it is quite evident, first, that the gold in the sand is free, but owing to a peculiar attraction, or influence at least, the gold and black sand remain closely associated; also that the gold was not heavy enough to sink readily and still not light enough to float easily. Had the financial condition of the company investigating been more substantial, the research would have been carried on to a complete solution, but the results now only indicate what line should be followed. Much time was lost in the acceptance of the erroneous premise that the black sand was in itself of value.

The close association of the gold and the black sand was sufficient to make a first-class showing in treatment on the concentrating table, but of course the capacity of the table was limited, and the question of economical treatment in this way alone was very doubtful. In this the black sand acted as a retainer or carrier, and even then could not be washed extremely clean without danger of washing out the fine gold. In most of the concentration tests the results showed without doubt the posibility of recovering a large part of the gold in this manner at a reduction of bulk to about 1 or 2% of the original amount. This of itself would seem to prove the possibility of isolating the

ALONG THE FEATHER RIVER.

FIELD LABORATORY.

gold in some way; the question being the economy of the operation, which essentially rests only on the point of the capacity of the devices used.

The erratic results of the concentration can be laid to the unavoidable differences in adjustment of the table which in short runs are bound to occur. In regular running these matters are very easily taken care of, so that it can readily be said that, so far as recovery is concerned, concentration is successful, but as regards economy it is not so well assured. In the one test made by washing through a fine screen, the results were astonishingly good. But there is only the one test to base calculations on, and while it was to all appearance efficient, it is not possible to say with any great degree of assurance that the problem was solved by it. However, the results seem to indicate a line of investigation which might possibly lead to some substantial solution. As the sphere of my activities has been removed so far from the California field, the results of the long and careful, and at times most baffling, series of experiments, can be of no great value to me, but may indicate to others a line of investigation and perhaps a system of operation.

Errors in the Determination of Moisture in Coal

W. F. Hillebrand and W. L. Badger, in a paper presented before the Eighth International Congress of Applied Chemistry, discuss at some length the determination of moisture in fuels. Methods for moisture determinations in general belong to the class of indirect methods which in the absence of a simple reagent for water are most convenient and expeditious. When applied to so complex and easily oxidized a substance as coal, reactions occur which greatly affect the results. These are classed as follows: The sensitiveness of coal to atmospheric conditions, especially when finely powdered. The loss of volatile substances other than water. The absorption of oxygen directly by the coal substance, by combining with carbon and with hydrogen, splitting off as CO_2 and H_2O, respectively. The customary practice of coarse crushing followed by air drying, fine grinding, and determination of the remaining moisture. The relation between the air-drying loss and the moisture as determined on the air-dried samples is not constant. Fineness, area of surface exposed, temperature, and especially humidity of the air all affect the results. This is illustrated by a table of results of tests under varying conditions of humidity which illustrate the influence of humidity. In determining the moisture in the ground air-dried sample all the disturbing factors come into play. Four methods were used: drying in vacuum over sulphuric acid; drying for 1 hr. in an oven at 105 to 110°; for 2 hr. at 105 to 110°; and for 1 hr. at 105 to 110° in a current of dry air. The first mentioned method gave most uniform results, and the last mentioned ranked next. Tabulated results of tests on six coals are given. In view of the wide discrepancies between different indirect methods, a direct one is desirable. Work has been done along this line, but no definite conclusions have been reached. Some methods which have been tried are: heating coal in a U-tube in currents of hydrogen and nitrogen, and absorption of moisture in sulphuric acid, and weighing. Other methods which may prove of value, and which it is hoped that the Bureau of Standards may be able to consider, are some modifications of the calcium carbide method, and the magnesium-methyl-iodide method of heating in high vacuum and direct weighing of the moisture.

FUSHUN COAL was used experimentally by Korean railway trains for the first time last year, and has proved quite satisfactory. The Fushun variety is somewhat cheaper than the Kyushu coal, and it is this factor which is chiefly responsible for its increased general use. The gold mines operated under foreign management are said to be now using Fushun coal exclusively.

Japan's Mineral Output

The exact figures of the total value of the production of principal minerals during last year, based on the latest investigation of the authorities concerned, are represented at Y106,071,000, showing an increase of Y5,770,000 over the figures of the previous year, and an increase of about twice compared with ten years ago. The following statistics, taken from the *Japan Times*, show the quantity and value of the principal minerals produced last year:

	Quantity,	Value,
	momme.	yen.
Gold	1,248,654	6,059,497
Silver	36,811,090	4,761,652
	kin.	
Copper	88,958,342	27,119,987
Lead	6,874,586	506,604
Sulphur	83,790,856	1,271,672
	kan.	
Zinc ore	6,288,941	806,475
Iron	17,032,591	2,575,514
	koku.	
Petroleum	1,529,593	6,888,552
	tons.	
Coal	17,632,710	55,006,501

The output of gold throughout the country during last year is returned at 1,248,654 momme, valued at 6,059,497 yen. Of the total production Kagoshima prefecture, which is the foremost gold-producing district of this country, heads the list with 1,588,800 yen, closely followed by Ibaraki prefecture with 799,000 yen, Akita prefecture with 737,000 yen, Niigata prefecture with 620,000 yen, Iwate prefecture with 467,000 yen, and Hokkaido with 407,000 yen, the remainder representing the production from various other prefectures.

The total yield of all silver mines the same year aggregated 36,811,090 momme, valued at 4,761,652 yen. The bulk of the output was from the mines in Akita prefecture, which occupies the first place in the silver production of the Empire with the yield amounting to 2,634,000 yen last year. Ibaraki prefecture comes next in order with 364,000 yen, followed by Hyogo prefecture with 273,000 yen, Aichi prefecture with 247,000 yen, and Fukushima prefecture with 205,000 yen.

The production of the two precious minerals shows a marked increase compared with ten years ago. The output of gold last year reached 6,059,000 yen in value, an increase of 53%, against 3,967,000 yen of 1902, and that of silver 4,761,000 yen, an increase of 14%, against 1,936,000 yen of 1902, as may be seen from the following returns:

	Gold,	Silver,
	yen.	yen.
1902	967,590	1,936,753
1907	3,868,755	4,040,431
1908	4,457,430	4,362,740
1909	5,077,058	4,261,481
1910	5,671,806	4,896,188
1911	6,059,497	4,761,652

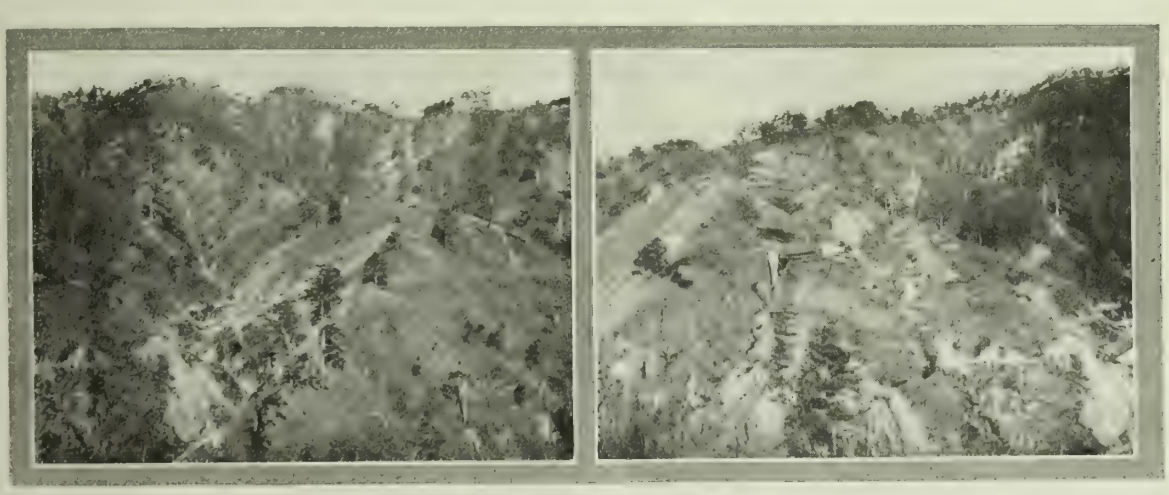
IN the Trebizond region there are 40 copper, 8 silver-lead and copper, 2 lead, 3 antimony, 8 lead and copper, 1 copper-zinc, 2 manganese, 1 copper and coal, 2 coal, 5 copper-silver, 3 silver-lead, 1 silver, 4 iron-lead, and 1 iron-arsenic mines reported within 2 to 30 hours distance from the coast. Only 14 of these have *firmans*, the others holding permits only, and no serious work is being done in any of them. The owners expect to find capitalists who will buy their mines.

DREDGE NO. 10 of the Natomas Consolidated is reported to have cleaned up $16,500 as a result of eight days run while operating in gravel containing 61c. per yard, digging to a depth of 30 feet.

The Major Mines

By A. W. Geiger

The Major mines lie about seven miles southeast of Baguio, the chief town of the province in Benguet, about 150 miles north of Manila, in the island of Luzon, Philippine Islands, and are reached by a good road which winds through the hills along a general descending grade. The elevation at the Major mine main camp is 4000 ft., or about 1000 ft. lower than the Baguio bench-mark. The property consists of 17 mining claims, each 300 metres square, forming a contiguous group, but naturally divided by topographic conditions into two parts, those claims on Major creek and those across a high ridge to the north. All the work of consequence has been done on the Major creek side, where there are several large veins showing considerable mineralization. The three principal ones are called the Vidette, Dan J., and Engineer. They outcrop very plainly in the creek and have the appearance of strong veins; the general strike is N.45°E. and dip to the northwest 30 to 60°. The development consists of numerous adits, aggregating 1500 ft. of work, most of which has been poorly directed. The greater part of the work has been done on the Vidette vein, and consists of five adits with the uppermost about 400 ft. higher than the lower at the creek level. Several shoots of workable ore have been found, but nothing very extensive as yet. In the upper workings, known as the Long Horn, there is a well defined ore-shoot which has been developed for about 40 ft. on the dip and 50 ft. on the strike. This shoot is not developed to its limit and extends beyond the present workings dipping to the northeast. A considerable amount of ore was milled from this pocket, and the results indicated a gross assay-value of $12 per ton. Of this amount, not over one-third was saved, and on account of expensive mining and tramming methods the company did not make a profit in the working of this ore.



DAN J. WORKINGS, MAJOR MINES. VIDETTE WORKINGS.

Geology

The prominent formation of the Major area is an andesitic eruptive varying from a true andesite porphyry to a more holocrystalline rock resembling diorite; these changes in texture are frequent and due to differences in rates of cooling of the eruptive, largely influenced by the successive flows which have occurred here at different periods. Included in the andesite there is present an extensive series of sedimentary rocks which are well exposed in Major creek for a thickness of over 1000 ft. and extend to the southwest over the high ridge above the Major ground and into the Benguet road, where they are again plainly visible. They consist of lime shales and conglomerates, and have been tilted to an angle of about 45°. The Major deposits vary greatly in character. The veins occur as (1) fissures in the andesite, (2) along the contact of the andesite with the sedimentary shales, and (3) in cracks and spaces along the bedding planes of the shales.

The fissure veins in the andesite are big soft leads, as a rule, with some vein-quartz filling, but extensive silicification, impregnation, and softening of the wall rock. It is difficult to determine the limits of the true vein. The mineral content is irregular, and in places extends a considerable distance into the softened wall rock, making small kidneys of good ore, caused by local enrichment at these favorable places. This is easily mined, but the ground is heavy and there has been difficulty in holding it during the rainy season. The ore is soft and oxidized, with much kaolin, often with pyrite, as much as 5%, and small amounts of galena, chalcopyrite, and zincblende; it yields about 70% of slime in milling, and the cyanidation necessary to make proper saving must be by agitation methods. The free gold is as fine as mustard generally, and care must be exercised in amalgamation. Generally not over one-third of the gold can be saved on the plates.

These large soft veins and impregnated zones in andesite are characteristic of the ore deposits of the Benguet district. The contact veins and mineralization along the bedding planes of the shales appear to be the most important type at the Major, although not characteristic of the Benguet district. These deposits are very irregular, the leads splitting up and coming together in bunches, often of considerable size. The ore in the shale is very hard and contains as much as 8% sulphides, principally pyrite. The gold is quite coarse, and often specks of it are visible in the ore, principally in the numerous small quartz seams filling cracks in the shale. The content is irregular and there are wide differences in assays of adjacent samples. The Long Horn ore-shoot, already mentioned, is of this type, and represents the most important development on the property so far.

All the workings at the Major are above the primary ore-zone, and in fact this is true of all the work done in the district. The rapid erosion of this area keeps pace with the oxidation, and that zone is very generally of shallow depth. In the oxidized zone there has been extensive concentration by secondary enrichment and mechanical concentration. At many places in the veins there are streaks and spots where samples taken show considerable value. In prospecting over this area with mortar and pan, one may be unduly influenced by the many samples that show a lot of fine free gold. The former management of the Major mines attempted to work the numerous small bunches of enriched surface material, with the result that there are widely scattered workings and a complicated expensive system of trams for getting the ore into the mill.

The milling plant consists of a 6-stamp Hendy mill, with individual mortars, quadruple discharge, and having

1000-lb. stamps, crushing through a 30-mesh punched screen. The equipment includes an 8 by 10 jaw-crusher, grizzly, 50-ton ore-bin, automatic feeders, two amalgamating plates, and mercury traps. The power is furnished by boiler and 50-hp. engine using wood fuel. The cost of the wood in the past has been only about ₱4 per cord for 3-ft. wood. It is cut by the Igorrotes under contract.

Below the plates there are two Wilfley No. 6 sand tables, followed by cyanide leaching plant. This consists of six vats, 20 by 5 ft., arranged for filling with Butters distributers. A stock tank, sump tank, 10 by 16, zinc-box, piping, and other accessories complete the equipment. It is all housed in and well situated for protection from the *baguios*, which is most important in this district. An electric-light plant was installed for lighting the mill and manager's house.

The method of treatment for the Major ore was marked out in detail by the California Ore Testing Co., of San Francisco, and it was shown conclusively that over 90% of the content could be saved by amalgamation, concentration, and cyanidation, and about equal amounts by each method. The difficulties are that the concentrate recovered is not high-grade enough to permit of marketing in San Francisco, and tests made tend to show that the sulphides cannot be satisfactorily cyanided. The possible solutions of this problem are: (1) The reduction of the freight rate to water transport, on the completion of the railroad now building into Baguio; (2) by roasting and smelting in small reverberatory-furnaces with silicious high-grade ores, a fire method of concentration may be developed; (3) by chlorination methods in connection with other small mines of the district. This question of rendering the values in the concentrate available at low cost is the only difficulty in the metallurgy of these ores.

A total of $100,000 gold has been expended in the exploitation of these Major mines, and it furnishes a striking example of the things that ought not to be done in a new mining field. The deposits have not as yet even been prospected, as there has not been any development work done at any considerable distance from the surface. The mill and other expensive improvements were installed without any knowledge of the extent and value of the ore deposits.

Reducing Conveyor-Belt Costs

In a belt-conveying system, the largest single item of expense is the belt, and large users of this machinery devote considerable study to this part of the equipment. The original cost of the belt constitutes from one-third to one-half the cost of the entire conveyor, increasing with the length of the conveyor. Belt renewals are also the largest item of up-keep, this cost varying according to so many conditions that no general rule can be laid down. There are, however, certain general principles covering machinery of this type, and proper observance of these principles may greatly reduce the cost of operation. In analyzing the causes of belt wear, we will consider first the wear caused by the material carried and, second, external causes. The material produces wear by (a) slipping on the belt due to its inertia at the loading chute, (b) slipping back on the incline of the conveyor, and (c) by rearranging its position on the belt between the loading and discharge points.

The first can only be overcome by delivering material to the belt at the belt speed. The chute should be inclined in the direction of the conveyor's travel so that the material may receive a certain impetus before it strikes the belt. A curved lip is sometimes advocated at the bottom of the chute, but this arrangement is usually impractical and does not greatly reduce slippage. A more effective arrangement used under certain circumstances is to fit a V-shaped lip to the chute or a perforated plate which allows the fine material to drop upon the belt first, and then the larger lumps fall upon the fine material.

The second cause may be entirely overcome. On a properly designed conveyor, there should be no slippage whatever on the incline. For most materials the maximum inclination used should be about 20°, although this is sometimes exceeded under certain conditions. In all cases it should be as a minimum 10° less than the angle of repose of the material on the belt. Lumpy material has a tendency to roll back on the belt, unless intermixed with fine, and also an intermittent flow allows more slippage. All these conditions should be taken into account before determining the operating angle.

Rearrangement of the load is greatest in a deeply troughed belt and is reduced to a minimum on a flat belt. The present tendency is, accordingly, to use a very shallow trough. At the present time 20° is usually the standard practice, whereas from 30 to 45° was common several years ago. The change has been made without perceptibly reducing the capacity, but with a great saving in belt wear. It is often well, however, to use deeply troughed carriers beneath the chute, one placed about 3 in. behind the point of loading and two others closely spaced beneath the skirt boards.

The proper alignment of the carriers is always important in order that the belt may run perfectly true. This may be done by leaving one side of the carriers only partly tightened. Then, by running the conveyor empty, any tendency of the belt to run to either side may be corrected by tapping the carriers either forward or back. By going over them in this way, several times, the belt may be adjusted to run centrally and the carriers should then be tightened. Neglect to observe this precaution allows the belt to run against the guide idlers, and the sides of the chutes, thus rapidly wearing the edges of the belt.

Another point to be considered is the action of the weather. The sun's rays are as detrimental to rubber belts as to rubber tires, while rain, snow, and ice are all injurious. Water may get between the piles and rot the fabric, or may freeze and force the piles apart. In some cases, where no covering is provided, the belts are taken from the conveyor during the winter, but the best results may be secured by providing a permanent housing.

A steady feed is important, especially for an inclined conveyor, and it is good economy to provide an automatic feeder with all installations. Another very important consideration is the type of carrier used. The carrier must be constructed so that the pulleys will revolve freely in all weather, and under all conditions, so as not to offer more resistance to the belt than is absolutely necessary. A ball-bearing carrier has practically no wearing effect upon the belt, and it usually pays to use such a carrier, even at an increased cost. The strength of the carrier should also be taken into consideration, as a broken pulley can sometimes greatly injure or even ruin a belt. By a careful observance of these principles, good service can always be secured from high-grade belts.—*The Labor Saver.*

SAND is the main constituent of glass, forming 52 to 65% of the mass of the original mixture, or from 60 to 75% of the finished product after melting has driven off carbon dioxide and other volatile materials. On the quality of the sand depends the transparency, great brilliance, and hardness of glass. Generally speaking, sand should not contain more than 0.2% of iron oxide when used for making good glass. Pennsylvania produces 30% of the sand used in glassmaking in the United States, about 400,000 tons, the average value being $1.40 per ton.

THE Government Water Supply Department, now furnishing water to the Kalgoorlie mines at $1.68 per 1000 gal., is charging the Mountain Queen, near Southern Cross and 140 miles nearer the Mundaring weir, $2.40 at the Marvel Loch stand-pipe, from which it must be carted, and $5.40 if delivered to the mine by pipe-line. The mine uses 200 gal. per ton treated, so it costs $0.48 per ton for water at the stand-pipe, and the whole cost of milling, including carted water, is $1.

Recent Advances in Industrial Chemistry

By Raymond C. Benner

Advances in modern science are so rapid that it is out of the question for anyone but a specialist to keep abreast of the times. In fact, time after time, even those of us who make it a business to keep up on a particular subject, find that important things are missed, so vast is the volume of literature to be reviewed. Therefore, it is not amiss to give a brief review of some of the more important discoveries of the past few years.

Metallic Elements and Alloys

Probably in no branch of applied chemistry has so rapid an advance been made as in the isolation of the rarer elements in a pure state and in making alloys of them with the more common elements. As a matter of fact, the properties of the alloys, in many cases, differ so radically from the original elements entering into the combination that, to all intents and purposes, so far as the physical properties are concerned, they act like a new element. There seems to be an alloy with properties suited to each special purpose.

Tungsten, tantalum, molybdenum, and boron have yielded to the efforts of the chemists and are now to be obtained in the pure state in the open market. The high melting points, together with high electric resistance of tungsten (3100°C.) and tantalum (2300°C.) make them especially valuable for the filaments of electric lights. The efficiency is thus increased to such an extent that the statement is frequently made that, at the present price, the consumer can afford to buy a tungsten lamp rather than have a carbon lamp given him. The most recent progress in the metallurgy of these interesting elements has been in the obtaining of them in a ductile form. Tungsten, tantalum, and molybdenum wire can now be purchased on the market. Formerly, in the manufacture of lamp filaments, it was necessary to form the metallic powder into a paste with some plastic substance, squeeze it through a die, then drive off the binding substance by means of the current and at the same time fuse the metal into the form of a wire, but now that the secret of obtaining these in a ductile form has been solved the wire can be drawn.

The extremely high melting points, combined with the high electrical resistance of these elements, makes them of special interest to all laboratory workers, because of the possibilities in the way of wire-wound resistance furnaces for high temperatures. Temperatures considerably higher than with a platinum-wound furnace can thus be obtained. It is possible to make furnaces wound with tungsten wire in a manner similar to that in which any other wire-wound resistance furnace is constructed, with the one exception that, as these elements are readily oxidized, they must be kept in an atmosphere of hydrogen during the time of heating.

Boron has recently been obtained in a very pure state by Weintraub in the laboratories of the General Electric Co., and has been found to possess many interesting as well as valuable properties. Iron, although one of the most common of the useful elements, has been until recently one of the hardest to obtain in a pure state. Among the elements utilized for the manufacture of commercial alloys there are few, if any, which are more affected by very small amounts of impurities. It has been found possible, for some time past, to remove nearly all of the impurities from iron by various means; but not until Franz Fisher electrolyzed an iron salt at from 100 to 120°C. in the presence of some hydroscopic salt, such as $CaCl_2$, was it possible to obtain iron free from hydrogen, which rendered it hard and brittle. On the removal of the last traces of hydrogen, iron becomes softer than gold and silver, and not much harder than aluminum. Pure iron possesses the valuable property of becoming magnetic more quickly and again losing its magnetism much more rapidly than when it contains carbon and silicon, thus making it about 2½ times as efficient for use in electric motors.

The development of the electric furnace in the metallurgy of steel has solved the problem of the removal of the sulphur and the production of a slag free from metal. The electric furnace for this purpose is in use in a number of places in Europe and America, where the electric power is obtainable from water power and sufficiently reasonable in price. It may not be out of place to mention here that it has recently been found possible to economically remove practically all of the sulphur from iron ore by roasting in some of the more modern furnaces.

The ease with which nickel forms an alloy with iron has been known for a long time, but on account of the impossibility of obtaining nickel in a pure state, the alloys have until recently been but little used. The same fact holds with many alloys, more especially with those of chromium, silicon, and manganese with iron. The most important object in manufacturing a successful armor-plate is to obtain a tough non-crystalline structure. This is accomplished by the removal of more or less carbon and by subjecting to a peculiar heat treatment (suddenly cooling when at high temperature, heating again, and keeping at a certain lower temperature for some time). The nickel-steel sheets are two or three times as hard as welded iron, have a tensile strength of 55 tons per square inch, and are much less easily fractured than ordinary steel. Alloys containing 23% and more nickel are non-magnetic. Those containing over 30% have a high resistance to electricity, while those containing 45% have a coefficient of expansion about one-twentieth that of steel.

Chromium, tungsten, and molybdenum form alloys which are of interest to the chemist and metallurgist because they are very resistant to chemical reagents, and because variations in the heat treatment likewise cause this resistance to vary greatly. It can be increased as much as five times in this manner. Alloys have been made which are insoluble in dilute hydrochloric, sulphuric, and nitric acid. An alloy containing 60% chromium, 35% iron, and from 2 to 3% molybdenum is said to withstand the action of boiling aqua regia. The use of these elements for special self-hardening tool steel, which makes possible the running of the lathe tool nearly to a red heat without softening, is familiar to all.

The use of vanadium in steel for special alloys would increase much more rapidly—as it is very useful—were it possible to obtain it at a more reasonable price. Krupp is said to have recently patented a remarkable alloy which cannot be drilled, exploded, nor cut by an oxyhydrogen blowpipe. The hard manganese steel invented by Robert Hadfield is used for castings and, although not malleable, can be bent in a cold state without breaking. It thus forms a useful alloy.

Non-Metallic Elements

The conquest of the air by the chemist forms one of the greatest triumphs of the last decade. Although the fact that oxygen and nitrogen can be made to combine by means of an electric discharge, has been known since the time of Priestley, it remained for Birkeland and Eyde to commercialize it. The NO formed by the union of the O and N when exposed to the excess O in the air forms NO_2. This gas, when brought in contact with water, forms NO_3, liberating NO, which is then capable of forming more HNO_3 in the same way as before. The dilute acid is concentrated to 50% acid in the absorption towers, when it is sold, used to neutralize with $CaCO_3$, forming $Ca(NO_3)_2$, or as a basis for the preparation of other compounds.

Caro has found that where calcium carbide is heated in the presence of nitrogen, $CaCN_2$, called cyanamide, is formed. The nitrogen of the air can thus be caused to

enter into chemical union, in a form available for agricultural purposes and for the extraction of gold. The world's production now approximates 200,000 tons. Ammonia can be prepared from this substance by treating under pressure with steam.

One of the most striking results of scientific investigation is the method of making synthetic ammonia from the elements. It is a well known fact that the affinity of nitrogen and hydrogen is so small that they do not unite appreciably with one another, either at ordinary or at a raised temperature. Many chemists have worked on this synthesis, but it remained for Haber to devise a successful process of circulating a mixture of nitrogen and hydrogen, over iron as a catalyte, at a temperature of 650 to 700°C. and under a pressure of 200 atmospheres, the ammonia being removed from the cycle by means of absorption in water.

Industrial Processes

The need for a good process for the recovery of tin from old tin-plated ware has given rise to a new method which takes advantage of the property of chlorine gas in a dry state to act upon tin, and not on iron, between certain temperatures. By this method a very pure form of anhydrous chloride is obtained instead of impure tin mud, as formerly by means of the older electrolytic process.

Among the new compounds which have been developed within the last few years are the peroxides, percarbonates, perborates, and persulphates. Peroxide of hydrogen, formerly sold only in water solution, has been found to form a crystalline compound with urea, which makes it possible to buy this useful oxidizing agent in solid form for hygienic and pharmaceutical purposes. There is also the new industry of making true artificial gems, which do not vary in chemical composition from those found in nature. These can now be made because of the ease with which high temperatures are controlled and used. Artificial rubies, and white, yellow, and blue sapphires are made by coloring fused alumina by means of chromium oxide, iron oxide, or titanium oxide.

Last but not least, is the successful outcome of a long series of experiments by W. H. Perkins upon the permanent fireproofing of cotton goods, more especially that commonly called canton flannel, so widely used for children's garments, which is especially inflammable, burning with great rapidity. It has long been known that this purpose is temporarily accomplished by impregnating the cloth with such solutions as a mixture of three parts ammonium phosphate, two parts amminoum sulphate, and forty parts water, or a solution of sodium tungstate. But these, together with some thousands of other mixture, give only temporary results; for the substances used for impregnating the fabrics are soluble and, not becoming fixed in the fibre of the cloth, are dissolved out after two or three washings. It was finally discovered, however, that cotton goods become permanently fireproof and that the tensile strength of the goods increased some 20% by the following process:

"The material is put through a solution of sodium stannate of about 45°Tw. in such a manner that it will become thoroughly impregnated. It is then squeezed in order to remove any excess of the solution, and passed over heated copper drums to dry it perfectly. It is now run through a solution of ammonium sulphate of 15°Tw., again squeezed, dried, washed, and finished in the ordinary manner."

Zinc Smelting in Japan.—The Mitsui Bussan Kaisha is erecting a zinc smelter at Omuta, near the coke plant, to refine the ores from its zinc mines. At present the ore is shipped to Europe, and the refined zinc imported. The new smelter will therefore effect a saving in the cost of zinc and will also stimulate the development of mines heretofore considered unprofitable. Another company has recently been organized at Osaka to engage in smelting and refining zinc. These two zinc smelters are the only ones in Japan at present. The total import of zinc into Japan is about 4000 tons per year, valued at $500,000, of which amount 10% is imported into the Nagasaki district. The local consumption is more than the capacity of these two companies' plants, and if they prove successful in operation they will have a market for their entire output. The chief zinc mine in Japan is the Kamioka, in Gifu prefecture, Kyushu, which produced about 9000 tons in 1908. This property yields copper and silver as well as zinc.

International Map of the World

The first sheet of the United States portion of the international map of the world has just been issued by the United States Geological Survey, and includes Rhode Island and portions of New York, Connecticut, Massachusetts, New Hampshire, Maine, and Nova Scotia. This world map, recently undertaken by the leading nations, is being prepared on the scale of 1 to 1,000,000—that is, 1 linear inch on the map represents 1,000,000 inches, or nearly 16 miles, on the earths surface. The map is to consist of about 1500 sheets covering all the land areas of the world, each sheet representing 4° of latitude and 6° of longitude. The sheets will be numbered according to a scheme covering the whole world, and the symbols indicating the natural features and the works of man will be uniform on all the sheets. It has been the dream of geographers for many years to have an international map scientifically constructed on a uniform scale, and the work is now well under way. The maps at present available, printed on all sorts of scales, in geographies and atlases, where the most important areas are allotted the greatest space, inevitably lead to misconceptions as to the relative size of the different countries. Thus it is not generally known that the area of England, Scotland, and Ireland together is less than that of any one of our five largest states; or that Texas is much larger than France; or that the new states of New Mexico and Arizona are each larger than the combined areas of the Balkan countries of Bulgaria, Rumania, Servia, and Montenegro, now engaged in war with Turkey; or that Argentina is more than three times the size of the thirteen original states. With an international map on a uniform scale the study of comparative geography will become far more fascinating and instructive.

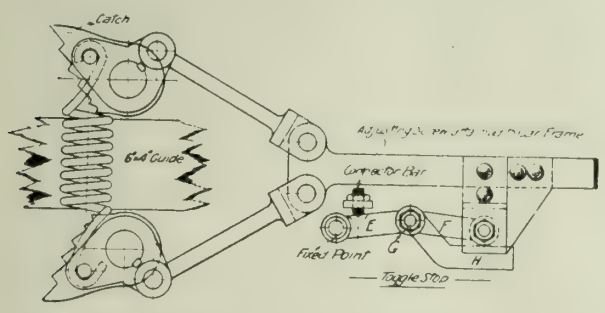
At the present rate of progress the United States portion of the international map should be finished within eight or ten years. It will be by far the best map of the country in existence. There is, in fact, no very accurate map of the United States as a whole, although the Geological Survey publishes a base map about 7 ft. wide, and the General Land Office has issued a similar map. Most of the commercial maps, though pretty to look upon, are full of gross errors. For a superficial study of the country the ordinary maps may serve the purpose, but when one finds a town 5 or 6 miles out of position with reference to a railroad or some other town he realizes that the present-day geography or atlas map is anything but accurate.

The Geological Survey has topographically mapped in great detail more than one-third of the United States, but these maps are mostly on a scale of 1 mile or 2 miles to the inch and are too large for ordinary comparative purposes. The Boston sheet of the millionth-scale map is a very accurate map and is a beautiful product of the engraver's and lithographer's art, printed on fine enameled paper. This sheet is sold by the Geological Survey at the bare cost of production, namely, 40c., which will be the price of the other sheets as issued. Thus the entire map of the United States will cost $20.80. As a preliminary to the issuance of the completed color sections of the United States portion of the world's map the Survey is printing, in black and white, state maps on the scale of 1 to 500,000, being thus four times as large as the world's map of the same area. Already such maps have been finished and printed for Vermont, Illinois, Indiana, Iowa, Minnesota, Mississippi, and Georgia, and a dozen others are in process of publication. These are sold by the Survey at varying prices according to the size of the maps. For instance, the Vermont map is sold at 10c. and the Minnesota map at 40 cents.

Safety Device for Skips in Inclined Shafts

From time to time serious accidents occur in inclined shafts through the rope on a skip breaking, brakes refusing to act on hoisting engines, or the safety device on the skip not acting in time. At Mount Morgan, in Queensland, a safety man car was devised, and interesting details have been given in a paper prepared by N. F. White, T. R. Dibdin, and P. Drain for the Australian Institute of Mining Engineers, from which the following is abstracted.

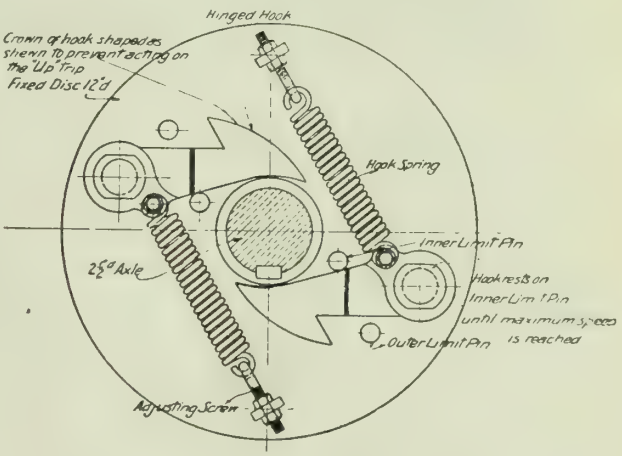
The safety device finally adopted completely fills the two conditions of coming into action independently of the position of a fracture in hoisting rope, in the event of the rope unreeling from the drum due to the latter getting beyond the control of the engineer, and operating



POSITION OF TOGGLE-STOP WHEN HOLDING CATCHES CLEAR OF GUIDES.

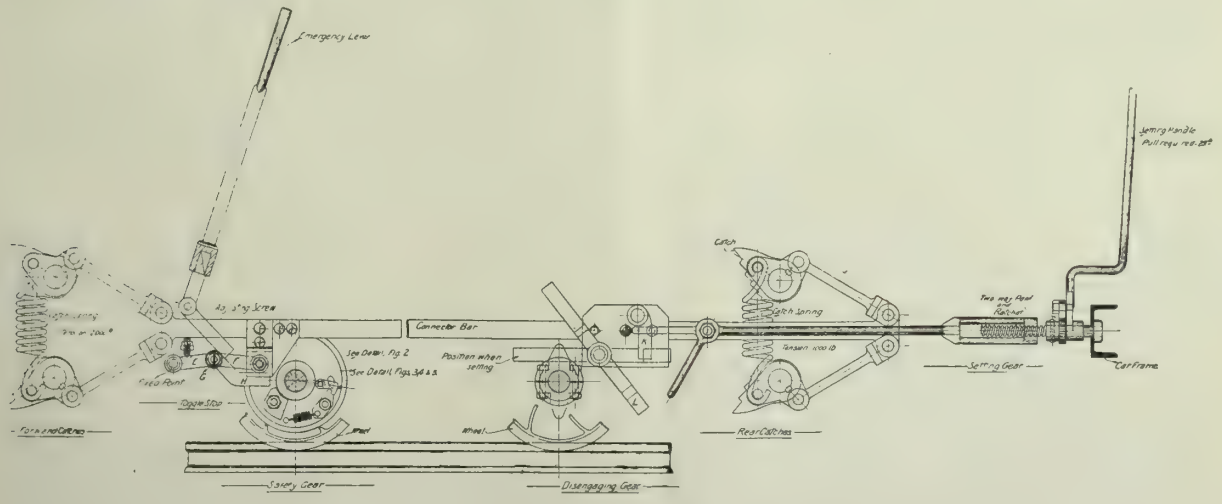
at an adjustable speed limit, being actuated by centrifugal force derived from the rotating car axle. This safety gear is essentially a shaft governor, and remains fixed until a predetermined speed is obtained, when it operates instantly.

The man cars at Mount Morgan are provided with a device which is a combination of four main parts: (1) hinged rotating hooks, (2) trigger and drop catch; (3) toggle-stop, and (4) spring-actuated catches. Of these the duties are as follows: (1) Fixed rigidly to the forward axle is a disc, to which are attached two hinged hooks, each being fitted with an adjustable retention spring. Projecting from the face of the fixed disc are 'outer' and 'inner' limit pins. The hook springs maintain the hinged hooks in continual contact with the inner limit pins until the working speed limit is reached. The outer limit pin prevents the hinged hook from flying completely out, should the hook spring break. (2) Loosely riding on the same axle to which the fixed disc is attached is a second disc, the loose disc carrying a trigger and spring-actuated drop catch. The trigger has an arm which passes through, and beyond the loose disc, by means of a slot. When the drop catch is set, it is clear of the hinged hooks. Should the rate of rotation exceed the proper speed limit, the hooks move radially outward and strike the trigger-arm, thereby moving the trigger clear of the spring-actuated drop catch, which then rotates into such a position that a hinged hook engages with it. The hinged hook now being engaged with the spring-actuated drop catch, the loose disc also rotates. Attached to the back of the loose disc is a knocker, by which the toggle-stop is operated. (3) The toggle-stop consists of two main members, hinged together by a pin. This pin is prolonged to form a handle with which the toggle-stop may be set or removed. The main member has



FACE VIEW OF FIXED DISC.

a prolongation called the toggle horn, which is struck by the knocker attached to the loose disc. When the toggle-stop is set, the main member rests against an adjusting screw. (4) The car is fitted with two sets of catches, which are connected together by a bar and four links in such a manner as will make them move simultaneously. Each set of catches is provided with a powerful spring, whose total tension is about 3000 lb. when the catches are fully opened, and about 1000 lb. when on the point of gripping the guides.



ELEVATION, SAFETY MECHANISM OF MAN CAR.

The setting gear, by means of which the catches may be opened clear of the guides, is plainly shown in the accompanying illustration. To render the mechanism entirely independent of any person, suitable gear to automatically disengage the setting gear is provided. The action of the gear is as follows: When the velocity of the car exceeds the predetermined limit (450 ft. per minute at Mount Morgan), the centrifugal force of the hinged hooks overcomes the tension of the hook springs, and the hooks move into a position where they strike the trigger-arm, and thereby move the trigger a short distance, thus dis-

engaging the drop-catch. The spring-actuated drop-catch being released, rotates into a position where a hinged hook may engage with it. The hinged hook being engaged with the drop-catch, the loose disc rotates and carries with it the knocker. The knocker striking the toggle horn drives the toggle-stop into the 'off' position, whereupon the catches engage the horizontal guides, bringing the car to rest. Operation by hand may be effected by pulling an emergency lever, whereby the toggle-stop is driven into the off position. This type of car was thoroughly tested by severe tests, and is in use at Mount Morgan where the grade is 1 in 3. The shaft has two compartments, each with 26-in. gauge track laid with 30-lb. rails. The dimensions of the car are: length over all, 18.5 ft.; width, 4.25 ft.; width of seats, 1 ft.; height of seats, 1 ft.; width of foot plates, 18 in.; wheel base, 6.25 ft.; weight of empty car, 4480 lb.; seating capacity, 18 men.

Gold Production of Western Australia

The July gold output was valued at $2,059,100, the principal returns being as follows:

	Tonnage.	Yield.	Profit.	Div.
Gt. Boulder Proprietary	19,069	$235,400	$122,100	.....
Ivanhoe	20,836	204,200	80,000	$225,000
Kalgurli	10,375	110,200	61,700	120,000
Yuanmi	5,510	50,400	24,300	.....
Sons of Gwalia	13,354	107,700	22,900	.....
Lake View & Star	18,352	110,100	18,000	.....
Gt. Boulder Perseverance	21,318	126,900	16,100	.....
Black Range	2,364	39,700	16,000	13,600
Oroya Links	11,450	69,400	15,400	.....
Oroya Black Range	4,900	41,400	10,200	.....
Associated	11,010	72,600	10,100	.....
Mararoa	2,674	29,900	8,900	.....
South Kalgurli	9,696	59,700	9,500	.....
Ingliston Consols, Extd.	1,322	16,600	6,300	.....
Sand Queen	1,052	14,700	6,200	.....
Great Fingall Consols	6,214	53,300	3,500	.....
Great Boulder No. 1	959	8,900	3,100	.....
Lake View Consols	9,045	8,600	2,500	.....
Lady Miller	2,200	12,500	2,400	.....
Burbanks Main Lode	1,870	19,600	1,100	.....
Mountain Queen	4,035	19,000	550	.....
Ida H.	1,166	13,600	300	.....
			Loss.	
Golden Horse-Shoe	29,421	157,800	8,600	.....
Hainault	5,799	27,300	9,100	.....
Morning Star	1,293	11,700	2,600	.....
Associated Northern	1,975	36,200	.....	.....
North Kalgurli	1,003	19,600	.....	.....

When at the end of last year the Consolidated Gold Fields of South Africa absorbed the Rhodesia Exploration & Development Co., it was generally understood that Sir Abe Bailey had retired from the arena of Rhodesian mining, or at any rate, that he ceased to be an active factor in the mineral industry of the country. When he left South Africa a few months ago for England, he was faced with complex lawsuits in regard to certain 'deals' with the Amalgamated Properties Co., and it was generally understood that he had disposed of all his holdings in the country. It seems, however, that Sir Abe proposes to re-enter the field. Advices from London state that he has obtained control of the London & Rhodesian Mining & Land Co., which owns several important mining properties in Mashonaland, notably the Cam & Motor (which promises to become one of the largest mines in the territory), the Hay, and others. In Salisbury it is rumored in usually well informed circles that Sir Abe Bailey, Hans Sauer, and H. G. Latilla (the three chief factors in the now defunct Rhodesia Exploration & Development Co.) are busily engaged in forming a new and large company for the purpose of exploiting mineralized and agricultural properties in Charterland. Whether this refers to a reconstruction of the London & Rhodesian company or not remains to be seen, but it is now clear that Sir Abe and his colleagues have by no means retired from the zone of activity in the northern territory.

Preparation of Metallic Tungsten

The preparation of tungsten from its ores has been described by G. Erhard in *Metallurgie*. If bismuth is present in the ore in sufficient quantity, it is first extracted by crushing, roasting, and leaching with HCl. The dried residue is then heated with carbonate of soda, using 60% excess over the theoretical amount necessary to produce sodium tungstate. After the charge is sintered it is cooled, crushed in a ball-mill, and again sintered. The second sintering increases the extraction from 70 to 97%. The sintered charge is leached in iron vats with hot water. Steam may be introduced to keep the water hot. The solution is evaporated until crystals of sodium tungstate separate, and are skimmed out. It is difficult to keep the crystals from forming on the sides of the kettle and burning fast. The sodium tungstate is decomposed by salt and 6% of nitric acid into tungsten trioxide. The tungsten trioxide settles on the bottom of the vat in a hard mass and is removed with difficulty. The fumes from the reaction are caught in an absorption tower. Care must be taken to prevent contact with iron while the tungsten trioxide contains acid. The dried tungsten trioxide is heated with 14 parts charcoal and 2 parts colophonium, thus reducing it to the metallic state. The metal is mixed with some reducing material and undecomposed tungsten trioxide, from which it is freed by crushing and washing.

Stream Flow in California

The material progress of California has in large part been measured by its water-supply development. In the days of forty-nine its first great boom was the result of finding gold in a creek bottom, and throughout the early gold days the rapid growth of California was made possible by the development of water supplies for use in placer mining. In later years came the great irrigation activities, and especially in southern California have the agricultural products become so valuable that in that part of the state water is probably worth more than it is anywhere else in the country.

Throughout the Sacramento and San Joaquin valleys water has the same relatively large values for irrigation. Still later came the recognition of the enormous importance of California water-powers. In a very few years the development of water-power has grown until California ranks second only to New York, the total horse-power in the state in the year 1911 being over 500,000.

It is apparent that in a State so thoroughly dependent upon its water supplies, investigations which will reveal the amount of water available in the streams and beneath the ground are of the highest importance. The people of California have recognized this, and for many years have through their legislatures coöperated with the United States Geological Survey in the determination of stream flow and the location of underground supplies.

The Geological Survey has just issued Water-Supply Paper 291, on the surface water supply of the Pacific coast in California, 1910, by W. B. Clapp, F. F. Henshaw, and H. D. McGlashan. This report contains the results of measurements of some of the California rivers, made during the year 1910, at regular stations maintained by the Survey in coöperation with the office of the state engineer. All the important rivers of the state were covered in this investigation, and in addition many of the smaller tributaries and irrigation canals. There are in all 98 stations from which data are reported in this publication, and work has been carried on in a way that affords for almost every stream reported a daily record of the discharge.

Value of the Spanish Arroba

By Robert Frazer, Jr.

Investigation shows that the Spanish arroba varies in almost every province, and in some cases, as in Valencia, there are several different arrobas. That of the province of Castile contains 25 Spanish pounds of 16 oz. (the Spanish *onza* (ounce) contains 28.755 gm., the avoirdupois ounce 28.3495 gm.), and is equivalent to 25.358 United States pounds; but a table of equivalents published in Valencia gives no less than five different arrobas used in the province of Valencia—the 'common arroba' of 36 lb. of 12 Spanish ounces, the 'lesser arroba' of 30 lb. of 12 oz., the 'flour arroba' of 32 lb. of 12 oz, the 'fish arroba' of 24 lb. of 18 oz., and the 'lead arroba,' of approximately 32 lb. 4 oz., used in weighing that metal. The table referred to gives the 'common arroba,' which is now the only one much used here, as equivalent to 12.355 kg., or 27.238 lb. U. S.; but as the metric system is the only one now legally recognized in Spain, the term 'arroba' seems to have come to mean in common parlance, certainly in Valencia at any rate, an eighth of a metric quintal, or 12.5 kg. (approximately 27.5 lb. avoirdupois) instead of the 12.355 kg. it originally represented.

Copper Producers' Association Report

The Copper Producers' Association statement, November 8, shows an increase during the preceding month in accumulation in this country of 13,679,380 lb. The details are as follows:

	Pounds.
Stock of marketable copper of all kinds on hand at all points in the United States, Oct. 1, 1912	63,065,587
Production of marketable copper in the United States from all domestic and foreign sources during October	145,405,453
Deliveries for consumption, October	84,104,734
Deliveries for export, October	47,621,342
Stock of marketable copper of all kinds on hand at all points in the United States, November 1.	76,744,967

The changes in surplus since November 1, 1911, have been as follows, in pounds.

	Increase.	Decrease.
November, 1911		23,212,454
December		22,330,493
January, 1912		22,173,252
February		3,301,944
March		572,431
April	2,927,829	
May		15,450,386
June		5,280,639
July	5,945,416	
August		3,579,046
September	16,364,213	
October	13,679,380	

That portion of the international geological work along the 141st meridian (the Yukon-Alaska boundary) which had been undertaken by the Canadian Government, the United States and Canadian Geological Surveys having agreed to map the geology along the boundary line from Yukon river to the Arctic Ocean, a distance of about 350 miles, is now finished. This work was commenced in the spring of 1911, and by the terms of the agreement the United States and Canadian geologists worked to the north and south respectively of Porcupine river, each extending their investigations at least two miles east and west of the boundary line. This work not only gives a geological section at that longitude through the northern half of the Yukon plateau, the entire Rocky Mountain, and the Arctic slope physiographic provinces, but should also assist materially in correlating the geology of Alaska with that of Yukon and British Columbia, both in Canada.

Copper Review for October

By Misha E. Appelbaum

During the past month the main sellers of copper have adhered to a price of 17¾c. Due to the Balkan war situation, the London Metal Exchange exhibited irregular and at times weak tendencies, which resulted in large sales by the dealers to consumers, principally at lower quotations. While domestic consumers purchased some copper during that period, Europe practically remained out of the market. As soon as the result of the election became known, copper on the London Metal Exchange exhibited very strong tendencies, scoring a smart advance, with the result that even the dealers' prices were advanced about ¼c., bringing them up almost to the producers' prices.

It must, however, not be overlooked that in spite of the increase for the past two months in the visible supply in the United States that in Europe has decreased largely and that the statements for the next few months on this side will reflect the reduced output due to the strike situation in Utah and other States, so that by the first of January, or February at the latest, there will be much less copper on hand than at any time since 1907. In trying to diagnose the course of future prices one must, of course, be guided by the business situation, which at the moment is in an exceedingly healthy state. I, for one, do not believe that the tariff or trust legislation which will be attempted by the Democrats will be of such a drastic nature as to paralyze business or even to interfere with the improvement in business which has been going on steadily. If, therefore, I am correct in my assumption that the business improvement will continue and that the Democrats will seize the opportunity which has been given to them for the first time in over sixteen years by advocating conservative and proper legislation, then I do not hesitate to go on record in stating that by the beginning of next year, copper will sell at much higher prices than at any time since 1907. In fact, this opinion applies to all metals.

Gold-Mining in Antioquia, Colombia

By Louis A. Maire

At Amalfi, an American company under G. B. O'Brien, has some ground suitable for working by hydraulic methods and is running a long bedrock tunnel about 1000 ft., preparatory to commencing operations. Production at this property should begin within three months. In Anori another American company has done some prospecting work with a small giant, and has just started work on a 2000-ft. tunnel to gain sufficient dumping space for larger operations. A third company, also American, has commenced operations about eight miles from the above.

On the upper Porce river some Colombians are working the Gabine mine by native methods, and it is reported that they have secured over $130,000 worth of gold in two years. About two miles below this mine some Americans, leasing the La Clara, under Mr. McGuire, have taken out about $30,000 in about four months' work. In addition to these companies there are a number of smaller concerns that are operating successfully. Most of the ground on the Cauca, Porce, and Nechi rivers has been located, and persons desiring to get property on these rivers are obliged to deal either with native owners or through middlemen, who add a considerable amount to the original price.

Of late years more attention has been paid to placer deposits and many opportunities to obtain good quartz mines have been overlooked. In my opinion, Colombia offers today exceptional chances, not only in the placer mines, but in quartz mines as well, and the mines can be obtained on a far more favorable basis from the owners than can placer ground. Large amounts of capital are required, and the individual with only a small financial backing is not likely to be able to develop an enterprise to the profitable stage of work.

Discussion

Readers of the MINING AND SCIENTIFIC PRESS are invited to use this department for the discussion of technical and other matters pertaining to mining and metallurgy. The Editor welcomes the expression of views contrary to his own, believing that careful criticism is more valuable than casual compliment. Insertion of any contribution is determined by its probable interest to the readers of this journal.

A Treatment Problem

The Editor:

Sir—I wish to bring to your notice the following: I have recently taken up a number of heaps of silver tailing (600,000 tons in all), scattered over the province of Junin, Peru. These are the results of the old *patio* process worked by the Spaniards on Cerro de Pasco and other silver ores for the last three hundred years. They consist of very fine material (80% passing through a 200 mesh), silver content 8 oz., SiO_2 80%, Al_2O_3 1.7%, FeO 7.7%, and a fairly large amount of mercury. In order to ascertain the true value of the tailing, I want to obtain information in regard to the cost of extraction of the silver. I should feel very much obliged, therefore, if some of your readers would inform me of the results obtained by the companies in Mexico or elsewhere that are working similar material.

HENRY VOGEL.

Cerro de Pasco, Peru, October 12.

Cripple Creek History

The Editor:

Sir—In your issue of November 2 you published a letter from me containing a correction of an item in your issue of October 12 regarding the shipment of ore on burros from Cripple Creek in 1892. In the letter as published it appears that I corrected the *Colorado Springs Gazette*, which was not the case at all. As you can see by referring to the original communication, I said that *your correspondent* was in error. The item quoted said nothing whatever about burros.

HORACE F. LUNT.

Colorado Springs, November 6.

[We proffer our apologies both to the *Gazette* and to Mr. Lunt. Our 'correspondent' was another Colorado exchange, which evidently elaborated its quotation from the *Gazette*, with unfortunate results.—EDITOR.]

Cyanidation of Concentrate

The Editor:

Sir—The article on cyanidation of concentrate by Robert Linton in your issue of October 5 recalls to mind an interesting series of tests I ran on raw concentrate at one of the Tonopah mills. With a sulphur content of 30% perfect extraction was readily obtained by cyanidation at 90°F., but the cyanide consumption was 40 lb. per ton. In testing the resultant solution it was found that KSCN was present in sufficient amount to account for about 80% of the cyanide consumption, and consequently twenty or thirty tests were run with various reagents in the attempt to prevent the formation of KSCN. In repatedly titrating for thiocyanate I was struck by the remarkable resemblance between the curves representing extraction and the concurrent KSCN titrations. After running a few tests it was possible to determine silver extraction to within a few per cent by merely titrating for KSCN. Furthermore, the sulphur present as thiocyanate was found to correspond almost exactly with the sulphur which had been combined with the silver which had gone into solution, and until the extraction of silver became complete only the sulphur so combined entered the solution as KSCN. By prolonging the test beyond the point where all the silver was extracted, considerable sulphur, combined otherwise than with the silver, came into the solutions, so that knowing the amount of silver in the concentrate, the most economic point to stop the test could be determined merely by the KSCN titration. In extended experimental work I found nothing which prevented the formation of KSCN and finally concluded that either silver sulphide goes into solution without decomposition, or if decomposed, that the KCN snapped up the liberated sulphur ion before any preventive reagent could perform its beneficent function.

NOEL CUNNINGHAM.

Timmins, Ontario, October 14.

Valuation of Mines

The Editor:

Sir—The following extracts from a report on a Colorado mine, made by a so-called mining engineer, will interest your readers, I hope.

"I personally called upon the owner several times to have him put a price on this property and at first I thought his figures rather high, but later on I had advise from him that he would take $10,000 cash for the property, but would not give time nor option.

"I consider this one of the best mines in that district after being cleaned out and developed, as the assays show from $6.00 a ton and upwards, while the vein shows from $5,000 to $30,000 per ton and upwards of $100,000 per ton at 150 to 200 foot level, this being practically a dry mine and can be worked the year round, having plenty of water on the property for milling purposes and Company has a fine milling cite for milling all the lower grade ore, while the high grade ore and select ore can be treated with the Company's own smelter on the ground which would cost the Company $1,500 or $2,000. A fifty ton second-hand milling plant will cost from $2,000 to $3,000. I believe the Company has enough ore on the dumps to repay for all the machinery and purchase price for the mine, as the assay shows $6.16 per ton. The company milling 30 tons per day would mean $300 per day or upwards of $9,000 per month, and upwards $100,000 per year.

"Ten to fifteen per cent will pay expenses. This does not include any of the high grade ore which will be encountered in the mine, which increases the output of the mine to a much larger figure and the Company should pay enormous dividends to holders of stock in this Company. I have examined mines for large corporations all over Alaska, Siberia, Australia, South Africa, all over Mexico, Canada and the United States, and I can truthfully say this is the richest mine I have ever examined. The samples I present to you were taken from this mine, also the assays which are included in this report. I am personally interested in this property and would advise any one wishing to purchase stock to buy now as the Company only wishes to sell enough stock to make its payment on the property and erect a mill if so advised by me, the less stock the Company sells the larger the receipts will be and the larger the dividends will be paid the share holders, as there will be no salaried officers except the Manager, Secretary and Treasurer, who will be at the mine looking after their interest as well as the share holders.

"We will suppose that the Company only takes out two tons of high grade ore in one year as per assay attached, this alone representing upwards of $150,000 per year. Say ten tons at $20,000 per ton would represent $200,000 per year. Say then, 1,000 tons at $100 per ton would represent $100,000, so you can readily see what enormous dividends this Company would pay on their small investment."

In any case, the moderation of the owner in only asking $10,000 for a mine from which $200,000 could be taken per year in 10 tons of ore is worthy of being put on record, as an object-lesson to prospectors.

ALEX. MCLAREN.

Llano, Texas, October 16.

RECENT regulations governing the platinum industry of Russia prohibit the export of crude platinum after a date to be fixed by the Minister of Trade and Industry.

Special Correspondence

MEXICO

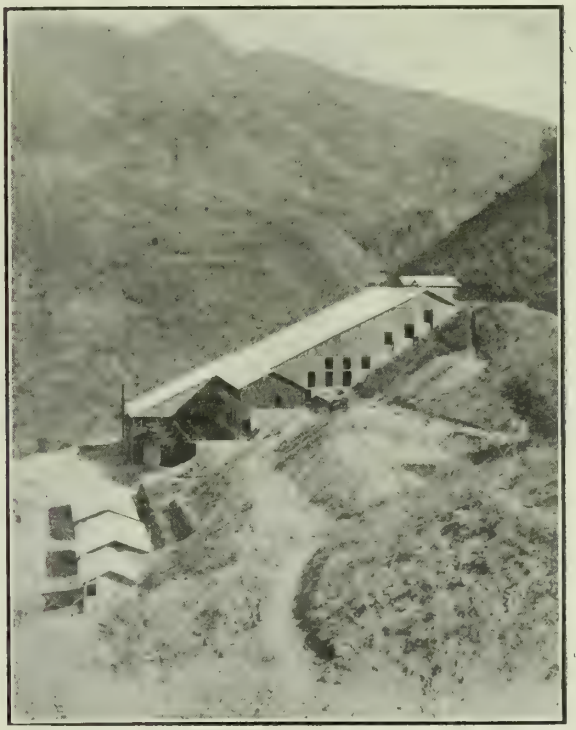
SALE OF THE PALOMA.—EXPANSION AT MEZQUITAL.—DEVELOPMENT IN JALISCO.

Normal conditions in Mexico, with the present prices for silver and copper, probably would mean a mining boom. As it is, with generally disturbed conditions and an uncertain future, little money is coming into the country for mining or other investments. According to late advices, the most important deal of the year was recently made and involves the transfer of the Naica silver-lead mines in Chihuahua to French interests for a consideration of several million pesos. One report places the price at ₱8,000,000. The mines have been owned by the Compañia Minera de Naica, and it is said that the Mexican stockholders guarantee the sale of a part of the stock of a new company that the French interests are launching. Some months ago the Peñoles Mining Co., controlled by German capital, purchased the Paloma silver-lead mines in the state of Coahuila for ₱1,000,000, and the same company is reported to be negotiating for the Cabrilla mines in the same district at a price of ₱$2,000,000. The Peñoles is operating the principal mines and the smelter at Mapimi, state of Durango. The United States Smelting, Refining & Mining Co. of Boston, controlling the big Real del Monte y Pachuca mines in the Pachuca district of Hidalgo, is willing to invest extensively if suitable properties can be found, but as yet has not figured in a big transaction. Several properties have been examined by representatives of this company this year. Philadelphia men identified for several years with copper mines in the state of Jalisco recently arranged a working bond on the Mezquital del Oro mines in the state of Zacatecas, the purchase price stipulated being ₱200,000. It is expected to take over the properties at that figure. An American company was recently formed to take over and work the San Gregorio mines of the Dwight Furness interests in the Guanajuato district of Guanajuato.

The Mezquital del Oro mines in Zacatecas, now under bond to Philadelphia investors, have been owned by English interests for many years. The present company, the San Carlos Gold Mines, Ltd., organized in 1906, succeeded the Mezquital Gold Mines, Ltd., which in turn was a reorganization of an earlier company. The first English company extensively developed the gold properties, and took out several bonanzas. In the bonanza days great quantities of gold were stolen and marketed in Guadelajara. American engineers estimate the available ore in the old workings at more than 300,000 tons and believe that all of it can be milled at a profit. A 50-stamp mill and cyanide plant at the mines are being overhauled, and milling will be started about December 1. Tests of the ore have shown a high extraction with coarse grinding, and it is expected to handle 200 tons per day in the present mill. The Philadelphia men have organized the Mezquital Mining Co. to operate the properties.

In the state of Jalisco neither revolutionists nor bandits have directly interfered with mining, and most of the principal companies have been operating uninterruptedly. The Amparo Mining Co., of the Etzatlan district, is producing at a rate of ₱140,000 per month, one-half of which is profit over operating expenses, and is distributing $60,000 in dividends quarterly. The Southern Pacific has completed a 9-kilometre extension of its Jalisco line, which will be of much benefit to the majority of the mines of the Hostotipaquillo, and will place it in operation immediately. The El Favor, of the Makeever interests, continue to ship heavily, and the Mololoa, under the same ownership, is paying heavy development expenses from limited shipments. The year has seen extensive development at the Casados mines, which are under option to American and French interests for ₱4,500,000, and much high-grade ore has been shipped. The Espada Mines Co., which has under lease the mill built by the Virginia & Mexico Co., is now handling 100 tons per day and shipping concentrate and bullion regularly. The Cinco Minas Co. is busy with work preliminary to the erection of its proposed 250-ton cyanide plant. A branch from Ameca to the Magistral portion of the Ameca district is to be built by the National Railways of Mexico, and this will mean great activity in that copper district of Jalisco. The smelters are eager for the Ameca district ores and concentrates.

While portions of the state of Mexico have been overrun with bandits for months, operations in the El Oro district of that state have not been interrupted. Threats of a raid were made some weeks ago, and while bands approached to points near El Oro, they did not attempt to enter, probably because plans were made for an energetic defense. So far this year the Dos Estrellas Co. has continued its dividend disbursement of ₱500,000 per month. Pachuca and Guanajuato are two other important mining districts that have



EL FAVOR MILL, HOSTOTIPAQUILLO.

not suffered directly from revolutionists or bandits this year. In the state of Guerrero there has been serious interference with mining, many important enterprises having been closed down for months. The companies at Pachuca are reported to be shipping bullion as fast as produced, to lessen the chance of loss in case of an attack.

Up to the first of October the production of the Greene-Cananea company was 34,442,000 lb. of copper, 1,010,836 oz. of silver, and 5126 oz. of gold. The 25c. dividend declared in October placed the company's stock on a $1 per annum basis. A reduction of the Greene-Cananea capitalization is being discussed. The rebel activity at Nacozari in September, with the cutting of the Nacozari railroad, caused the production of the Moctezuma Copper Co. (Phelps-Dodge) to slump that month to 771,844 lb. of copper. The August production was 3,229,839 pounds.

Heavy cargoes of oil are being shipped from Tampico to the United States by the Doheny interests under a new contract with the Standard Oil, which will run for several years. The Pearson interests are shipping from Tampico to England. These interests recently purchased a tract of land just north of Tampico on which they will build a big refinery. Besides the Doheny and Pearson companies, the other producing concerns of the Tampico district at present are the Topila, a Southern Pacific enterprise; the International, of John Hays Hammond and associates; and the Hidalgo, controlled by Los Angeles men.

NEW YORK

Alaska Gold Mines.—Results at Braden.—The Granby Program.

The continually waiting attitude of the New York market, which has prevailed so persistently during the past year and a half or more, was not changed by the recent election. Speculation as to the policy of the new administration, formation of the new cabinet, the governmental position toward trust prosecutions, the banking situation, the money trust investigation, and issues of similar import now form an excuse for the prolonging or continuation of the market's waiting attitude. All kinds of activity have been submerged during the past fortnight while the last campaign broadsides were fired and the actual balloting took place. There have been a few days of market buoyancy and activity on the floor of the New York Stock Exchange, but there has not been wanting some coldly skeptical criticism nor expressions of avowed belief in a lack of genuineness in the movements of leading shares and the amount of activity therein.

Some of the leading copper shares have been making high records, particularly Chino, which is in process of distribution and which is expected very shortly to enter the dividend list. These shares have sold at $50, which is a new high mark for the stock. The Hayden, Stone-Guggenheim-McNeill-Jackling combination is at the moment making its campaign in Chino and in Alaska Gold Mines. The latter is traded in in Boston and New York 'when issued', and the stock, which is $5 paid, is selling above $9. A competent and skillful publicity campaign is being carried on, and distribution is proceeding as fast as the public can be brought into the market. It is stated that some 500 men are now at work upon the Alaska Gold Mines property, particular attention being given to the work preparatory to the installation of the company's 6000-ton mill. The old Perseverance mill is running full capacity, but no attempt is being made to derive any revenue therefrom, the work that is being done consisting of tests to deduce the best method of ore treatment. The magnitude of the work is suggested by the fact that three sawmills are at work cutting the timbers to be used in various parts of the construction work. Chino is now said to be earning at least $6 per share per year, and is expected to earn $8 per share, or better, as soon as the final unit of the mill is put into commission. During the last quarter Chino has produced 10,000,000 lb. of copper at a profit of $1,000,000; when operating at capacity its output will reach 6,000,000 lb. per month, and it will undoubtedly be a leader of the low-cost producers.

In the outside market Braden has been a feature during the past week. Braden's convertible bond issue is selling at 150. This is due to the speculative feature which these bonds possess by reason of the privilege of conversion into stock. The shares are now selling at $7.50, and prospects are stated to be particularly bright. The ore reserve, estimated at some 23,000,000 tons at the time of the last official report, is now stated to have been more than doubled by reason of recent work at the property, and, beginning with the current month, the first unit of the company's mill will be operating under the Minerals Separation Co., Ltd., process, and a recovery of 85% is expected. Early in the coming year the mill will be handling 3000 tons of ore per day and turning out copper at the rate of 40,000,000 lb. annually.

It is rather interesting to note that, in the face of the success achieved by the Braden people in financing the property through a convertible bond issue, the Granby should have definitely decided against a similar course. After a recent meeting of the directors of the Granby, W. H. Nichols, president of the company, made the following statement: "We have instructed our people at the Hidden Creek property to go ahead with the construction of the plant, which will have a capacity of 2000 tons per day, as rapidly as possible. This plant will be financed out of the earnings of the company, which will mean that dividends will be delayed for a while. We have expended so far about $500,000, and it is estimated that about $1,250,000 will be required to complete the plant and equipment. This money we now have on hand, so that a bond issue is unnecessary. Developments at the property are very good. We have developed about 5,000,000 tons of ore ranging from 3½ to 8% copper, the average being about 3%. Providing machinery, etc., can be got together, the plant will be in operation in about a year. While the plant will have a capacity of about 2000 tons per day, it has ample water-power for a much larger mill. The plant itself is so arranged that its capacity can be increased at any time." The determination of the Granby board is something of an exception to the rule which has recently prevailed in matters of mining finance. The success of the various convertible bond issues which have been put out have been very attractive to the larger part of mining promoters controlling properties of sufficient magnitude to warrant a bond issue at all.

There are very few mining deals of importance under way in New York. The negotiations for the Shattuck are at a standstill, though it is understood that the only question involved is one of price—a matter upon which buyers and sellers have had different opinions since the beginning of time. The General Development Co. has taken an option on what is now known as the Bagdad Copper Co., and which was formerly known as the Copper Creek. The terms of the option are not stated, but it is said that somewhere between 4,000,000 and 5,000,000 tons of 2% ore has been developed, and the General Development Co. has agreed to expend a certain amount of money and, if a sufficient quantity of ore can be developed, to take over the property. Some tentative efforts have been made to secure an option on the South Live Oak ground, a property which adjoins the old Live Oak, now a part of the Inspiration Consolidated. The production of the British Columbia Copper Co. is showing a gratifying increase each month, the October output being 1,013,000 lb., which compares with 932,000 lb. in September. It is said that the Copper Mountain properties recently acquired by the British Columbia Copper Co. are developing much better than was expected and that a very considerable addition to the output is anticipated from this source.

The copper-metal market has been a featureless affair during the past fortnight. The metal price has been absolutely pegged and lower bids made by consumers both at home and abroad, it is understood, have been rejected. This is, of course, due to the element of combination, the strength of the aggregation which now controls the copper metal market having been the subject of exhaustive comment. The figures of the Copper Producers' Association, covering refinery production for the month of October, show an increase in the surplus in this country of 13,679,000 lb. Against this 'bear' card, one of the copper producers played the consumption of ammunition in the Balkan war, estimating that the ammunition consumed by the Bulgarian army is 155,000,000 rounds of small-arms ammunition per day of fighting; the consumption by the Turks in small-arms ammunition, 260,750,000 rounds. A full five days of fighting is figured to consume 1,303,750,000 rounds of small-arms ammunition, and this is figured to take up, counting in the ammunition of the field pieces, somewhere in the neighborhood of 20,000,000 lb. of copper.

The Hedley Gold Mining Co. is, like some of the copper companies, in line for increased dividends, and has recently increased also its property holdings by the acquisition of five mining claims, upon which diamond-drills have been at work for the past three months. Payment made for the new properties was $150,000 in cash. Nevada Consolidated and Calumet & Arizona are both expected to increase dividend disbursements when their next meetings are held. New York friends of Walter Harvey Weed are taking a great deal of interest in the new Butte & Zenith City Mining Co., which, as its name indicates, is an organization consisting of Butte and Duluth people who are developing a large area in the old Bluebird district near Butte.

Mr. Weed finds great similarity in the geological formation of the Butte & Zenith City property to that of Butte hill. Old mining men in Butte have always been skeptical about ore being found in this part of the district, and if developments are satisfactory it will prove a triumph for Mr. Weed.

LONDON

CYANIDING AT KOLAR.—RESULTS AT HUTTI.—THE SHEBA MINE.

The mine managers in the Kolar district of India have not had much reason to call the cyanide process to their aid, because the ore is free-milling and from 80 to 90% of the gold content is extracted by amalgamation. The tailing of 15 to 20-dwt. ore contains only 1 to 2 dwt. gold. Nevertheless, the mines all have a cyanide plant and thereby the output and profit are slightly increased. There is some intention now of extending the plant by sliming the tailing and subsequently filtering, following the lead of the Butters plant at Champion Reef. The question of re-treating the vast accumulation of tailing is also under consideration. Probably there is ten million tons of tailing, and much of it will be of higher grade than that now produced, so that the scheme looks decidedly attractive.

While writing of India, it is opportune to record the improvement in the fortunes of the Hutti gold mines in Hyderabad. This mine was introduced in England in 1901 and was floated as a subsidiary of the Hyderabad Deccan company. Milling commenced in March 1903 and dividends were paid from 1903. During the nine months ended June 30, 17,485 tons of ore was milled, and gold worth £46,386 recovered. The profit was £12,417, out of which £7195 has been written off for depreciation, £712 paid as tax, and £3480 distributed as dividend, being at the rate of 5%. Since the closing of the accounts, £4000 has been spent on winding engine, boilers, and steel head-gear for the new main shaft. A Butters filter-plant is being provided for the treatment of slime. The developments at the mine have been eminently satisfactory recently. The high-grade ore discovered on the 1840 and 1940-ft. levels has been proved on the 2040-ft. level, where the lode varies from 2 ft. 6 in. to 5 ft. in width and from 10 to 20 dwt. in content. A winze sunk from the 2040-ft. level is in ore of the same quality. The reserve of ore is estimated at 20,000 tons, averaging 15 dwt., and in addition there is a large quantity of ore of lower grade. The outlook is most encouraging and a renewal of former prosperity seems certain.

The Rand bulks so largely in the Transvaal output of gold that the 'outside' districts are occasionally forgotten. Barberton and Lydenburg were goldfields before the Witwatersrand was discovered. One of the oldest mines is the Sheba, which had a run of prosperity in the nineties, and after 12 years of disappointment has once more won a position on the dividend list. The company was originally formed in 1884 and dividends were paid during the year 1891 to 1898. In 1904 the company was reconstructed. Three years ago it was decided to alter the method of working the properties, and instead of drawing ore from a great number of mines, attention was concentrated on two or three. The results were gratifying, for development disclosed large orebodies, parts of which were of high content. A year ago the nominal capital was reduced by changing the denomination of the shares from £1 to 5s., and now stands at £269,738. During the year ended June 30, 68,865 tons of ore was raised, averaging 12¼ dwt. per ton, chiefly from the Zwartzkopje mine. An average of 65 stamps (out of 120) were in operation, and the yield was 34,980 oz. During the previous year, 49,455 tons yielded 24,016 oz. The income from the sale of gold was £148,074. The cost at the mine was £92,442, and London and other charges £4400. The sum of £3804 was written off for depreciation and mine development, and £4632 was paid as taxes. The dividends, at the rate of 15%, absorbed £40,460. During the year 7603 ft. of development work was done, and the ore reserve increased by 22,750 tons to 127,000 tons on June 30. The control is with Lewis & Marks.

One of the steadiest of dividend payers is to be found in the Lydenburg district, namely, Glynn's. The mine, which is on the Sabie river, was opened-up in 1895. Milling commenced in 1897 with 10 stamps, and profits have been made continuously. The plant now consists of 20 stamps and 1 tube-mill. The control is with the Central Mining group. During the year ended July 31, 37,325 tons of ore was mined, estimated to contain 11⅔ dwt. gold per ton. By amalgamation 6983 oz. was recovered, and by cyanide 13,856 oz., the total being 20,839 oz., or 11¼ oz. per ton. The revenue was £87,362, or 47s. 2d. per ton, and the working cost was £42,643, or 23s. per ton. As compared with the previous year, the tonnage was 3455 greater, the yield per ton 1 dwt. less, and the total yield £622 greater. In addition to the working profit, there were sundry items of revenue totalling £2714. The sum of £4557 was allocated to taxes, and £42,500 was distributed as dividend, being at the rate of 25%, the same as during the last six years. The developments during the past year have disclosed 33,245 tons of ore, of the same average grade as that mined, and on July 31 the total reserve was 69,200 tons.

JOPLIN, MISSOURI

ORE MARKET STRONG.—TRANSPORTATION FACILITIES AT NOWATA.—DEEP LEAD ORE AT JOPLIN.

With only a few more weeks to be included in the total of zinc and lead ores for 1912, it is safe to predict that this year's aggregate production will establish a new record. The output of zincblende early in November was 220,000 tons for the year and the aggregate valuation was $11,950,000. The combined valuation of both zinc and lead ores was $14,500,000. The largest aggregate valuation in the history of the district was in 1907, when the $15,000,000 mark was passed. This year will see a valuation in excess of $17,500,000, and possibly the $18,000,000 mark will be passed. Next in importance to the production of zincblende is galena, the output now being 45,000 tons valued at $2,175,000. Calamine does not figure conspicuously in the local production, the output being only 20,000,000 lb. for the year, valued at $370,000. Already the aggregate valuation of the ores is in excess of the total valuation for last year, which was $13,055,512. The price of zincblende continues firm, although a slight decline is noted in the past few weeks. The price is now $52 to $57 per ton, assay basis of 60% metallic zinc, while choice grades bring as high as $60. Lead ore brings $62. Calamine brings $30 to $32, basis of 40% metallic zinc, choicer lots bringing $37.

The Nowata Mining Co., operating at Duenweg, Missouri, has made several innovations in mining in this district, the latest being the construction of a narrow-gauge track, leading from its north ground to its mill, a distance of a half mile, over which a 7-ton locomotive runs, making a round trip every half hour and drawing five 2½-ton ore cars. These are filled from a hopper at the north shaft, are carried to the base of an inclined tramway at the mill, and then hoisted to the ore-bin, the dumping process being accomplished with a projecting wheel which rides an elevated rail and tips the forward end of the car to the front. Formerly the company dressed the ore from its new north workings in an old mill near the shaft, but the necessity for better milling resulted in the construction of the steam railway, the only one of the kind in the district. The shaft from which this ore is taken is into thin sheet ground at a depth of 215 ft. and was raised from the workings beneath. The description of how this was done, by the use of a cable through a drill-hole, a working platform being attached at the lower end, has previously appeard in the *Mining and Scientific Press*. Suffice it to say that the process was so satisfactory from a money-saving and a time-saving standpoint that the company is now raising its second shaft and will soon have it broken through to the surface. In this the method has been slightly modified. The raise will be brought to within 4 ft. of the upper crust of the hard limestone, which occurs immediately beneath the stratum of residual soil. A shaft will penetrate through the residual

soil to the limestone formation. The intervening limestone will then be shot out with one round of shots. In the first shaft the upper part of the shaft was shot down at one blast, no shaft from the surface having been sunk to the limestone. The result was that a large cave was torn in the surface, and the filling of this added expense to the undertaking.

On the G. L. Sansom land, at Belville, northwest of Joplin, new development by three companies has resulted in the opening of some disseminated ore-bearing ground at a depth of 120 ft., and one company, known as the Capitalista Development Co., has driven a number of drifts and found conditions so encouraging that a concentration plant of 150 tons capacity per day has been erected and is now nearing completion. The discovery of an unusually deep body of galena ore on the land of the Granby Mining & Smelting Co. at Joplin is attracting attention. At the Monitor mine, where operations were conducted in disseminated zinc ore at a depth of 140 ft. for many years, the shaft was sunk deeper to develop a deeper body of blende found in drilling on the lease. At a depth of 171 ft., which is shallower than the depth of the deep zinc ore indicated in drilling, rich galena was found, and driving has been started at this level. The formation is proving to be unusually extensive and is much deeper than any lead ore previously mined on the tract.

FAIRBANKS, ALASKA

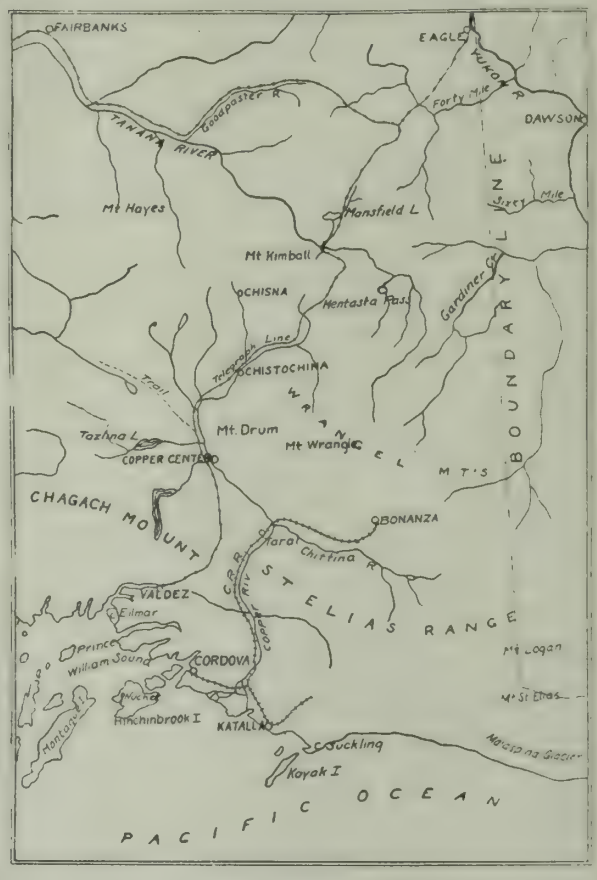
WORK ON FAIRBANKS CREEK.—DEVELOPMENT IN DISTRICT.—MANY NEW MILLS.

On the divide between Wolf and Fairbanks creek, Furstenau and McCarty are rapidly developing the Pennsylvania quartz claim. A Little Giant mill has been erected on Fairbanks creek and started crushing steadily the first of the month. The mill will also be used as a customs mill in case ore cannot be supplied steadily from the mine. As this mill is the first one brought into the district its performance is being watched with interest. Owing to its light weight and small power consumption as compared to its capacity, a satisfactory run this winter would make it a very popular mill here. A Pierce amalgamator and Monarch table are part of the equipment.

At the head of Fairbanks creek, two outfits are working on the Angus McDougald properties. Mr. McDougald and two men are opening up the Pioneer claim and have a large amount of good ore blocked out. Alois Friedriehs and partner have a lease on the Iron Mask and are sinking at present. After having their claims surveyed, Cook Bros. are preparing to run an adit on the rich vein discovered recently. Several tons of rich ore have been already sacked and it is thought that the winters' work will provide enough ore so that a mill may be ordered in the spring. So far, most of the work on this vein has been done in tracing it on the surface, 1700 ft. of vein being now uncovered. The width varies from 6 in. to 2 ft. A sample taken from the ore sacked assayed $860 per ton. M. A. Schaffer has a very promising prospect on Fairbanks creek on which he is now working. Coarse gold can be seen in the ore and the owners feel confident of a bright future for their property.

One of the most talked of properties and the cause of a recent stampede to Fairbanks creek, is the Crites & Feldman group of claims opposite 8 Above creek claim. The vein has been traced for 3000 ft. and has a width of 6 in. to 2 ft. Large pieces of ore sprinkled with coarse gold have been taken out of the prospect holes. An adit has just been started, that being the means of development decided upon by the owners. An adjoining claim, belonging to Hannibal Hoover and 'Coal Oil Johnny,' has been bonded recently by George Wheeler for $100,000. The Kansas Girl, another claim the vein is supposed to cross, was bonded to the same people for $10,900. This latter claim is owned by Cook Brothers.

A quiet stampede has been on for several days to that part of Fairbanks creek lying between Coffee Dome and the rich claims found up the creek. All open ground is being staked, more staking than digging being carried on. As all this ground lies opposite some of the richest placer claims on Fairbanks creek, there is good ground for the excitement. The promiscuous staking without discoveries is, however, much to be deplored, as many lawsuits over conflicting claims will result if anything is found. The Alaska Exploration dredge is still working on 8 Above, having turned around and started to make another cut down the pay-channel. With the expectation of doing considerable development work this winter, Gordon and Sterling, owners of the Rainbow on Skoogy gulch, are erecting a large messhouse and installing a double-cylinder



PART OF ALASKA.

hoist. If further developments show the same grade and width of ore, a mill larger than those installed at other properties this year will be put in next year.

Several rich stringers are being prospected by Kinney and Comstock at the head of Fox gulch. While no workable vein has yet been found, the coarse gold in the channel below and richness of the stringers are incentives to active prospect work. A promising vein 2 ft. wide was cut by Kinney and Comstock on the Sunnyside No. 2 recently while the assessment work was being done. While low-grade where cut, the character of the ore will lead to further prospecting. The claim is owned by L. M. Drury. While the customs mills at Chena and Fairbanks will probably be idle this winter on account of high transportation costs, a summary of the properties shows that there will be ten privately owned mills crushing this winter where there was but one last winter. These include the Hudson, Spalding, McGillvray & Fisher, Newsboy, Tolovana, Rhoads-Hall, Burns & McIlroy, Willis & Larson, Horton & Solomon, and the Furstenau & McCarty mill. At least nine of these should crush steadily through the winter and make the quartz output for the year a considerable item. Anderson & Johnson, employing 50 men on 14 Below Cleary, have shut down for the winter, after handling 125,000 sq. ft. of bedrock. It is estimated that three seasons' work remains, and probably next summer 70 men will be employed at the three shafts.

General Mining News

ALASKA

Fairbanks

Around Cleary creek everybody is busy, and the noise of stamp-mills is now constant. On the Pioneer claim on Chatham a mill is being erected. The Tolovana, Rhoads-Hall, and Little Giant mills are working continuously, while the Burns & Scrafford mill has been crushing custom ore. In the west end of the 215-ft. level of the Newsboy mine, good quartz has been opened again, after passing through a mass of antimony ore. The mill should be in operation now. After crushing 42½ hours with stamps weighing 250 lb. each, the Spalding claim, on Dome creek, yielded gold worth $2250, making a total of $8000 cleaned up during the past summer. A Joshua Hendy 2-stamp mill will be erected on creek claim No. 9 Above, where there is plenty of water throughout the year.

Nome

The estimated gold output from the Nome district for the season to November 1 is $3,500,000. Dredges are expected to operate until early in December. Hodgson & Shaw, representing an English syndicate in Nome, have acquired several valuable properties around Little creek. The property of P. D. Winter was bought for $125,000. In the spring a large dredge to cost $200,000 will be built. On October 24 a heavy storm did considerable damage to coastal shipping, and the schooner *Silver Wave,* loading tin ore at Cape York, was wrecked, and ore worth $20,000 was lost.

Telegraph advice from Nome states that a rich discovery has been made near that centre in the old channel opposite No. 3 Anvil creek. The gravel is 8 ft. deep and averages 25c. gold per pan.

ARIZONA

Cochise County

The October output of the Calumet & Arizona smelter was 4,404,000 lb. of copper, against 4,462,000 lb. in September, the total for the year to date being 44,440,000 pounds.

The Bisbee Extension mine and surface equipment has been sold by the sheriff to M. F. Dicus, of Douglas, for $1100, as he had recently obtained a judgment against the company. The property is situated a few miles beyond the Divide, and work ceased about a year ago. Shipments from claims in the Ash Canyon district are to be made to the El Paso smelter this month. Work has been of an intermittent character at this centre of late years.

Gila County

The October output of the Miami mine was 2,879,750 lb. of copper, against 3,048,750 lb. in September. The Old Dominion output was 2,523,000 lb., an increase of 300,000 lb over that of September.

Graham County

During October the mines and smelters controlled by Phelps, Dodge & Co. produced 13,165,070 lb. of copper, individual outputs being: Copper Queen, 7,257,746 lb.; Montezuma, 3,045,667 lb.; Detroit, 1,934,828 lb.; and custom ores, 926,829 lb. The Shannon production was 1,210,000 lb. of copper, 220 oz. of gold, and 15,600 oz. of silver.

CALIFORNIA

Calaveras County

Settlements on five cars of ore containing 257 tons, shipped by the Calaveras Copper Co. to the Kennett smelter, returned 11.50% copper, the total returns to the company being $6391. There are several carloads at the smelter awaiting settlement, and it is expected that during November one car per day will be shipped.

Sierra County

(Special Correspondence.)—The Keystone Mining Co. is arranging to resume milling. Sufficient water is now available. Portions of the recently developed vein are reported to assay $100 per ton. The adit gives backs of about 1200 ft. Milling has commenced at the Sacred Mount. The Swastika Mining Co. has placed its 10-stamp mill in action. Good ore has been opened, and recent development has proved satisfactory. The International Reducing Co. is sinking on the vein at the Gray Eagle mine, in the Gold Point section. Hoisting equipment was recently installed. The company is operating under an option, with W. S. Fletcher in charge. The discovery of gold in the porphyry formation is reported by the management of the True Blue Extension mine, near Alleghany. The gold was found in the walls of the deposit, and the find has caused much interest. According to advice from Brandy City, the Brandy City Hydraulic Mining Co. has arranged for vigorous work during the winter. It is said a force of 100 men will be employed and mining conducted on a large scale. San Francisco people are largely interested. Considerable snow and rain has fallen in the Sierras during the past week, and an abundance of water for mining and milling is now available in all districts. Prospectors report 4 ft. of snow in the Four Hills and Gold Valley districts. Several mines that have been idle because of low water are again in operation or arranging to resume.

Downieville, November 8.

Trinity County

Five tons of ore averaging $900 per ton has been crushed from the Belli mine, near Carrville, which has been taken on bond and lease by J. McMillan, of Nevada. This mine is noted for the return of $25,000 from two weeks work by Antone Belli.

Yuba County

A pit is being excavated for the construction of a dredge for the Marysville Gold Dredging Co. The dredge will be fitted with buckets having a capacity of 16 cubic feet.

COLORADO

Clear Creek County

(Special Correspondence.)—Heavy shipments of ore have been started from the Virginia City mine on Lincoln mountain. Stoping is in progress on the sixth level, and a body of smelting ore is showing which is from 18 to 24 in. wide. Returns of $75 per ton in gold and silver are obtained. Work has been resumed on the Raymond adit on Griffith mountain. Driving has been started on the Paris vein 800 ft. from the portal. The Boston Mines Corporation has enlarged operations at the Bellevue-Hudson mine on Columbia mountain. Driving is under way on the Anamosa vein, and a vein of 700-oz. silver ore is being followed which is from 6 to 10 in. wide. The new mill being erected near the portal of the Hoosac adit, on Fall river, will be completed within 60 days. The structure is completed, and machinery is now being placed in position. Good headway is being made in the construction of the 500-ton mill, which is to be below the dumps of the Newhouse adit. It will be four months before the machinery will be ready to start work. Extensive development will be commenced this month at the holdings of the Waldorf Con. M. Co. at East Argentine. The Wilcox adit is being repaired and the compressor plant is ready to be started.

Georgetown, November 5.

Gunnison County

The Forest Queen mine has been purchased by J. G. Berryhill, owner of the Ruby Chief group in the Irwin district. The deal also includes the Irwin water rights and other privileges, with the old plant which will be remodeled and improved for use at the two properties to furnish light and power to operate all the surface machinery. A mill and cyanide plant is to be erected. The Keystone basin adit was started last week for the purpose of prospecting the orebodies under the central portion of Mt. Emmons. J. Larson, of Aspen, who has an option on the Star mine on Italian mountain, and owns other claims in the district, proposes to drive a tunnel through the centre peak of the Italian mountains. The Star mine workings will be cut by this tunnel, and generally it is thought the work will be of benefit to the district.

LAKE COUNTY (LEADVILLE)

The tonnage for the month of October was an increase on that of September, and was probably the heaviest during the year. The Western, Yak, Iron-Silver, Stars Consolidated, Ibex, New Monarch, Castle View, Ethelma, Sugar Loaf, Dinero, and others produced more than the average tonnage, and the total was about 70,000 tons. As the search for zinc carbonate continues throughout the district, more ore is brought to the surface; and where one mine fails to find zinc, either lead or good bodies of iron are found, and as long as this work continues the monthly tonnage will increase. The last fall of snow practically closed the season in the outlying districts, that is, the work being carried on above timber-line by prospectors. In these parts several companies will work through the winter, among them being the Winthrop Gold Mining Co., Anderson, Kankakee, Ella Beeler, Gleason Gulch, and the Mt. Champion company. Car shortage is being felt throughout the Leadville district.

OURAY COUNTY

During October 63 cars containing 1512 tons of concentrate were shipped from the district, of which the Wanakah contributed 525 tons. The total for the current year is 15,101 tons. The Barstow mill has been shut down for the winter, due to shortage of water. From June to October, inclusive, the mill produced 1259 tons of lead concentrate. About 200 tons of zinc concentrate is stored at the mine.

SAN MIGUEL COUNTY

The United States Government is suing the Telluride Power company for $1500, being the amount of damage done to the Newmire ranger station and buildings by the bursting of the middle reservoir of the power company. This happened on September 6, 1909.

TELLER COUNTY (CRIPPLE CREEK)

The annual meeting of Stratton's Independence, Ltd., was held in London on November 5. During the year the

CONCENTRATOR ROOM AT STRATTON'S INDEPENDENCE.

total production from mine and mill was $758,977, the latter treating 112,391 tons of dump ore averaging $3.10 per ton, from which the gross production was $253,659, at a cost of $1.27 per ton. 'Mining' the ore in the dump cost $0.095, and treatment of concentrate $0.137, making a total of $1.52 per ton. The net value of the mine production for the year was $398,465, lessees contributing $290,525 of this amount. Dividends absorbed $120,000. Stratton's has now produced a total of $21,821,562.

On No. 12 level of the Gold Dollar mine the main ore-shoot has been opened 70 ft. south and 150 ft. north with good results. Four machines are working on the level, and several on No. 8, 10, and 11 levels, while lessees have 12 machines in different parts of the mine. Present production from the Mable M. shaft is 40 cars per month. The C. K. & N. mine on Beacon hill sent out 15 cars of ore during October. The Rapp ore-shoot is 400 ft. long and 4 ft. wide. The company is doing development on No. 9 level, and a cross-cut will be driven 830 ft. before the C. K. & N. vein is cut.

IDAHO

SHOSHONE COUNTY

A controlling interest in the Marsh mine, near Burke, has been secured by E. J. Carter and V. D. Williamson, of Spokane, by the purchase of a majority of the capital of 1,290,000 shares. The deal was concluded on October 23. E. W. Greenough, who has been in charge, will be retained as general manager. A shaft will be sunk 400 ft. some distance east of the old inclined shaft. A 12-drill air-compressor driven by 150-hp. motor and other machinery was recently installed. The mine is opened nearly 800 ft. below the apex of the vein. Three adits have been used for development, most of the ore shipped so far coming from No. 3. The mill has been treating 75 tons per day, yielding a concentrate containing 55% of lead, 35 oz. of silver, and a small percentage of gold. The production to date has been over $120,000 net.

MICHIGAN

HOUGHTON COUNTY

No. 22 drill-hole at the Mayflower has proved the lode to be 85 ft. wide, all of which is fairly well mineralized. Assays of the sludge from 1024 to 1086 ft. are said to have returned 40 lb. of copper per ton, against 33 lb. and 26 lb. from No. 20 and 17 holes. No. 21 hole has been restarted, and is down 1000 ft. Preparations are being made at the Adventure to start another diamond-drill from the bottom of the prospecting shaft. Trenching on the Kearsarge lode outcrop at the Isle Royale continues; but nothing of value has been found lately. The Isle Royale railroad connections with the Mineral Range will be completed in a few days, when surplus 'rock' will be shipped to the Allouez-Centennial mill, where a stamp has been reserved for this production. Remodeling the Tamarack stamp-mill is well under way. The Pontiac shaft at the Quincy was connected with the Mesnard at a depth of 3000 ft. by means of a drift and raise from the latter shaft, and was considered a good example of accurate surveying work. The following are October returns from the Lake Superior copper mines: Mohawk, 1,482,000 lb. of copper; Quincy, 2,430,000 lb.; Wolverine, 1,002,000 lb.; Calumet & Hecla, 5,583,424 lb.; Osceola, 1,700,225 lb.; Ahmeek, 1,463,475 lb.; Tamarack, 687,050 lb.; Isle Royale, 712,785 lb.; Allouez, 550,310 lb.; Superior, 238,953 lb.; and Centennial, 152,790 pounds.

The commerce through Portage Lake waterway in October was much greater than during the same month of 1911, there being 256 vessels of 364,811 tons register. The total up-tonnage was 239,574 tons, including 167,838 tons of coal, 14,000 bbl. of cement, and 43,641 bbl. of salt; while the down-tonnage of 511,600 tons included 10,581 tons of copper and 15,017 tons of iron ore.

MONTANA

MISSOULA COUNTY

The Iron Mask mine, near St. Regis, is a lead-silver property and a great deal of development has been done. An upper adit is in 1200 ft., while a lower adit, intended to cut the orebody at a depth of 1000 ft., is in 1650 ft. Three veins have been cut, and a fair quantity of shipping ore opened. Equipment includes an air-compressor driven by water-power under 129 lb. pressure. A number of Kellogg and Helena men are interested.

NEVADA

ESMERALDA COUNTY

The half-yearly report of the Pittsburg Silver Peak company states that gross earnings of the Silver Peak Gold Mining Co. and Mohawk Alpine company were $402,025, and net $49,465; while gross earnings of Pittsburg Silver Peak G. M. Co. were $211,858, and net $97,278, the total being $151,596. Assets include cash, $458,271; bills receivable, $60,829; supplies, $55,164; and depreciation account, $679,830; while liabilities include accounts payable, $43,373; and profit and loss account, $1,009,772. Dividend No. 1, paid July 1, 1912, amounted to $446,997.

Regular ore shipments are being sent to smelters in

Utah from the deep levels of the Grizzly Bear and Clermont mines of the Goldfield Consolidated. A small but fair-grade orebody has been opened above the 250-ft. level of the Nevada Eagle, situated four miles west of the centre of Goldfield, and shipments are being made. A raise from the 400-ft. level has also proved ore at this depth. This greatly extends the producing area of the district, and may lead to further extensive operations at this point.

Lyon County

(Special Correspondence.)—The October production of the Nevada-Douglas company was as follows:

Ore from Ludwig mine, dry tons	7491
Copper from Ludwig mine, pounds	790,099
Average per cent	5.27
Ore from Douglas mine, dry tons	4785
Copper from Douglas mine, pounds	346,625
Average per cent	3.62

Ludwig, November 4.

Nye County

During the week ended November 9 production from the Tonopah district was 9144 tons, valued at $228,850. Sinking has been resumed from No. 13 level at the Belmont, and the winze is 70 ft. below this level, and will be kept lower than the shaft for drainage. The North Star shipped 45 tons from the 850 and 1250-ft. levels on November 5. At the Halifax main shaft a new electric hoist has been erected. It was made by the Wellman-Seaver-Morgan company, and consists of two drums, each 60-in. diam. and 36-in. face, with friction clutch and post brake driven through one reduction of herringbone gear. It is designed to operate in or out of balance, and capable of hauling the following load: skip, 4000 lb.; ore, 8000 lb.; and rope, 3000 lb., at a speed of 750 ft. per minute. The hoist is operated by a 300-hp. Westinghouse motor, and the electric power is so controlled by a magnetic switch that at no time can the hoist be run at a greater than the set speed, power being automatically controlled independently of the hoisting engineer. The drums are each fitted with 2500 ft. of 1⅛-in. yellow strand steel rope.

Storey County

At the Consolidated Virginia the east cross-cut on the 2300-ft. level is out 162 ft., and 10 mine-cars of ore worth $8.25 per ton were saved during the week ended November 9. The vein is strong and regular, and has 3 ft. of quartz on the hanging wall. On the 2500-ft. level of the Sierra Nevada the northeast drift, which has been crossing the fault met with two weeks ago, is in vein formation. The Mexican mill treated 521 tons averaging $28.54 per ton, with 93% extraction. Work has been started at the Keyes and Monte Cristo properties recently acquired. The Ophir cyanide plant is working well. Crown Point shipped 110 tons to the Yellow Jacket mill. At the C. & C. pumping shaft the usual pumping and repairs were done, while at Ward shaft all pumps have been removed from the 2475-ft. station. Tanks, discharge, and suction pipes are now being dismantled.

White Pine County

There was milled at the McGill plant during the quarter ended September 30, 797,794 tons of Nevada Consolidated ore averaging 1.74% copper, of which 737,065 tons was from the pits and 60,729 from the Veteran mine, which yielded 18,405,467 lb. of copper. Earnings from the mine, etc., were $1,816,117, and dividend No. 12 absorbed $749,784, leaving a surplus for the term of $1,066,333. Depreciation of Steptoe plant and ore extinguishment totaled $268,197, leaving net credit of $798,135. In the assets and liability statement, metals on hand and in transit are worth $3,798,036, and cash $1,303,191; while undivided profits are placed at $3,442,708. Soon after the end of September a strike of miners started, but everything is working nearly full time at the present time. Deep drilling to determine the existence of additional ore at the Eureka pit was begun in September, but work was hampered by the strike referred to.

The Giroux Consolidated mined 85,758 tons of ore during the third quarter of the year, valued at $414,818. Mining, freight, and treatment cost $414,728. The Giroux shaft and workings partly filled with water on account of the strike, and unwatering has not been commenced yet.

In an explosion at the Nevada Consolidated company's mine at Copper Flat last July, eight Austrian miners were killed. The Consul General from Austria-Hungary, at San Francisco, appeared through local attorneys at Reno on November 13, as plaintiff in eight suits for a total of $310,000 against the company. The suit involves seven claims

COPPER FLAT, NEVADA CONSOLIDATED MINES.

of $40,000 each, and one of $30,000. The action is taken upon an order issued by the Royal District Court of Austria, which appointed the Consul as administrator for the estates of the deceased men.

NEW MEXICO

McKinley County

(Special Correspondence.)—Reese H. Beddow has been appointed State Mining Inspector, this being the first appointment to this position. He is compiling a set of mine regulations and is assisted by J. W. Stonehouse.

Gallup, November 8.

Socorro County

The Ozark Smelting & Mining Co., owned by the Sherwin-Williams Paint Co., of Cleveland, Ohio, is erecting a 200-ton concentrating plant, to cost $250,000, at the Ozark group of lead-zinc mines at Kelly. F. L. Preston is the new superintendent. The property has been worked for nearly 35 years, first for silver, then lead, and now for zinc, producing both carbonates and sulphides. The former is shipped, and the latter concentrated. At the present time the Tri-Bullion, McDonald Leasing, and Ozark companies are shipping about 25 cars of zinc and lead ore weekly. At the Nit shaft of the Tri-Bullion a large deposit of copper ore has been opened, and the Ozark company is driving toward the orebody. The old Germania zinc mines at Kelly are idle.

UTAH

Salt Lake County

(Special Correspondence.)—Bingham is beginning to resume a nearly normal aspect, following the breaking of the backbone of the strike, and now the operators are counting the cost. The actual expense has been slight compared with the loss of profits, but the operators generally have been willing to make this sacrifice (which, after all, amounts to deferring rather than losing profits) in order to deal this blow to the Western Federation of Miners. There is no question now as to the complete failure of the strike. As to loss of profits by the Utah Copper Co., the largest producer, figures on output recently released indicate that the loss of profit is not far from $1,250,000, without taking into account actual expenses. The management of the company, however, considers this cheap when compared with the ultimate cost of a victory by the Western Federation. In the quarterly report D. C. Jackling reviews the strike. He says the underground miners were the cause of the trouble, which he considers over. No at-

tempt has been made to resume underground operations at the mine; in fact, they were nearly ready to permanently discontinue underground mining when the strike occurred. The millmen and Bingham & Garfield railroad employees will receive an increase in wages amounting to a maximum of 25c. per day; but this has been done without recognizing the union or the existence of a strike among miners. The revised scale was effective on November 1, and is to apply so long as copper remains at or above 17c. per pound.

Ohio Copper is another company which is steadily increasing its production. According to A. Frank, general manager, the mill is now treating an average of 2000 tons of ore per day. It is expected to increase this amount by not less than 50% in the near future. The annual report of the Utah Apex company, of Bingham, contains some interesting features, not the least of which is the description of the Parvenu orebody. This is stated to have a width in one place of 200 ft., and to be the largest deposit of lead ore in Bingham. E. P. Jennings, consulting engineer, estimates ore reserves at approximately 100,000 tons.

Salt Lake, November 10.

In its third quarterly statement for the current year, Utah Copper Co. reports that the mills treated 1,581,527 tons of ore, averaging 1.41% of copper, which yielded 29,966,920 lb. of copper, at a cost of 7.707c. per pound. The Magna plant treated 62% and the Arthur 38% of the tonnage. Profit from ore treatment was $2,539,584, and dividends were paid amounting to $1,182,412, while the net surplus for the quarter was $1,744,057. Overburden totaling 1,408,133 cu. yd. was removed. Practically all construction work at the mills is finished. Owing to the acquisition of hydro-electric plants in Utah and Idaho, extension of the Magna steam-power plant is unnecessary. Between September 18 and October 9, operations were interfered with by the miners' strike; but at the present time work is assuming a normal stage.

Summit County

During the quarter ended September 30, the Daly-Judge mine produced 12,791 tons of concentrating and 1224 tons of shipping ore. Lead concentrate amounting to 2247 tons, and 1502 tons of zinc concentrate was sold. The average monthly earnings were $27,903, and the cash balance was $540,691. The quarter's net earnings were $83,710, against dividend requirements of $45,000. Monthly development covers 1500 ft. on levels below 500 ft. Ore shipments from the district during the week ended November 9 weeks were 1155 tons, and for October a total of 7443 tons, of which the Union Pacific carried 5416 and Denver & Rio Grande 2027 tons.

Tooele County

At the Consolidated Mercur a little prospecting is being carried on, but so far it has resulted in nothing of importance. The manager, G. H. Dern, states that the mill will work until after the beginning of next year.

WASHINGTON

Stevens County

Spokane people have been largely instrumental in developing the copper-silver veins of the Chewelah district. At the United Copper mine, the largest producer, one vein has been opened by an adit to a depth of 500 ft., and driving has proved an ore-shoot about 1400 ft. long. Several winzes have been sunk 150 ft. below this adit, with favorable results. A lower adit, which is being driven from near the mill, will give 600 ft. extra depth. The Copper King, north of the United Copper, is working on the same vein to a depth of 400 ft., and a large quantity of ore is ready to mine, as soon as the lower adit is connected. The upper adit, now in 700 ft., is being extended to cut the veins. The Aurora group lies north of the Copper King, and is being developed by a drift from the 400-ft. level of the latter mine. The June-Echo has shipped two cars of ore averaging 4% copper and 20 oz. silver. Other properties attracting attention are the Imperial, Copper Cliff, and Liberty.

AUSTRALIA

New South Wales

The Great Cobar mine in September produced 551 tons of copper, 2502 oz. of gold, and 12,712 oz. of silver. A bakery was established by the company some time ago, and lately an abattoir was opened, resulting in employees getting cheaper supplies. The Broken Hill Proprietary concentrated 20,195 tons of sulphide ore, and reground 14,535 tons of dump tailing, producing 4964 tons of lead concentrate. The flotation plant yielded 6200 tons of concentrate, assaying 46.14% of zinc. During the half-year ended July 31, the Y. Water Tin Co., 463 miles north of Sydney, sluiced 333,000 cu. yd. of gravel yielding 196 tons of black tin, or 1.3 lb. per cubic yard. The record shows 105.3 cu. yd. sluiced per working hour, and 12.6 cu. yd. of water used per cubic yard sluiced. Profit amounted to $69,000, and dividends $38,000. The Sydney mint received 40,462 fine ounces of gold for coinage, and for the nine months of the year, 432,517 fine ounces.

Queensland

During August the mills and cyanide plants at Charters Towers produced gold valued at $194,500; silver, $800; lead, $900; copper, $400; tin, $6800; and alluvial gold, $200. The mills crushed 11,964 tons of ore, and cyanide plants treated 12,538 tons of tailing. In September the Brilliant Extended treated 2740 tons, yielding $29,000, with a profit of $5300; Brilliant Deeps, 872 tons, yielding $28,000; Mills United, 1562 tons, $17,000; and New Brilliant Freeholds, 1456 tons, yielding $17,500. A good deal of development is being done in the 30 mines of the field.

In September the Mt. Morgan smelters handled 27,720 tons of ore, producing 818 tons of copper and 8959 oz. of gold. Mt. Elliot smelter yielded 625 tons of copper, 1065 oz. of gold, and 1187 oz. of silver from 5848 tons of ore. During the year ended May 31, the Scottish Gympie, at Gympie, crushed 85,100 tons averaging $5.50 per ton, the profit being $81,000 and $61,000 paid in dividends. A cyanide plant is to be erected to treat the tailing. Graphite has been a trouble on this field.

Victoria

The Melbourne mint has received 465,949 fine ounces of gold this year for coinage. The State Government has a coal mine at Wonthaggi, about 60 miles from Melbourne, and despite labor troubles and much criticism, produced 454,121 tons of mixed coal during the year ended June 30, and over 1,000,000 tons since November 1909. The mine is now capable of producing 3000 tons per day. Systematic boring over 5100 acres proved 20,000,000 tons of coal, allowing 20% for loss in mining. During the year ended June 30, the Central Red, White & Blue company, at Bendigo, crushed 15,471 tons of ore at the 20-stamp mill, details of which were given in the *Mining and Scientific Press* of August 17. The proceeds of gold from amalgamation and sale of pyrite was $172,000, and $94,000 was paid in dividends. Mining and milling costs totaled $3.12 per ton. The mine is in splendid condition.

Tasmania

The Mt. Lyell company is having its share of trouble lately, with labor differences, a heavy fall of ground and fire in the North Lyell mine in which many men were killed. During September 26,468 tons of ore was smelted, yielding 556 tons of copper, 743 oz. of gold, and 36,259 of. of silver. The Briseis company removed 110,000 cu. yd. of overburden and drift yielding 45 tons of black tin; also dredged 127,000 cu. yd. of gravel in Victoria, yielding $1200 in gold. The Pioneer company, during the six months ended June 30, sluiced 667,300 cu. yd., yielding 475 tons of black tin at a cost of 9.94c. per cubic yard. Since 1900, 4,979,600 cu. yd. has been sluiced. Reserves are estimated at 5,440,600 cu. yd., containing 0.985 lb. of tin per yard.

CANADA

British Columbia

The British Columbia Copper Co. produced 1,013,000 lb. of copper during October. The properties in the Copper

Mountain district, on which the company has taken options, are opening in a satisfactory manner. The Queen Victoria mine at Beasley, near Nelson, one of the best known properties in Kootenai, has been sold to the British Columbia Copper Co. About 40,000 tons of low-grade gold-copper ore has been opened at the property, which is equipped with an aerial tramway of 60-ton capacity per eight hours, conveying ore from the mine to the bins at the railroad. The mine is fairly well equipped and is the third property secured by the company. Numerous transfers of mining properties have recently been recorded at Nelson, 16 claims or interests in same having been sold in various districts.

The net earnings of Granby Consolidated during October were $145,000, against $181,000 in September. During the week ended November 9 the smelter at Grand Forks treated 24,115 tons of ore, making a total of 1,072,554 tons for the year to date. Blister copper sent out during the week was 435,000 lb., and a total for the year of 10,290,500 pounds.

Cobalt

(Special Correspondence.)—The slump in La Rose has been checked by the announcement of the discovery of a 6-in. vein of high-grade ore on the 180-ft. level of the Lawson property. On La Rose proper, a shaft is being sunk to the 500-ft. level on the fault vein picked up in cross-cutting on the 380-ft. level in the hope of finding improvement at depth.

Cobalt, November 9.

During the week ended November 2 five mines shipped 269 tons of ore, and four sent out 154,029 oz. of bullion, making a total of 18,579 tons for the year to date.

The Nipissing company has started regular operation of the tramway from the mill to Meyer shaft. There are 19 buckets on the line, each holding 500 lb. of ore, traveling over Cobalt Lake and the town. The Temiskaming & Hudson Bay company has declared dividend No. 43, amounting to $23,283, making a total of $1,684,137 to date.

Porcupine

The Hollinger company has issued a report covering recent work at the mine and mill. Since January 1, 1912, underground development has been satisfactory, and to October 5 total work shows the following results:

	Length, ft.	Av. Width, ft.	Av. Value.
100-ft. level:			
Vein			
No. 1	1000	3.0	$31.54
No. 2	665	5.2	12.50
No. 3	136	4.4	5.60
No. 4	485	8.2	12.91
No. 8	56	5.2	4.90
No. 37	70	4.6	11.60
No. 38	66	3.8	15.30
200-ft. level:			
Vein			
No. 1	839	6.7	45.74
No. 2	42	6.2	10.60
No. 4	125	5.0	9.20
No. 37	155	4.2	10.80
No. 41	57	4.5	15.10
300-ft level:			
Vein			
No. 1	63	5.7	8.40
No. 2	63	13.0	16.00
No. 37	63	4.0	20.00

The new mill was started on June 15 and was expected to treat 300 tons daily, but stamps have been tested up to 12 tons per stamp per day, and actual results have proved that 40 stamps can crush from 450 to 500 tons daily. At present 97% extraction is being made on ore worth $30 per ton. During the period under review 26,221 tons, worth $23.69 per ton, have been treated, made up of 20,444 tons from development averaging $19.70, and 5777 tons from stopes worth $37.89 per ton. A surplus of about $509,000 is the result of operations since July 1. No further heavy expenditures for plant are contemplated, save additional boilers at the power-plant, and blast and cupel furnaces in the refinery. At the mill, Dorr thickeners are being erected in place of Trent agitators. The company's assets include cash, $33,496; and bullion on hand, bullion shipped, gold

No. 1 shaft and test mill at the Hollinger.

precipitates on hand, gold in mill solution, and gold in slags worth $255,568.

CHILE

The last 350 ft. driven at the Braden mine, in the No. 1 Teniente, averaged 4% of copper, which is much higher than the average contents of the reserves. This development is in an unexplored section of the property, and the adit is now about 1500 ft. from the surface. During October 42,500 tons of ore was treated, averaging 2.8% copper. In the old mill a recovery of 61% was made, while on 46,000 tons treated by the Minerals Separation process the extraction was 75.5 per cent.

MEXICO

Sonora

Between October 15 and 31, returns furnished by the collector of customs at Agua Prieta show that 197 cars containing 7694 tons of ore valued at $1,127,500 were exported from this state.

The Yaqui Indians are causing some trouble in this state and have killed several men lately, besides taking away grain, horses, and cattle. Escorts are being provided for men taking supplies to the mines from Guaymas.

During its past financial year the Boleo Copper Co., of Santa Rosalia, Lower California, produced 14,850,000 lb. of copper, which was shipped to Swansea, England, and France.

NEW ZEALAND

The Waihi company has broken the back of the strike, in spite of interference and many miners going to jail, and over 300 men are now at work. Contractors who did not resume, had their contracts canceled. Mining here is all done on contract. At the Thames, the 'Deep Levels tunnel,' at 1000-ft. depth, has been driven 2360 ft. from the main shaft at a cost of $84,000. This adit is for the purpose of testing and draining the field.

PERU

Copper production of Cerro de Pasco for August was over 3,600,000 lb. Nearly all the miners who went to the Tipuani gold rush have left the place, but a few have decided to stay in the country for a while. In *Peru To-Day*, of September, Luis A. Delgardo gives a description of the 'Coalfields of Oyon,' which are situated between the Chancay, Cajotambo, and Dos de Mayo provinces. The area is abaut 55 by 220 kilometres. The coal is semi-bituminous, low in ash and water, and high in fixed carbon, suitable for steamers, or where confined grates are used. The Gasuma Mining Co. uses fine coal in its reverberatory furnaces, and gets a flame 6 metres in length. At present only 280 pertenencias of 40,000 square metres each, have been taken up. Coke is supplied to the smelter at Cerro de Pasco at a low price, it being carried on llamas. The climate is a healthy one, labor is experienced, and the nearest seaport is Huacho, 150 km., from Oyon, of which distance 56 km. is by railroad.

Personal

Professional men are invited to send news of their engagements and travels. Such news is interesting to friends.

D. C. JACKLING is at Chino.

B. G. HITE is in Los Angeles.

J. B. DUMONT is in Salt Lake City.

M. J. WELCH is in Jerome, Arizona.

E. P. KENNEDY is in San Francisco.

W. H. LOVELETT is back from Portugal.

A. H. NESBIT has returned from Nome.

JOHN W. FINCH has gone to New York.

D. W. SHANKS was in El Paso recently.

HOYT S. GALE was here during the week.

J. F. NEWSOM has returned from Alaska.

H. C. HOOVER has returned from the East.

W. C. OREM is at the Nevada-Douglas mine.

JOHN E. PELTON is here from Los Angeles.

JOHN HAWKINS is here from Elks, Nevada.

COREY C. BRAYTON has returned from Nome.

F. L. GARRISON is in Mono county, California.

D. H. STEINMETZ was in San Francisco recently.

P. D. BURTT has returned from southeastern Alaska.

R. C. CRANSTON has gone to Brazil on professional work.

J. E. SPURR and S. H. BALL were in San Francisco Tuesday.

F. W. BRADLEY has been elected president of the Ocean Shore railway.

WALTER CURRIE was in a motor accident last month, but escaped uninjured.

H. M. SPICER is now in London, returning from a seven months trip to India.

W. J. MCGEE, who has been ill at the St. Francis hospital, has returned to Sutter Creek.

ARTHUR L. PEARSE left London on October 26 on a tour of inspection in the south of Spain.

J. B. TYRRELL has returned to Toronto from a five months expedition to the shores of Hudson's Bay.

E. K. SOPER has left Minneapolis for Sierra Majada, Mexico, expecting to be absent six or eight months.

REESE H. BEDDOW has been appointed State Mine Inspector for New Mexico, with headquarters at Gallup.

F. H. PROBERT, who was recently appointed consulting engineer to the Shannon Copper Co., is at Clifton, Arizona.

RALPH H. RAMSDELL, general manager for the Casados Mining Co., was recently attacked by the brother of the Mexican who killed THOMAS D. MURPHY last year, but escaped with only a slight wound.

Obituary

THOMAS KAVANAUGH died at Phoenix, Arizona, on November 5, 1912. He had been a resident of Arizona for many years and was interested in mining operations in different portions of the state, but principally in and around Globe. He was associated with Philip Wiseman and others in the promotion of the Ray Con. Copper Co. several years ago, and later in the sale of the Inspiration property to its present owners. In addition to his mining interests he had business and real estate holdings in Globe, Tucson, Phoenix, and Ray. Having been closely identified with the life of Arizona for so long, he leaves a large circle of acquaintances. He made his start as a practical miner, and by his energy and determination, coupled with splendid mining judgment and high moral principles, not only won material success, but obtained the respect and esteem of all with whom he came in contact. He was a splendid exponent of the highest type of self-made men.

Market Reports

LOCAL METAL PRICES

San Francisco November 14.

Antimony	11—11½c	Quicksilver (flask)	41.50
Electrolytic Copper	18—18½c	Tin	52—53½c
Pig Lead	5.00—5.95c	Spelter	8½—8¾c

Zinc dust, 1400 lb. casks, per 100 lb., small lots $9.50—9.75; large $7.50—8.50

METAL PRICES

(By wire from New York.)

NEW YORK, November 14.—The copper market is firmer owing to the demands for home trade and increased sales in Europe where buyers are all poorly covered. The lead market is quiet and inclined to be weak. Spelter remains steady. Average daily prices for the past week, in cents per pound, based on wholesale transactions, standard brands, are given below.

Date.	Electrolytic Copper.	Lead.	Spelter.	Silver, per oz.
Nov. 7	17.23	4.70	7.25	62½
" 8	17.28	4.68	7.25	62⅜
" 9	17.28	4.68	7.25	62⅞
" 10	Sunday.	No market.		
" 11	17.30	4.65	7.30	62⅜
" 12	17.30	4.65	7.30	62½
" 13	17.30	4.65	7.30	62⅜

LONDON QUOTATIONS

(By cable, through the courtesy of C. S. Burton & Co., New York.)

	November 14.
Camp Bird Ltd	£ 6½
El Oro	4½
Esperanza	9¾
Oroville Dredging	—
Santa Gertrudis	6¾
Tomboy	6⅝

COPPER SHARES—BOSTON

(By courtesy of J. C. Wilson, Mills Building.)

	Closing prices, November 14.		Closing Prices November 14.
Adventure	$ 6½	Mohawk	$ 65
Alloues	43	North Butte	36½
Calumet & Arizona	79½	Old Dominion	59¾
Calumet & Hecla	586	Osceola	111
Centennial	20	Quincy	87½
Copper Range	56½	Shannon	14½
Daly West	3½	Superior & Boston	2¾
Franklin	10½	Tamarack	43
Granby	76¾	Trinity	5¼
Greene Cananea, ctf.	9½	Utah Con	13½
Isle-Royale	36¾	Victoria	2¾
La Salle	5⅜	Winona	4½
Mass Copper	6¼	Wolverine	77

NEVADA STOCKS

(By courtesy of San Francisco Stock Exchange.)

San Francisco, November 14.

Atlanta	$ .17	Montana-Tonopah	$2.05
Belcher	.31	Nevada Hills	1.52
Belmont	9.00	North Star	.35
Big Four	.44	Ophir	.51
Con. Virginia	.34	Pittsburg Silver Peak	.90
Crown Point	.33	Round Mountain	.36
Florence	.70	Sierra Nevada	.36
Goldfield Con.	2.47	Tonopah Extension	2.62
Halifax	1.60	Tonopah Merger	.92
Jim Butler	.70	Tonopah of Nevada	6.37
Jumbo Extension	.31	Union	.45
MacNamara	.19	Vernal	.10
Mexican	1.87	West End	1.62
Midway	.42	Yellow Jacket	.40

MINING STOCK QUOTATIONS—NEW YORK

(By wire from C. S. Burton & Co., New York.)

	Closing Prices. November 14.		Closing Prices. November 14.
Alaska Mexican	$ 13⅜	McKinley-Darragh	$ 2½
Alaska Treadwell	40½	Miami Copper	28½
Alaska United	22⅜	Mines Co. of America	2⅜
Amalgamated Copper	85⅜	Nevada Con	22⅜
A. S. & R. Co.	79	Nipissing	8½
Braden Copper	9	Ohio Copper	1⅜
B. C. Copper Co.	4⅜	Ray Con	22⅜
Chino	48	Tenn. Copper	41
First National	2⅜	Tonopah Belmont	9
Giroux	4⅜	Tonopah Ex	2⅜
Goldfield Con.	2½	Tonopah Mining	6½
Greene-Cananea	9⅜	Trinity	6½
Hollinger	15	Tuolumne Copper	2¼
Inspiration	20	Utah Copper	63¼
Kerr Lake	2⅜	West End	1⅜
La Rose	2⅜	Yukon Gold	3⅜
Mason Valley	12¾		

Company Reports

AMALGAMATED ZINC (DE BAVAY'S), LTD.

At Broken Hill there are two large flotation plants which treat the tailing bought from the mining companies. These are known as the Amalgamated Zinc, and Zinc Corporation, respectively, treating 43,000 and 27,000 tons of tailing per month.

The half-yearly report of the former gives the following details:

Treated, tons	259,425
Zinc concentrate produced, tons	70,496
Metal contents:	
Zinc, per cent	49.1
Lead, per cent	6.2
Silver, ounces	9.3
Lead concentrate produced, tons	992
Metal contents:	
Lead, per cent	53.2
Zinc, per cent	17.0
Silver, ounces	35.8
Average price of spelter, per ton	$124.36
Net profit for term	475,000
Dividends paid	370,000
Dividends paid to date	1,120,000
Surplus liquid assets	395,000
Carried forward	250,000
Reserves	120,000

During the period under review $86,000 was spent on tailing purchased, and $120,000 on additions to plant, which included another unit to the acid plant, and a 400-kw. low-pressure turbo alternator.

CONSOLIDATED MINING & SMELTING COMPANY OF CANADA, LTD.

This company is mainly a holding corporation, controlling the following mines in British Columbia: Centre Star, Le Roi, St. Eugene, Richmond Eureka, Molly Gibson, Phoenix Amalgamated, No. 1 and No. 7, and the Sullivan group; while it owns and operates a smelter at Trail. During the year ended June 30, 18,549 ft. of development and 20,282 ft. of diamond-drilling was done at the mines mentioned. Generally the condition of the mines is good. During the year Le Roi property was acquired which has added materially to the tonnage of ore and shows a fair profit on operations. Some mines have been purchased and others taken on option. The smelter treated 296,458 tons of ore yielding 26,072,074 lb. of lead, 2,914,181 lb. of copper, 129,789 oz. of gold, and 1,765,992 oz. of silver, valued at $5,083,078. A good deal of custom lead ore has been sent in during the year. The strike at the coal mines at Crow's Nest Pass affected operating costs, and the cost of electric power is higher than formerly. Compressor plants driven by water-power were built at the Sullivan and Molly Gibson properties. At the smelter the flue has been enlarged, the matte handling plant rebuilt, lead sampling plant altered, and a number of electric traction lines have been laid down to facilitate handling of ores, fluxes, and bullion. The year's work shows a profit of $310,346, after writing off $185,120 for depreciation; development of properties under bond, $43,120; and charging profit and loss account with $319,549 for development of the company's properties. Purchase and development of new properties cost $337,018, and the amount due to banks for borrowed capital is $343,819. The credit on the profit and loss account now stands at $1,183,635.

ROOIBERG MINERALS DEVELOPMENT CO., LTD.

This company was organized in 1908 and owns 3186 *morgen* of land in the Rustenberg district, Transvaal. The authorized capital is £180,000 in shares of £1 each, all issued and fully paid. A 10-stamp mill was constructed in 1910 and an additional 10 stamps was added early this year, as well as equipment for treating the accumulated middling and slime. During the year ended June 30, 1912, the mill treated 20,800 tons, of which 789 tons was accumulated middling and slime and the rest ore. The total amount treated was 20,799, and the yield of concentrate was 884.58 short tons, equal to 789.8 long tons. The average metallic content of the concentrate was 67.89%, and the recovery was 57.97%. The reserve on June 30 of middling and slime to be re-treated was 44,485 tons having an average assay value of 2.51% metallic tin. A Brunton roasting furnace and a magnetic separator have been provided, and by their means the content and quality of the concentrate will be increased. As regards the development done during the year, Edward S. Schoch, the manager, reports that owing to the irregularity of the deposit it is impossible to give a dependable estimate of ore reserve, but he states that disclosures of profitable ore continue to be made. His figure for the ore reserve on June 30 was 21,300 tons, with a recovery value of 4.7% metallic tin. He mentions also that the content per ton treated has been less than during the previous year and that it will probably remain at this lower level, the reason being that the dumps containing high-grade material are approaching exhaustion. The sale of concentrate during the year brought an income of £105,617 and the profit was £33,547. Out of this £27,000 has been distributed as dividend at the rate of 15 per cent.

The Tin Market

The position at the end of October was more favorable than was expected, according to a report by L. Vogelstein & Co., the decrease in visible supply being 2510 tons. United States deliveries were 3850 tons, an increase of 350 tons for the month, and 3650 tons for the year to date. Shipments from the Straits Settlements were 4425 tons during October, while the increase over the first 10 months of last year is 4057 tons. Australian shipments have decreased 220, and Bolivian 1335 tons. Consequently supply has fallen short of demand by about 5600 tons; and the visible has decreased approximately this amount this year. It is estimated that the visible supply will decrease 1000 tons by the end of the current year, so stocks will be at a record low total. During the past four years between January and April, the average decrease in stocks has been 4262 tons. Should the year finish with only 10,000 tons on hand, and the January-April 1913 period be robbed of 4000 tons, tin prices cannot go lower. Requirements for future delivery should be covered in view of these facts.

No new mining enterprises were started in Turkey during 1911. After the declaration of the Turkish constitution there was a great demand for mining properties, and several American companies sent out engineers with a view to acquiring any likely deposits, but no results have been obtained. During the year new concessions were granted by the Government for three chrome mines, two emery mines, one mercury mine, and one silver-lead mine. Thirty or forty claims were also registered. Minerals exported from the province of Smyrna during the year ended March 13, 1912, were as follows:

	Tons.	Value.
Antimony	830	$ 4,382
Chrome	13,870	137,313
Copper	3	69
Emery	21,436	339,546
Iron	2	13
Lignite	1,602	3,524
Manganese	1,400	9,240
Mercury	27	25,806
Silver-lead	140	4,928
Totals	39,310	$524,821

An iron mine is to be opened at Chateaubriant, near that French city, by the Compagnie Générale des Mines de Fer de Bretagne, of 18 Rue Lafayette, Nantes.

Book Reviews

Any of the books noticed in this column are for sale by, or can be procured from, the MINING AND SCIENTIFIC PRESS.

THE BUSINESS OF MINING. By Arthur J. Hoskin. 219 pp. Ill., index. J. B. Lippincott Co., 1912. For sale by the *Mining and Scientific Press*. Price $1.50.

This is a popular exposition of the business side of mining, pointing out in readable form why many mining ventures fail.

A TEXT-BOOK OF RAND METALLURGICAL PRACTICE. Vol. II. By C. O. Schmitt. J. P. Lippincott & Co., Philadelphia. 432 pp., index. For sale by the *Mining and Scientific Press*, San Francisco. Price $6.50.

This second volume of the set is divided into two sections, the first dealing with the design and construction of reduction plants, and the second with the transport of materials. Of the two volumes, the second is distinctly more valuable than the first. There are more specific data, more concrete facts, since the practice on the Rand, and the Rand only, is covered, and there is an absence of the generalities that are really superfluous in such a work as this purports to be. Only thirteen pages are given to an introductory statement, which, however, should not be neglected, as it is full of suggestions that, while they perhaps have not been presented here for the first time, are nevertheless helpful and replete with good sense. More space might have been given to the factors influencing the design of reduction plants; in fact, a book might be written on this subject alone. Judging by the many blunders that are committed in this particular, more enlightenment would be welcome. Much cost data are given throughout, which, being admittedly accurate, enhances the value of the publication many times. The frequent use of good line-cuts to illustrate the text is to be commended. This type of illustration, from an engineering standpoint, is far more valuable than photographs, by reason of the clear idea that is given of construction details. Data on sorting will interest many operators in the United States and Mexico, where the methods employed on the Rand may be applied to some ores with good results. The general subject of ore dressing is discussed so exhaustively that it is doubtful if such complete data have ever before been published elsewhere than in R. H. Richard's treatise. The prevalence of the flat millsite on the Rand has brought about a set of special requirements for ore-bin and building design that find few, if any, counterparts on the American continent, but the designs used are none the less interesting; in fact, many of the structural details could be adopted to good advantage in American mill practice. An extended discussion is given of the vexed question of broken cam shafts, but from the fact that no definite solution of the difficulty is offered, it is evident that the question is still far from settled. Nothing of importance is added to the data already published on heavy or individual stamps. The test made of the Nissen stamps against the heavy stamps in the City Deep mill is mentioned, but the author apparently does not regard the result as marking the end of the 5-stamp unit on the Rand. Data on fine grinding are both interesting and instructive. Flow-sheets are discussed and the result of variations in feed, classification, types of lining, etc., are given in detail. Amalgamating devices and clean-up apparatus employed are, with a few variations, of California origin, and present nothing essentially new. The section devoted to cyaniding is by far the most interesting part of the book. It is on the Rand that sand treatment by leaching has been developed to its greatest possible usefulness, and the subject matter will well repay careful study. The craze in America for sliming everything indiscriminately has subsided to a great extent; the cyanide engineer of today gives due consideration to the economic advantages to be found in double treatment whenever possible. Slime treatment methods are covered exhaustively, construction details as well as metallurgical features being described in full. The many patented processes that have been tried out with more or less success are described, but no opinions are advanced as to their value. It is pleasing to note the attention that the author has given to the question of power supply. More could have been written on this subject, as there is no question but that with such large-scale operations as exist on the Rand many economies might be achieved through the careful study and attention of a power specialist. A schedule of items as a guide for making estimates is given, and chapters are devoted to construction costs and transport of materials. As a whole this volume is excellent, and beyond its local interest, forms a distinct addition to the literature on milling practice.

Recent Publications

MINE FIRES. By G. S. Rice. Bureau of Mines Technical Paper 24. 51 pp., ill., index. Washington, 1912.

SUMMARY REPORT OF THE GEOLOGICAL SURVEY BRANCH OF THE DEPARTMENT OF MINES, CANADA, 1911. By R. W. Brock. 412 pp., maps, index. Ottawa, 1912.

GEOLOGY OF THE NEW PLYMOUTH SUBDIVISION, TARANAKI DIVISION. By E. de Courcy Clarke. New Zealand Geological Survey. Bulletin No. 14. 58 pp., index, maps. Wellington, 1912.

PRODUCTION OF NATURAL GAS IN 1911. By D. T. Day and B. Hill. Advance chapter from 'Mineral Resources of the United States, 1911.' U. S. Geol. Surv. 58 pp. Washington, 1912.

FIRST ANNUAL STATISTICAL REPORT OF THE SAN FRANCISCO CHAMBER OF COMMERCE FOR YEAR ENDED DECEMBER 31, 1911. Prepared by T. C. Friedlander. 94 pp., ill., index. San Francisco, 1912.

PAPERS ON THE CONSERVATION OF MINERAL RESOURCES. Reprint from Report of the National Conservation Commission, 1909. U. S. Geol. Surv. Bull. 394. 214 pp., ill., maps, index. Washington, 1909.

COMPARATIVE STATISTICS OF LEAD, COPPER, SPELTER, TIN, ALUMINUM, NICKEL, QUICKSILVER, AND SILVER FOR 1911. 107 pp. Metallbank und Metallurgische Gesellschaft, Frankfort-on-main, Germany, July 1912. Although somewhat late in the year, this annual publication is of much interest and value, and its statistics may be relied on as being accurate. The principal metal mining companies of the world are reviewed in tabulated form.

UTILIZATION OF PEAT FUEL FOR PRODUCTION OF POWER. By B. F. Haanel. A record of experiments conducted at the fuel-testing station, Ottawa, 1910-11. 145 pp., ill., tables, plans. Ottawa, Canada, 1912. This is an interesting publication and contains a great deal of valuable information. The fuel-testing station is equipped with a Korting peat gas-producer and engine, an electric generator, switchboard, motors, a chemical laboratory, and accessories. It was erected to test the various kinds of fuel produced in Canada. The theory of producer-gas is described in a practical way, while the description and plans of producers and engines is especially good. The fixed carbon in the peat experimented on was 25.2%, and the calorific value of the dry fuel, 8650 b.t.u. per pound. Tests ran 7 to 30 hours, and the average fuel consumption was 1.68 to 2.2 lb. dry weight per brake-horse-power. Using coal or charcoal the usual consumption is about 1 lb. Tar was a nuisance in these tests, so the producer was altered by Korting Bros., of Hanover, Germany, and 26 tests made, with the following conclusions: The present type of producer-gas plant is reliable; tar is not troublesome; regular cleaning of pipes and engine is necessary; average consumption of dry peat per brake-horse-power is 1.7 lb., with full load; with a load factor of 75% for 3000 hr. work per year, and fuel delivered at $2 per ton, the fuel costs would be $8.40 per brake-horse-power-year, including stand-by losses. Sulphate of ammonia and tar can be recovered as by-products.

Concentrates

Most of these are in reply to questions received by mail. Our readers are invited to ask questions and give information dealing with the practice of mining, milling, and smelting.

NATURAL GAS produced in 1911 from 10,809 productive wells in Pennsylvania totaled 154,475,376,000 cu. ft.; from 4717 in Ohio, 112,123,029,000 cu. ft.; 4755 in West Virginia, 80,868,645,000 cu. ft.; and 2004 in Kansas, 77,861,143,000 cubic feet.

LIMESTONE deposits are practically inexhaustible in the United States. The production of lime in 1911 from 1089 producers was 3,392,915 short tons, valued at $13,689,054. Pennsylvania had the largest output, of 841,723 tons, worth $2,688,374.

ANTIMONY in an ore generally interferes with subsequent cyanide treatment. Weak cyanide solutions, preliminary caustic soda treatment, and roasting at low temperatures have been suggested and tried. Several plants in Australia have made fair success in tailing treatment. A neutral or slight protective alkalinity is aimed at for best results. If the protective alkali is in excess, antimony sulphide is taken into solution and subsequently deposited on the zinc-shavings as metallic antimony. The addition of lead acetate would throw down a certain amount of sulphide which may be in solution.

VANADIUM steel superheater bends made by the American Steel Foundries plant, at Pittsburg, had the following analysis: C, 0.256%; Mn, 0.650; Si, 0.320; S, 0.030, P, 0.030, and Va, 0.200%. Tests showed the elastic limit to be 54,940 lb. per square inch; ultimate strength, 89,320 lb. per square inch; elongation in 2 in., 26%; and reduction in area, 47.8 per cent. Vanadium cast steel racks for a bridge, made by the Pennsylvania Steel Co., gave the following results from three heats: Elastic limit, 55,000 to 59,000 lb. per square inch; tensile strength, 92,000 to 94,000 lb. per square inch; elongation in 2 in., 20%; and reduction of area, 34 to 38.5 per cent.

PALLADIUM finds a fairly large use in technology. Circles of astronomical instruments are made of it, and it is also employed in watchmaking. Its most extensive use is probably for certain alloys in dental work. It is also employed for soldering platinum metals. As it is not altered or discolored by exposure to air, it is often used for plating metal ware. The demand for this metal is greater than the supply. In 1911, according to the U. S. Geological Survey, 2390 oz. of palladium was produced, 300 oz. from crude foreign and domestic sands, and the rest from the refining of copper ores and copper bullion. In the same year 1218 oz., of an average value of $46.22 per oz., was imported into the United States.

MOTION necessary to be imparted to the deck of a concentrator of the table type consists of moving it longitudinally of the riffle cleats upon its surface, and toward the concentrate discharge end, from a position of comparative rest, with a gradually accelerated speed to the end of the stroke, reversing the direction quickly with a maximum of speed, which gradually diminishes during the return to the position of comparative rest, at the beginning of the forward stroke. This has the desired effect of agitating and inducing the stratification of the settling material, which is caught in the channels between the riffle cleats and advancing the same at each stroke of the mechanism toward the riffle tips. Here the cross-flowing water gives a final cleaning and removal of gangue as the material approaches and passes the riffle tips. The heavier concentrates, in order of their specific gravities, pass out upon the cleaned ore plane, and are carried forward to the concentrate discharge end of the deck, and the tailing rejected as waste.

Decisions Relating to Mining

Specially reported for the MINING AND SCIENTIFIC PRESS.

JOINT MINING VENTURE—ACCOUNTING

Where five persons, including the defendant, associated together in a joint venture to lease mining property in Mexico, which was nominally leased in the name of a third person, and also to take an option to purchase in the name of one of the associates, not a party to this action, and the leased property and proceeds are still in the custody of the nominal lessee the defendant cannot be compelled in equity to account to any of the other associates for their share of the proceeds of the leased property pursuant to the agreement of association, as it nowhere appears that defendant ever came into custody or control of any of the property.

Bowman *v.* Furber, (New York) 137 New York Supplement, 560. October 4, 1912.

ASSESSMENT WORK—VALUE

Where defendant had almost continuously worked mines in controversy from February 15, 1908, until May 10, 1909, when plaintiffs took possession and dispossessed her, defendants being in possession January 1, 1909, performing work, the claims were not subject to relocation, and work thereafter performed would apply on the work required for 1909. The value of assessment work done on mining claims by hydraulic washing is not determined by the wages of the man holding the nozzle, but by the result accomplished, including the value of the use of the plant comprising the water rights, ditches, pipe-lines, giants, etc.

Anderson *v.* Robinson, (Oregon) 126 Pacific, 988. October 1, 1912.

TAXATION OF MINING CLAIMS

The constitution of the state of Nevada exempts from taxation patented mining claims on which at least one hundred dollars worth of labor has been expended during the year. The net proceeds of such claims alone are taxed. If at least one hundred dollars has not been expended for labor and improvements, then the claim shall be assessed at not less than five hundred dollars valuation. Held that the language of the Constitution exempting claims on which one hundred dollars had been expended is mandatory and not merely permissive. It was the intention of the legislature to encourage development work upon patented claims by exempting the land from taxation where work was being done, not merely to permit assessors to take that fact into consideration in making assessments.

Goldfield Consolidated Co. *v.* State of Nevada *et al.* (Supreme Court of Nevada) Oct. 17, 1912. (Not yet reported.)

PHOSPHATE DEPOSITS—CHARACTER OF LOCATION

Where extensive deposits of calcium phosphate or 'rock phosphate,' which is found in sedimentary beds or deposits in Idaho were located and patented under the placer laws, and a subsequent attempt was made by parties adverse to the patentees to locate the same claims under the lode laws, alleging that the deposits occur "in place" in the mass of the mountains between defining walls of country rock with surface outcroppings, it was held by the Federal court that it could not disturb the original findings, of the Land Department that the deposits were placer in character. While the rulings of the Department have been somewhat inconsistent with respect to the phosphate locations in this section of the country, some of them being patented as placers and some as lodes, still these findings are findings of fact and as such must be treated as properly within the jurisdiction of the Land Department and conclusive.

Duffield and Jeffs *v.* San Francisco Chemical Co. Decision rendered Sept. 3, 1912, by Judge Van Fleet in the U. S. District Court for Idaho. (Net yet reported.)

Catalogues Received

HARDINGE CONICAL MILL CO., 50 Church street, New York. Catalogue No. 5. 20 pages. Illustrated. 6 by 9 inches.

POWER SPECIALTY CO., 111 Broadway, New York. Catalogue, 'Foster Superheaters.' 32 pages. Illustrated. 6 by 9 inches.

BROWN HOISTING MACHINERY CO., Cleveland, Ohio. Catalogue E, 'Brownhoist Buckets and Tubs.' 56 pages. Illustrated. 6 by 9 inches.

INGERSOLL-RAND CO., 11 Broadway, New York. Catalogue No. 75, 'Water Lifted by Compressed Air.' 72 pages. Illustrated. 6 by 9 inches.

MILLER SAW-TRIMMER CO., Alma, Michigan. Price list, 'Miller Saw-Trimmer and Special Attachments.' 20 pages. Illustrated. 5 by 8 inches.

THOMPSON BALANCE CO., Denver, Colorado. '1912 Catalogue of Balances and Weights of Precision.' 28 pages. illustrated. 6 by 9 inches.

E. I. DU PONT DE NEMOURS POWDER CO., Wilmington, Delaware. 'Permissible Explosives for Coal Mines.' 18 pages. Illustrated. 6 by 9 inches.

ISBELL LINING MACHINERY CO., 306 Columbia Trust building, Los Angeles, California. Bulletin No. 2, 'Isbell Concentrator.' 12 pages. Illustrated. 8 by 10 inches.

NORDBERG MANUFACTURING CO., Milwaukee, Wisconsin. Bulletins 20 and 21, describing Nordberg 'S. C.' belted type compressors; and the Nordberg 'Uniflow' engine. 7 pages. Illustrated. 8 by 10½ inches.

INTERNATIONAL CONSTRUCTION CO., Orange, New Jersey. Concentration of ores by the International dry concentrator is explained, and 7 pages giving specific gravity of minerals. 28 pages. Illustrated. 3½ by 6 inches.

ALLS-CHALMERS CO., Milwaukee, Wisconsin. Bulletin No. 1526, 'Allis-Chalmers Corliss Engines.' 16 pages. Illustrated. 8 by 10 inches. Also Bulletin No. 1629, 'Hydraulic Turbines,' 20 pages. Illustrated. 8 by 10 inches.

CHICAGO PNEUMATIC TOOL CO., Chicago. Booklet No. 119, 'Operation and Upkeep of Rockford Railway Motor Cars.' 24 pages. Illustrated. 3½ by 6 inches. Also Bulletin No. 118, 'Chicago Giant Rock Drills,' and Bulletin No. 120, 'Instructions for Setting Up and Operating Chicago Giant Rock Drills.' Both 8 pages. Illustrated. 6 by 9 inches.

LUDLOW-SAYLOR WIRE CO., St. Louis, Missouri. Catalogue No. 45, 'The Perfect Double Crimped Wire Cloth.' 77 pages. Illustrated. 8 by 10 inches. This is the best catalogue of its kind that has come to our notice and should be in the hands of every user of wire cloth and screens. Aside from being a credit to the printer, it contains valuable tables, information relating to the mesh, number of wire, and size of openings of screens.

Commercial Paragraphs

In the front cover advertisement in this journal of October 26 it was stated that the entire power required for the operation of the L. C. TRENT UNIVERSAL CYANIDING MACHINE is 20 hp. per ton of ore treated. This was a typographical error and should have read 0.20 hp.

The HARDINGE CONICAL MILL CO. announces the sale of the exclusive rights to manufacture and sell, under their patents, the Hardinge conical mill in Arizona and Sonora. L. D. Ricketts, general manager of the Inspiration Con. Copper Co. and the Cananea Con. Copper Co., is the purchaser.

Ralph A. Gould, formerly chief of the San Francisco Food & Drug Inspection Laboratory of the United States Bureau of Chemistry; Edward E. Free, formerly with the United States Bureau of Soils in field potash investigations; and Charles S. Ash, formerly chemist and assistant superintendent of the California Wine Association, announce their association under the firm name of GOULD, FREE & ASH, Chemical Engineers, with offices in the Monadnock building, San Francisco.

Largest Direct-Current Generators

Seven vertical water-wheel type electric generators, of the largest capacity ever built for generating direct current, will be installed in the new plant of the Southern Aluminum Co., at Whitney, North Carolina. Each machine will have a rating of 5000 kw., delivering 20,000 amperes at 250 volts, and operating at a speed of 170 r.p.m. Two smaller direct-current generators of the same type, rated 2500 kw. at 300 r.p.m.; two 1250-kva. alternators, having a speed of 514 r.p.m., with two 16-kw. exciters; and all necessary switchboards and controlling devices are also included in the installation. The contract for all the electric apparatus has been placed with the General Electric Co., and the installation will be one of the largest and most modern of its kind in the world.

It is the intention of the Southern Aluminum Co. to have in operation in the course of the next eight months a manufacturing plant that will turn out 25,000 tons of aluminum per year. The company was recently incorporated under the laws of the state of New York with a capitalization of $8,000,000 and was organized by some of the largest aluminum manufacturing companies of Europe. The enterprise has been financed in France and is closely associated with L'Aluminium Français of Paris. The work at Whitney is in charge of Paul Heroult, an eminent French engineer, who is recognized as an authority on the manufacture of aluminum. Although Mr. Heroult has been directing constructive operations there but a few weeks, remarkable progress has been made, and it is confidently expected that the entire plant will be in readiness for turning out the product of the company by the middle of 1914.

The plant throughout will rank among the largest and most perfectly equipped for the manufacture of aluminum in the United States. Only one other in the country, at Niagara Falls, can compare with it. In the complement of buildings are nine furnace rooms, wherein the aluminum oxide will undergo the various processes incidental to conversion into aluminum. Each of these structures measure 60 by 500 ft., and one electrode factory of similar dimensions is also included in the group. Aluminum, because of its lightness and toughness, find wide application nowadays. Aluminum wire and cable are rapidly coming into extensive use for the transmission of high-tension electric power.

The immense machines, which will supply the electric current for the several operations of this vast industry, will be installed immediately over wheel-pits and directly connected to vertical shafts of S. Morgan Smith turbines by forged flanged couplings. Each 5000-kw. generator will weigh in the neighborhood of 150 tons, measure 22 ft. in diameter, and extend 13 ft. above the floor-level. The entire rotating element of the generators will be supported from an overhead thrust-bearing. While the normal speed will be 170 r.p.m., they will be designed with provision for a safety runaway speed of 75% above normal. Simplicity will characterize the switchboard and controlling devices, which are of types requiring an effective minimum number of parts. The wheel-governors will be provided with remote electric control for both hand and automatic operation.

The establishment of the Southern Aluminum Co.'s plant at Whitney is transforming the site into a bustling city. While the construction of the plant is under way, it is anticipated that 2000 people will reside there, and 500 new concrete houses are being erected to accommodate the influx of population. Experienced chemists, electric and hydraulic engineers, and experts in every branch of the business will constitute the working force of Mr. Heroult, under whose able direction this comprehensive and important development will be consummated and also operated after successful completion.

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EDITORIAL

IT has been steadfastly held that the Democrats were in a minority, but recent listing of men available for Cabinet positions throws doubt on this belief.

LITERATURE, rather than ore, formed the main output of the Hawthorne silver and iron mines companies, and the Government is now prosecuting a number of eminent gentlemen as a result. It is estimated that at least $3,000,000 was collected from the sale of 'securities,' much of this on misrepresentation, and after it was abundantly clear that there could be no profit to the stockholders. Keenly as we may regret the smirching of names honored in American history, all good citizens will rejoice that the Government is finding a way to stop the reckless promotion of worthless 'mining' properties.

ALASKAN coal mine matters are not likely to be soon settled. Engineers from the Bureau of Mines are now engaged in taking out a sufficient amount of coal from the Bering River field, to permit trial on one of the gunboats or smaller cruisers. Unfortunately, a large part of their supplies was lost while being lightered to shore and the first opening made proved to be where the coal bed thinned rapidly on passing into the hill. A second entry is now being driven. Supplies are also being sent to Knick to permit of testing the Matanuska coal, but at best the matter cannot be concluded till the spring of 1914. This preliminary work is, naturally, expensive, but will afford data upon which final conclusions can be drawn. In the meantime work by private claimants has stopped. The whole situation will be discussed at Spokane next week.

SOUTH AMERICA continues to attract attention of men capable of financing and developing great mining properties. Despite the low labor cost under which its ancient mines were operated, modern technology and improved transportation facilities are opening the way to a new era in mining. Our Boston correspondent gives this week details as to the Chuquicamata, the Chilean copper property about to be developed by Mr. A. C. Burrage and the Guggenheims. At Huallaripa, in Peru, Mr. D'Arcy Weatherbe and a party are busy examing gold placers for London clients, and in Goyaz, Brazil, Mr. R. E. Cranston is doing the same for New York investors. In the great iron ore fields of Brazil, Americans now occupy a strong position and everywhere throughout the continent to the south of us, the North Americans, as we are there called, are taking their part in building for the future.

The Moore-Butters Decision

As to patent litigation, there is never any certainty save that of uncertainty. On another page we present in full the opinion of the United States Circuit Court of Appeals for the Third District in the case of The Moore Filter Company *v.* Tonopah-Belmont Development Company, a case that concerns essentially the rival claims of The Moore Filter Company and the Butters Patent Vacuum Filter Company. A reading of the decision gives at once an im-

pression of its breadth and of its sweeping character. The Moore Filter Company naturally considers it final, and certainly it is so complete, and holds so strongly against the defendants, that it might almost pass for a brief. In any future litigation over vacuum filters it is sure to be of large moment. Yet it should be remembered that the decision was rendered upon appeal, and that the lower court had found, after examination of the evidence, for the defendants. It is also true that there is, under our peculiarly muddled system of patent laws, abundant opportunity for further litigation, though, as we see it, there is small probability that this particular decision can be brought before the United States Supreme Court for review, and for present purposes it is final. It happens there is no right of appeal in patent cases to that court. It lies wholly within the discretion of the court whether or not to review a patent case. The court may, and does, refuse to consider such cases on the ground that they are not of sufficient general interest. It may, at its option, consent to review a case if there be evidence of faulty interpretation of the law on the part of the Circuit Court. In the instance under review there seems slight ground upon which to rest such an appeal, since the court addresses itself almost exclusively to the facts rather than to the law. Patent cases do, from time to time, come before the Supreme Court; but mainly because of conflicting opinions rendered by United States Circuit Courts for different districts. Since there are in all nine such courts, and the learned justices have a failing for differing, albeit "with much regret," from the dicta of their learned brethren of other jurisdictions, it is in such possible conflicting decisions that the chance of further expensive and exasperating litigation lies.

As regards The Moore Filter Company and the Tonopah-Belmont Development Company, assuming that there be no appeal in this case, the matter is *res adjudica*. Considering also that there was no concealment of the fact that the real defense was made by the Butters Patent Vacuum Filter Company, it may be fairly assumed that within the Third District the matter is also *res adjudica* as regards that company. Within the jurisdiction of another Circuit Court, the same thing would be true, as a matter of comity between courts, to the extent of the prompt issuance of a preliminary injunction. If, however, the Butters company desires to contest such an action and feels that grounds exist for defense outside of those presented in the case just decided, new evidence will permit a new fight. As a result of such a further contest, another District Court may find, as did that of New Jersey, in its favor and another appellate court may sustain, instead of reverse, the decision. Furthermore, as concerns any user of the Butters filter not privy to the suit just decided, wholly new action is necessary, and any such user may elect to defend, despite the opinion already handed down by the Circuit Court of Appeals. In such action The Moore Filter Company would occupy strong ground, but would be put to much expense, with always a chance of losing.

In the decision it will be noted that, while the Butters filter is held to infringe, it is definitely stated that the significance of the machine lies not in the form but the principle on which it works, and much is made of the even cake, and the submergence of the filtering medium. By implication this bodes trouble for manufacturers of other filters that use the same principle, though the result is accomplished by novel means. How far the courts will go in holding to this can only be determined by trial, and with nine independent jurisdictions and a multitude of devices, it is easily apparent that there is abundant opportunity for fighting. All this illustrates excellently the point discussed last week, that the present system entails hardship and unnecessary expense not only on the inventor and the manufacturer, but a substantial burden on industry as well. The situation in cyanidation of gold ores is serious, and any engineer must give careful thought in selecting machinery not only to technical results, but to possible damages for infringement.

We believe thoroughly in adequate protection to inventors, and no informed engineer questions Mr. George Moore's early and large contribution to technology and to metallurgical advancement. Furthermore, we hold that not only inventors but those who protect and develop a business have rights that must be safeguarded. With no sympathy whatever for patent pirates, we still hold that Mr. Charles Butters, Mr. J. V. N. Dorr, Mr. E. L. Oliver, Mr. A. M. Nicholas, Mr. C. W. Merrill, and others, have contributed mightily to the actual present conditions of advancement and should share in the profits. Mr. Moore and his friends have won a great and substantial victory. Further fighting can only result in increased costs of production and in burdening the mines. The time has come, we venture to suggest, for negotiation rather than litigation. Let the contributions of each to the general result be recognized, and terms arranged under which the men who run the mills may benefit from the continued service of all men concerned. High-grade brains, as high-grade ore, are too precious to be wasted.

Financial Control of Copper

One of the most significant factors in the present situation is the close connection existing between some of the copper producers and the power companies, which in the past few years have marked the largest development in our industrial expansion. As an instance of this, there is to be noted the consolidation of the Butte Electric & Power Company with various similar companies in Montana through the organization of a new concern to be known as the Montana Power Company, with a capital of $100,000,000. In the directorate will be Mr. John D. Ryan, and among his associates will be Mr. Sidney Z. Mitchell, whose name will be found in the directory of the largest public utility and power and light companies in the country. Mr. Mitchell is president and director of the Electric Bond & Share Company, a holding company, which is in turn controlled by the General Electric Company. Among the other corporations of which Mr. Mitchell is president or director are The American Gas & Electric Company, The Duluth Edison Electric Company, The Central Colorado Power Company, Kansas Gas & Electric Company, Pacific Power & Light Company, Portland Gas & Coke Company, Puget Sound Electric Railway Company, and even this is but an incomplete list of his connections. Mr. Mitchell is also a director of the Mercantile National Bank of the City of New York. Mr. C. H. Sabin, one of the directors, is also the vice-president and a director of the Guaranty Trust Company of New York, now the largest trust company in the United States. The Guaranty Trust Company, recently enlarged by the absorption of the Standard Trust Company of New York, is a member of the group of banks in New York dominated by J. P. Morgan & Company, whose interests in the Guaranty Trust Co. are represented by Messrs. Henry P. Davidson, Thomas W. Lamont, and William H. Porter, who are all partners in the house of J. P. Morgan & Company.

Financial details of this nature are of interest in this connection only as showing how great are the resources of the men who control copper at this time, and how completely the present domination renders impossible, by reason of its financial strength, a recurrence of any such disastrous conditions as prevailed a short time ago when the overwhelming copper surplus was piled up in this country and the German manufacturers reaped the profit. While

the stabilizing of the copper industry is a proper matter for felicitation, it may be questioned whether some of the further developments along the line mentioned can be so considered. Independence of action and independent individual growth are, or at least have heretofore been considered, necessary elements in our economic well-being. If one group of individuals, however financially strong, or however wisely their projects may be undertaken and conducted, are to assume a predominating place in the development of an industry so large and so necessary as the production of copper, and are to add to its production the direction of a large part of its consumption, it may well be doubted whether the stifling of independent growth which may naturally ensue will be altogether happy. No would-be copper producer unwelcome to the present controlling powers would be apt to find it possible to achieve any large degree of success. Money to develop would not be forthcoming, smelter contracts could not be made, and his progress would be effectually blocked. The capacity of the men controlling, their ability to handle the situation, and the undoubted benefit derived from what has already been accomplished are to be accepted without question; but grave responsibility rests upon the shoulders of any group of men who control necessaries of life—such as the production of copper, its use in the development of power, and the distribution of that power in turn to the consuming public. The contemplation of the power so exercised must inspire its possessors with something akin to awe, and with its achievement it can only be hoped that there will come a very real sense of the responsibility and the trusteeship that is involved.

Publicity and the Mining Congress

The American Mining Congress, which will be in session at Spokane, Washington, next week, occupies a peculiar position that is not always clearly understood. In contrast with the Mining and Metallurgical Society, and the American Institute of Mining Engineers, the Mining Congress makes its appeal for support on the basis of business rather than technology. When the old International Mining Congress gave way to the new organization, it was hoped that the latter would come to be the centre around which all mining men would rally, and the society to which they would look for aid in advancing the business of mining. To a large and increasing extent the hopes of the reorganizers are being realized. The annual sessions of the Congress are becoming steadily more important because of the men attracted and the serious import of the discussions. While in the aggregate a considerable amount of excellent material on technology has been printed in the transactions of the Congress, the officers make no appeal for papers of that character, and it is generally recognized that there are much better media for their publication. But with regard to all that relates to mining as a business, and especially in its relations to the great general public, the annual sessions of the American Mining Congress afford today the most effective opportunity for discussion. That the organization does not yet fully answer the needs of the mining men, is due to lack of recognition of its possible usefulness by the miners rather than to any failure on the part of its officers. In the United States, public opinion is the ruling power in the nation and also in the individual states. Since but a minority of our people are concerned with mines, public opinion must necessarily be at best based on inadequate information in mining matters. Only active missionary work and constant effort will prevent the enactment of laws that do grave injustice to the great basal industry that made the West, and they are equally necessary to reform abuses. It is not that the lawmakers and those back of them who create public opinion wish to be other than scrupulously just, but they simply do not know. And for that condition no one is more responsible than the mining men, the ones most concerned. When the Federal corporation excise tax was levied, the framers of the act attempted to do justice to the mines in the matter of depreciation, but actually the matter is so involved that the most honest and well informed manager does not know how to make his returns. In the attempt to be just to workingmen, and in that effort mine operators are as much concerned as any, various states have enacted workmen's compensation laws. There is now little disagreement as to the soundness of the principle that each industry should bear its own burdens, but because of lack of knowledge, the actual laws now in force bear with great inequality on different industries. In Nevada the law differs materially from that in California and imposes heavier responsibilities and greater cost on mine operators. Either the Nevada law is too severe or that of California too lax; possibly neither is soundly drawn. In any event, it is clear that in these and other instances laws vitally affecting the mining industry are passed by men who know little of the actual governing conditions. It has often happened that such laws have been enacted at the insistence of an interested minority of men in the industry itself, and whether such pressure comes from a labor trust or an industrial trust, the effect of such self-seeking is bad. If mining men want even justice in legislation, they must spend time and effort in giving sound information to the public, the fundamental source of law.

The best means of accomplishing this is through open and frank discussions among mining men, staged in such a way as to get the public ear. A brass band may not convey much information, but it collects the crowd, and no wise speaker protests at its presence. The delegate feature of the Mining Congress, by which the President, governors, mayors, and other public officials appoint representatives to join the regular members in their deliberations, may not always result in the fittest men being chosen. It does, however, attract attention and get publicity, and upon the latter the mining men depend if sound public opinion is to be developed. At the sessions of the Congress, discussions covering topics of the widest interest, are arranged. Well prepared speakers introduce each topic and there is always time for general debate on the floor. This may result in no consensus of opinion, the Congress may never be able to agree on a resolution, though in most cases the latter proves possible, but at least the advocates and opponents of each measure have had the opportunity to present their arguments before a critical audience, and at the same time to reach the public ear. No markedly unsound argument can long escape challenge; and if wrong doctrine is sometimes preached, at worst the antidote is sent with the poison. We believe this is a good and useful work. We have watched the growth of the Mining Congress with interest and sympathy from the first day of a noisy youth to its present position of nation-wide influence, and we trust it may survive for many years of helpful endeavor. With such men, to mention only a few, as Messrs. S. A. Taylor, D. W. Brunton, Carl Scholz, John Dern, James Douglas, H. H. Gregg, Harry N. Taylor, E. B. Kirby, Falcon Joslin, John H. Jones, T. J. Grier, and S. W. Mudd actively interested, and with an honorable record of achievement, the Congress can well look to the future with confidence. The local committee at Spokane has made extensive preparation for the session of this year and the program covers many of the problems of most acute present interest. An enjoyable and useful session is certain. We shall present later an account of the meeting, but in the meantime express our felicitations on the past and extend good wishes for the future.

Milling Plants of the Oriental Consolidated, Unsan, Korea

By A. E. Drucker

The gold-mining concession of the Oriental Consolidated Mining Co. covers an area of some 600 square miles on the headwaters of the Anju river, in northwestern Korea. Since the operations of the company are so extensive a number of stamp-mills and cyanide plants are required. The following account of the results secured through recent changes in construction at some of these plants will be of interest. Details of operating costs during the fiscal year 1910-1911, as given in the annual report, appeared in the *Mining and Scientific Press* of January 13, 1912.

Maibong Canvas Plant

This plant was designed to make a saving from the mill tailing. The method of treatment consists of a preliminary classification and reconcentration of the resulting fine and slime tailing on canvas-tables. Total cost of plant, which includes two cone classifiers, three Callow cone thickeners, and eight adjustable canvas tables (8 by 16 ft.) was $1871. The gross value of concentrate saved from the canvas table has been $9116 to July 1, 1912. The net profit equals $3290, after deducting cost of plant, operating expenses, transportation, cyanide treatment of concentrate, and tailing losses.

Tabowie Canvas Plant

The treatment at this plant is almost identical with that at Maibong, with the exception that no Callow cones are used. The plant consists of eight cone classifiers and twenty canvas tables, which represents a total expenditure of $4354. The gross value of concentrate saved (243 tons) from the canvas since the completion of the plant (November 18, 1911) amounts to $5014 to July 1, 1912. This represents a total running time of five months, the plant being closed down during January and February on account of a shortage of water. The gross saving in concentrate for the month of July 1912 amounts to $1200. Net profit to August 1, 1912, equals $97, after deducting the cost of plant and all other expenses. From now on I estimate an average monthly net profit of $800 to $900.

Taracol Canvas Plant

The treatment is similar to the other plants, with the exception that the coarse product from the classifiers is treated on Wilfley tables instead of belt vanners. The plant consists of four classifiers, eight Wilfley tables, and 28 canvas tables. The total cost of installation was $9461. The gross value saved in concentrate from the canvas tables, since the completion of the plant (March 11, 1912) amounts to $5898. Gross value saved during July equals $1696. The profit derived to August 1, after deducting all operating expenses, amounts to $4183. By January 1, 1913, this plant will be paid for, and from that time on I estimate an average monthly net profit of about $1150.

Kuk San Dong Dump Re-treatment Plant

The total time this plant operated during the past fiscal year was 212 days, and in that time 11,953 tons dump, 88 tons Maibong, and 912 tons Kuk San Dong mill concentrate were treated. The method of treatment for the dump (sulphide tailing from old cyanide plant) consists of washing, classifying, and re-concentrating on Wilfley tables. The concentrate obtained, containing about 85% of the precious metals, is classified, re-ground (all-slimed), and the gold extracted by cyanide agitation and filter-pressing. Wilfley tailing from the concentrator plant is rejected. A description of this plant is omitted here, as it has already been described in my report for 1911. The concentrator plant (8 Wilfleys) treated an average of 56.3 tons per 24 hours of old dump material, or at the rate of 7 tons per machine. The average assay value of the Kuk San Dong re-treated dump material is $3.14 (this does not include re-treated Maibong tailing from old cyanide plant). The results obtained on this ($3.14) dump material are: gold extraction by re-concentrating, 85.7%; extraction from this concentrate by re-cyaniding, 63.6%; net bullion extraction from dump, 53.9%. Considering the material treated and its low value, this result is up to expectations.

The material to be treated during the coming fiscal year averages $8.28, or $5.14 more per ton, and this increased value should net us a good profit. Our average total expense per ton for the dump material treated was $2.26, and this amount is less than the concentrate treatment expense ($2.81) at the Alaska Treadwell mines, where a similar plant treats 90 tons per day using cheap electric power. Upon a total tonnage of 12,953, including Kuk San Dong dump, Kuk Son Dong mill, and Maibong mill concentrate, a net profit of $3881.14 was realized. My estimated net profit on the remaining Kuk San Dong old concentrate tailing dump, with practically all the low-grade

TARACOL REDUCTION PLANT, UNSAN, KOREA.

material re-treated, according to the results already obtained, is as follows:

Cost of treating 29,056 tons at $2.26	$65,666.56
Original cost of the plant	39,336.38
Value remaining in tailing ($2.50 per ton)	72,640.00
Total	$177,642.94
Net recovery	63,014.42
Gross content (29,056 tons at $8.28)	$240,675.36

To the net recovery must be added $13,842 as credit to be received for the plant machinery upon completing the work, so that the ultimate net profit will be $76,856.42.

The foregoing report of the Kuk San Dong dump plant gives the results for the fiscal year ended June 30, 1912. The results for the first three months of the fiscal year 1913 have been most encouraging. They are as follows:

	Tons treated.	Gross content.	Bullion recovery.
July 1912	1,529	$8,219.23	$6,712.57*
Aug. "	2,060	7,753.47	7,103.80†
Sept. "	1,956	7,598.45	5,905.78
	5,545	$23,571.15	$19,722.15

JULY, AUGUST, SEPTEMBER 1912

Average value of material per ton treated	$4.25
Average actual net bullion extraction, per cent	76.47‡
Total time operating, days	73
Capacity per 24 hours, tons	76
Cost of treatment per ton	$1.75
Net profit obtained	$10,000

The following is an average analysis of the old cyanide tailing dump (now being re-treated) before it had become weathered and oxidized:

MAIBONG CONCENTRATE.	%	KUK SAN DONG CONCENTRATE.	%
Gangue	62.96	Gangue	50.60
Pyrite	17.60	Arsenical pyrite	27.04
Arsenical pyrite	17.00	Marcasite	13.12
Iron oxide	2.21	Galena	9.14
Galena	traces	Sphalerite	traces
	99.77		99.90

(Gangue consists mainly of quartz.)

It is easy to imagine the difficulties likely to be encountered with such material after standing for eight to ten years before receiving a second cyanide treatment.

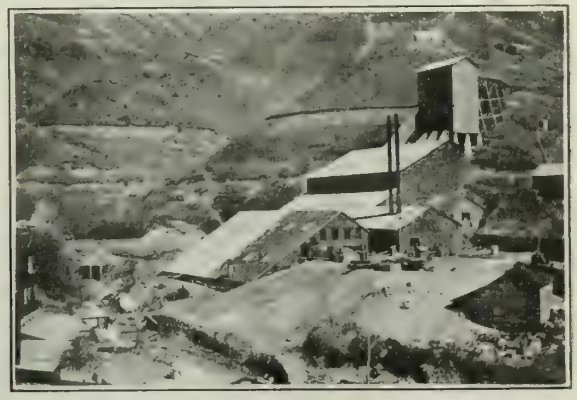
The increase in extraction over the previous fiscal year (1912) so far amounts to about 20%. The bullion now being obtained is derived only from the re-treatment of tailing from the old cyanide leaching plant. I attribute the better results to some changes made in the treatment during the past three months. Another small air-compressor was installed, which enabled us to put into commission a fourth Pachuca agitator, allowing for a longer time of agitation and treatment. Finer grinding of the sulphide was resorted to (all passing a 200-mesh screen). The barren solution wash applied through the main filling channel of the Dehne press was responsible for the better results in filter-pressing. A preliminary treatment Pachuca agitator has recently been installed which agitates the concentrate from the Wilfley tables with lime-water and air. The concentrate is now alkaline before passing to the tube-mill to be ground in cyanide solution. This effects a material saving in cyanide and prevents to a large extent the fouling of the solutions, and better extraction consequently results. The present foreman of the plant, G. C. Evans, is to be congratulated upon his good work.

TABOWIE MILL.

CANDLESTICK MILL.

TARACOL CYANIDE PLANT

The re-grinding plant was completed about the middle of May 1912, but did not operate steadily until the latter part of the month. Even the following month of June was occupied mainly in 'breaking in' Koreans to the new work.



KUK SAN DONG REDUCTION PLANT.

Our mechanical troubles were due chiefly to inexperienced labor. Because of several days of lost time during June it was necessary to run several charges of concentrate into the old leaching plant to prevent an accumulation of concentrate at the Tabowie and Taracol mills. Consequently there were two plants running until June 15. The total operating expense for both plants was included in one, and charged up against the new cyanide re-grinding plant. Also the total bullion clean-up was included as one and credited to the new re-grinding plant. The total concentrate for June treated in both plants was 2228 tons, which was valued at $55,993. The bullion extracted from this was

*Includes $1703.02 = bullion from May and June slag.

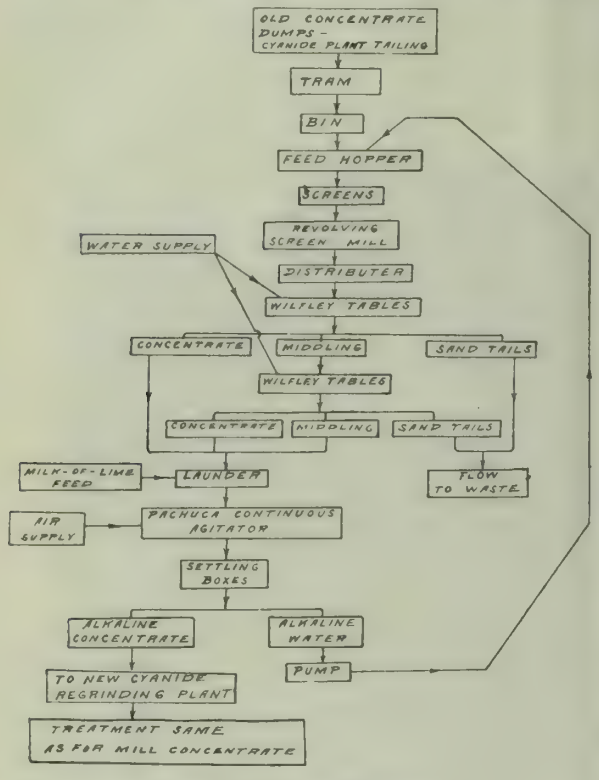
†Includes $896.25 = bullion from July slag.

‡Does not include $1703.02 July slag credit, which should have been credited to the previous fiscal year.

$50,238. Percentage of extraction, 89.7; theoretical extraction, 87.4 per cent.

During July the total concentrate from both mills (160 stamps) was treated in the new re-grinding plant. The treatment consisted of classifying, all-sliming, continuous Pachuca-tank agitation, Merrill zinc-dust in connection with zinc-box precipitation, and filter-pressing. One strong solution was used for the grinding and total treatment.

The plant consists of one 5 by 18-ft. tube-mill; two Morris 3-in. sand-pumps; two vertical triplex sand-pumps;

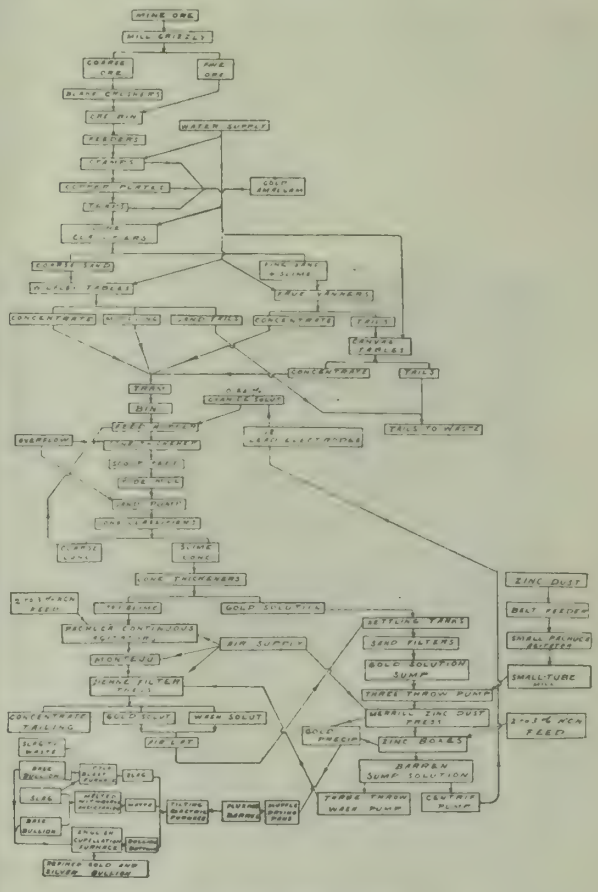


DUMP RE-TREATMENT CHART.

four Pachuca agitators, 10 by 40 ft., connected for continuous agitation; four cone classifiers; six Callow cone thickeners; two settling tanks, 6 by 25 ft.; two sand-filters, 6 by 25 ft.; one Merrill zinc-dust press; five zinc-bozes; one Monteju receiver; one Dehne filter-press, 50 frames; two Morris solution pumps; two vertical triplex pumps; one solution sump, 10 by 30 ft.; one gold-solution sump, 10 by 15 ft.; two stock-solution tanks; and a set of lead electrodes for the electrolysis of sump solution. The power-plant consists of one 250-hp. engine, three boilers, and two air-compressors, 500 cu. ft. and 107 cu. ft. air per minute.

The re-grinding plant results for the month of July are as follows: Total tons concentrate treated, 2070.3 of an assay value per ton of $29.20, or a total value of $60,446. The bullion obtained was $53,314.87, corresponding to an actual extraction of 88.2% or a theoretical extraction of 88.9%. It must be remembered that no definite conclusion can be attained from the first month's run of a new plant such as this. Our original estimated extraction for this plant was 91%, and I am sure that after all parts have been adjusted this extraction, or even better, will be obtained. I am confident that the work of this plant will be fully up to expectations. The cost of this plant has exceeded the estimates, but it is expected to offset this by realizing a larger net profit than was originally estimated. The following are the results for the month of August 1912, that were not at hand when the above report of the new Taracol cyanide plant was completed. Total tons concentrate treated was 2000, of an assay value per ton of $29.14. This gives a total content of $58,289. The bullion obtained was $54,567, corresponding to an actual extraction of 93.6%, or a theoretical extraction of 90.1 per cent.

These results are better than were expected, and with cheap electric power to be supplied from Anchu to this plant the coming year, the increased net profit ($20,880 per year over the results of the old leaching plant) originally estimated will be somewhat exceeded. Another re-treatment plant for the large concentrate cyanide tailing dumps at Taracol is now under construction. The process will be



ORE TREATMENT CHART.

similar to that at the Kuk San Dong re-treatment plant. The accompanying dump re-treatment chart will serve to explain the process employed.

New Copper District in the Caucasus

ST. PETERSBURG CORRESPONDENCE

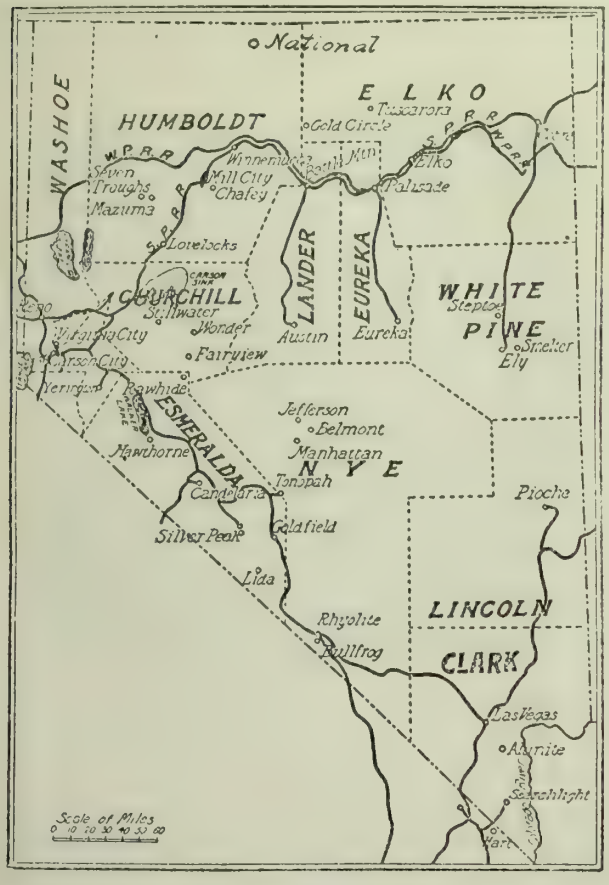
At a meeting of the Society of Mining Engineers held in St. Petersburg, on October 10, a report was read by A. M. Margolius on copper areas in the Artvin district of the Batoum province, Black Sea. It is stated that between the years 1908 and 1910 he had carried out a series of careful investigations respecting the deposits of various minerals in the district named. Within the limits of that district 600 claims have already been located, and of these some 500 are for the exploitation of copper. At the present moment particulars have been acquired respecting some of them and some are already being exploited.

The possibility of finding important accumulations of copper ore in the districts investigated are, according to Mr. Margolius, very favorable. The places investigated are about 15 to 150 versts from Batoum and 20 to 30 versts from the place called Ardanuga, in a mountainous district where a number of spurs from various mountain ranges form an area almost unexplored and difficult of access. The construction of a paved road along the Impercherska defile about 51 to 60 versts long would be a great stimulus to the development of the copper industry of these districts. The survey of the road has already been completed; and it has been decided to construct it. The road cuts through two other districts where claims have been staked.

Geology of the National Mining District, Nevada

By Alexander N. Winchell

The National mining district is about 75 miles north of Winnemucca, which is the county seat of Humboldt county, Nevada, on the Southern Pacific railway about 400 miles east of San Francisco. The district is in the northern part of the Santa Rosa mountains, about 10 miles south of the Oregon-Nevada boundary line. These mountains form the eastern boundary of the valley of the Quinn river, whose waters flow southwest and disappear in the Black Rock sink. The Quinn River valley, like many others in the West, is nearly flat, sloping gently upward toward the mountains on either flank, and still more gently downward along the course of the valley to the southwest. The district is accessible over good mountain roads from the county seat, and



WESTERN NEVADA.

there is at present an automobile stage, carrying daily mail, and making the trip each way in one day. The elevation of the Quinn River valley is about 4200 ft. above sea-level. The National mining district in the mountains on the eastern boundary of the valley occupies an area whose elevation varies from 6000 to 7000 feet.

General Geology

The north end of the Santa Rosa mountains is occupied by a portion of the great basalt flows which extend from this region northwestward to the Columbia river, and northeastward across the plains of southern Idaho, nearly to the western boundary of Wyoming. Elsewhere the great lava plains of Oregon and Idaho are occupied chiefly by basalt flows, but in this mining district near the southern boundary of the Columbia river lavas, the volcanic rocks are not of uniform composition; they include such acid rocks as rhyolites, as well as andesites and more basic basaltic rocks. The National mining district is therefore, in a certain way, a connecting link between the more uniform lava flows of the north and the diversified volcanic eruptions which have been described in southwestern Nevada by Spurr[1] and others. In a brief study of the relationships of the various volcanic rocks near National, I found evidence of the following succession, beginning with the oldest: older basaltic rock, older rhyolite, older andesite, later rhyolite and later andesite, later basaltic rock. That there are two series of volcanic rocks of different age in the district is shown by the difference in altitude and difference in physical conditions of the rocks. The older series consists of rhyolites and subordinate andesites, which form flows and more or less bedded tuffs now, in the large part, highly altered. The beds and flows of the older series have been tilted and truncated by erosion. The later series cuts through the older rocks and lies on this old erosion surface; it consists largely of basaltic flows with subordinate intrusions and extrusions (surface flows and volcanic tuffs) of rhyolite and andesite. On Charleston hill and Buckskin mountain flows of obsidian and later rhyolite are reported, lying above later basaltic rock. Still higher stratigraphically

NATIONAL IN 1910.

the latest flows are thick and basic. North of Eight-mile creek the later volcanic series consists of more than 2000 ft. of flows and tuffs dipping gently to the east.

The succession of volcanic rocks as worked out by various authors in regions near, and probably genetically connected with the National district, and the assumed relations between these areas, are summarized on the following page.

The oldest rocks discovered in the immediate vicinity of National are basaltic fragments enclosed in the older rhyolite. It may be inferred that the rhyolite had cut through basaltic flows in reaching its present condition. These old flows were not recognized in the field and apparently do not reach the surface near the National mine. The fragments are dark and rather basic, and the rock may be augite andesite instead of true basalt. They have not been examined microscopically. The next younger volcanic rock is a hornblende andesite, which shows evidence of much alteration. That the andesite did not follow promptly after the rhyolite is shown by the relations exhibited in an adit on Radiator hill, where andesitic tuff overlies an inclined and much weathered surface of older rhyolite; the surface dips about sixty degrees east. A hornblende dacite of uncertain age is closely associated in its rare occurrences with the older andesite.

The later rhyolites (and andesites) contain inclusions of a basic rock which is either basalt or augite andesite. It may represent basaltic flows younger than the older andesite (and of course older than the later rhyolite), or it may represent the same basaltic flows of which fragments are found in the older rhyolite. Like the latter, its character as a true basalt is questionable; it may well be an augite andesite.

The relative age of the later rhyolite and later andesite has not been fully established, but the andesite is considered the younger, since it contains fragments of rhyolite which are apparently not from the older rhyolite. It also con-

[1] J. E. Spurr, *Jour. Geol.*, Vol. VIII, 1900, p. 621.

SUCCESSION OF VOLCANIC ROCKS IN WESTERN NEVADA DISTRICTS

National, Nevada. A. N. Winchell. 1912.	Jarbidge, Nevada. F. C. Schrader.* 1912.	Elko county, Nevada. W. H. Emmons.† 1910.	Great Basin, Nevada. J. E. Spurr.‡ 1900.	
No. 0. Older basaltic rock.			Unknown.	Cretaceous.
No. 1. Older rhyolite.	Old rhyolite.		Biotite rhyolite.	Eocene.
No. 2. Older hornblende andesite and dacite.			Hornblende or biotite andesite and dacite.	
Basaltic rock?				Miocene.
No. 3. Later rhyolite.	Young rhyolite.	Rhyolite.	Rhyolite and basalt.	
No. 4. Later hornblende andesite (and dacite.) Augite andesite.		Andesite.	Hornblende pyroxene andesite latite, dacite, rhyolite.	Pliocene.
No. 5. Later basaltic rock (with rhyolite).		Basalt with rhyolite.	Augite and olivine basalt with rhyolite.	Pleistocene.

tains at the Shiloh group fragments of an older andesite. In the same region a single outcrop of dacite is associated with the later andesite.

Augite andesite in dikes, sills, and flows is clearly later than the older series, but its relation to the younger series is open to question. It may be the older member of the younger series, and identical with the basaltic rock occurring as inclusions in the later rhyolite.

The later basaltic rock has not been carefully studied, but it is supposed to be a true basalt. On Charleston hill, and on Buckskin mountain a flow of obsidian succeeded by rhyolite is reported above the later basalt. North of Eightmile creek the latest flows are basaltic in character.

PETROGRAPHY

The igneous rocks of the National district include rhyolitic obsidian, andesitic obsidian, rhyolitic tuff, andesitic tuff, rhyolite, dacite, hornblende andesite, augite andesite, hornblende augite andesite, and probably basalt.

The rhyolitic obsidian apparently forms a dike in the face of an adit of which the portal is about 500 ft. northwest of the Silver Slipper claim. It is of a greenish gray color, and contains crystals of abnormal (or high temperature) orthoclase, plagioclase, and quartz. Grayish black obsidian, supposed to be rhyolitic, is reported from the top of Charleston hill.

Andesitic obsidian of a dark gray color occurs in dike-like form at the southeast corner of Fairview No. 1 claim. It strikes N.70°W., and dips steeply to the south. It contains numerous crystals of labradorite feldspar in a dark brown groundmass. An obsidian containing biotite phenocrysts is reported from Buckskin mountain.

Rhyolitic and andesitic tuffs and breccias are not uncommon in the region; they present no features of special importance. In the immediate vicinity of National they belong chiefly to the older series.

Rhyolite of the older series is usually much altered; when the primary minerals are still recognizable they include abundant orthoclase and quartz with some plagioclase and little accessory ilmenite. A few samples contain some green hornblende. Secondary minerals often present include chlorite, leucoxene, quartz, calcite, sericite, kaolinite, epidote, hematite, and limonite. The rock often contains disseminated pyrite, and another sulphide of silver-gray color and metallic lustre which is probably arsenopyrite. These sulphides, as well as some of the calcite (or related carbonate), may be magmatic in origin.

Rhyolite of the later series has not been studied microscopically, but it is relatively fresh and contains abundant unstriated feldspar and glassy quartz.

Andesite of the older series is an important rock at National, being one of the wall rocks of the chief vein of the district. Like most of the rocks of the region, it is commonly fine grained, requiring the highest magnification to determine the mineral composition. It is either felsitic or porphyritic in texture, part of the groundmass frequently being glassy, and the phenocrysts usually small. It is sometimes amygdaloidal, and nearly always considerably altered. The small phenocrysts of plagioclase range in composition from basic labradorite to acid andesine. The groundmass is commonly composed of fine lath-shaped plagioclase slightly more acid than the phenocrysts, green hornblende or chlorite, more or less ilmenite, and rock glass. Rarely remnants of biotite may be discovered. Secondary minerals include chlorite, leucoxene, sericite, kaolinite, quartz, calcite, hematite, limonite, and pyrite. The remarkable feature of the andesite is the abundance of calcite (or a related carbonate, either dolomite, siderite, or ankerite). In samples in which the mass of the rock is much altered it is a natural inference that the calcite is secondary, but this inference is not so easily drawn for those samples in which the plagioclase and other primary minerals are quite fresh. Fig. 1 illustrates the appearance in thin section of such a rock from the face of the Atkinson adit on the Fairview claim. As shown in the figure the plagioclase is quite fresh and clear. Some of the crystals still retain sharp crystal outlines, and yet these crystals and ilmenite (or magnetite) are embedded in fine grained calcite. Such a condition forces one to consider seriously whether the calcite is not of primary origin, that is, crystallized directly from the magma. Magmatic calcite has been described by Adams,[2] Törnebohm,[3] Holland,[4] Emerson,[5] and Workman,[6] nearly always in nepheline syenites or in rocks associated with nepheline syenites. In the andesite from National, it is clear that part of the calcite in its present position is of

*F. C. Schrader, U. S. Geol. Surv. Bull. 497, 1912, p. 35.
†W. H. Emmons, U. S. Geol. Surv. Bull. 408, 1910, p. 34.
‡J. E. Spurr, *Jour. Geol.*, Vol. VIII, 1900, p. 621.

[2]F. D. Adams, *Amer. Jour. Sci.*, XLVIII, 1894, p. 14.
[3]A. E. Törnebohm, *Geol. Fören. Stockholm Forh*, XVII, 1895, pp. 100, 214.
[4]T. H. Holland, Mem. Geol. Surv. India, XXX, 1901, p. 197.
[5]B. K. Emerson, *Bull.* Geol. Soc. Amer., XVI, 1905, p. 105.
[6]Rachel Workman, *Geol. Mag.*, VIII, p. 193.

later origin than the feldspar, since it occurs in fractures running irregularly through the plagioclase. Such calcite-filled fractures not only cross the rare phenocrysts but traverse also the microlitic groundmass. Furthermore, the amygdules scattered through the rock are filled with calcite formed in two stages; the first formed being clear, colorless, and sometimes spherulitic, the second being cloudy and yellowish, probably from limonitic stain. On the other hand, there is not the slightest indication that the calcite is confined to, or is even more abundant near, fractures than in the rock as a whole. If the calcite, especially that in microscopic veinlets and amygdules, is the result of later alteration, that alteration must have occurred under conditions such that the plagioclase and magnetite were remarkably stable, while the rest of the rock was removed almost completely. It is well known that this will not occur under ordinary weathering conditions, and that, on the contrary, the plagioclase of the Columbia river basalts alters readily under such conditions, and that one of the products of such alteration is calcite. It is also true that ordinary rock samples illustrating the production of calcite from feldspathic rocks probably under conditions of moderately high

FIG. 1. UNALTERED LATH-SHAPED PLAGIOCLASE WITH SHARP CRYSTAL OUTLINES EMBEDDED IN CALCITE. FAIRVIEW CLAIM, NATIONAL, NEVADA. CROSSED NICOLS. × 30.

pressure and temperature furnish nothing like the andesite found in National. On the contrary, in such rocks the calcite is clearly derived at least in part from the alteration of the feldspar. It seems probable, therefore, that the calcite in the andesite at National is largely of magmatic origin.

Andesite of the later series has not been studied microscopically, but it is relatively fresh, contains little or no calcite, and consists largely of plagioclase and hornblende, commonly with rock glass. Some of the samples contain fragments of an older andesite, of a basaltic rock, or of a rhyolite.

Dacites are rare in the National district, but the two samples discovered seem to represent two periods of intrusion. One is closely associated with the later andesite, and, like the latter, is fresh and contains little or no calcite; it is a porphyritic rock containing small phenocrysts of quartz, andesine, and biotite in an extremely fine grained groundmass of the same minerals with much rock glass. It is a biotite dacite. The other is closely associated with the older andesite and like the latter contains abundant carbonate. Unlike those of the older andesite, the plagioclase phenocrysts and the smaller crystals of the groundmass are fresh and unaltered with sharp crystal outlines. The rock contains abundant feldspar, some quartz, light brown hornblende, magnetite (or ilmenite), apatite, and much carbonate, which is probably ankerite, since it does not effervesce in cold acid and has indices somewhat higher than those of calcite. This rock seems to furnish another example of primary carbonate, since the fresh unaltered minerals include not only plagioclase and magnetite, but also brown hornblende and apatite. The carbonate seems to have ceased to crystallize after the magnetite, but as early as the feldspar. Quartz was the last mineral to complete its crystallization and fills interstices between the other minerals. The rock is a carbonated hornblende dacite. The relation of the carbonate to the other minerals of this rock is shown in Fig. 2.

The augite andesite of National has been often called basalt because it differs sharply in appearance from the hornblende andesite of the same district, while it resembles closely a true basalt. The rock is essentially different from a true andesite, and therefore the name augite andesite, which implies that the rock is a variety of andesite, is distinctly objectionable. I would suggest that such rocks be called auganite. The relation in chemical composition between andesite, auganite, and basalt may be shown by comparing the averages computed from all available complete analyses.

FIG. 2. DACITE, NATIONAL, NEVADA. THE BLACK MINERAL IS MAGNETITE OR ILMENITE, THE ELONGATED GRAY MINERAL WITH CLEAVAGE LINES IS BROWN HORNBLENDE, THE IRREGULAR GRAY GRAINS ARE ANKERITE, THE WHITE GROUNDMASS IS A MOSAIC OF PLAGIOCLASE AND QUARTZ. ONE NICOL. × 60.

Auganite is a volcanic rock consisting essentially of basic plagioclase and pyroxene; the plagioclase is usually labradorite, but may be more basic; andesine marks a transition toward andesite. The pyroxene is often augite, but hypersthene, bronzite, diopside, and even enstatite replace the augite more or less completely in some types. Hornblende and mica are not common, nor abundant. Andesite consists of acid plagioclase (andesine or oligoclase) with hornblende or mica or pyroxene. Having provided the new name auganite for rocks ordinarily called augite andesite, it is possible to use the latter name for rocks which are actually varieties of andesite, and consist essentially of acid plagioclase and pyroxene. The close relationship in composition between augite andesite as thus defined and other andesites is clearly shown in the following table. Auganite at National forms dikes and flows which are dark colored and fine grained. In places they are amygdaloidal, the cavities being filled by layers of chlorite, calcite, and quartz, commonly formed in the order indicated. Rarely the rock contains accessory hornblende. Some samples contain abundant calcite and some pyrite. Part of the calcite seems to be of magmatic origin, but the evidence is not decisive.

Basalt is reported in flows stratigraphically above the foregoing rocks. I have not studied it.

AVERAGE COMPOSITION OF ANDESITE, AUGANITE, AND BASALT

	Hornblende and mica andesite.	Augite andesite.	All andesite.	Auganite.	Basalt.
SiO_2	61.31	61.33	61.30	54.97	48.78
Al_2O_3	17.16	16.47	16.88	16.69	15.85
Fe_2O	3.14	2.86	3.01	3.94	5.37
FeO	2.32	3.30	2.76	4.75	6.34
MgO	2.31	2.75	2.49	4.13	6.03
CaO	5.28	4.78	5.07	8.02	8.91
Na_2O	3.73	4.37	3.99	3.19	3.18
K_2O	1.94	1.81	1.89	1.45	1.68
H_2O	1.45	1.16	1.33	1.39	1.76
TiO_2	0.92	0.77	0.86	0.89	1.39
P_2O_5	0.26	0.24	0.25	0.28	0.47
MnO	0.18	0.16	0.17	0.30	0.29
	100.00	100.00	100.00	100.00	100.00

Hornblende and mica andesite: average of 34 analyses, from data of Daly, *Proc.* Am. Acad. XLV, 1910, p. 223.

Augite andesite: average of 23 analyses from data of F. W. Clarke, U. S. Geol. Surv. Bull. 419, 1910, Rosenbusch, 'Elem. Gest.,' 1910, p. 382, and Osann, 'Chem. Petrog.,' II, 1905. The name is here restricted to volcanic rocks containing acid plagioclase and pyroxene.

All andesite: average of 57 analyses, from data of R. A. Daly (*loc. cit.*), F. W. Clarke (*loc. cit.*), Rosenbusch (*loc. cit.*), and Osann (*loc. cit.*). Auganites excluded.

Auganite: average of 73 analyses, from data of F. W. Clarke, U. S. Geol. Surv. Bull. 419, 1910, Rosenbusch, 'Elem. Gest.' 1910, pp. 378, 382, and Osann, 'Chem Petrog.' II, 1905. Rocks containing acid plagioclase or orthoclase are excluded and 12 olivine-free basalts are included.

Basalt: average of 161 analyses, R. A. Daly, *Proc.* Am. Acad. XLV, 1910, p. 224.

ORE DEPOSITS

The ore deposits of the National district are all in quartz veins largely confined to the older volcanic series. There are two types of ores present: one is characterized by copper, lead, and silver, and the other by gold (with silver).

The veins containing the base ores were produced after the extrusion of the older rhyolite, and probably before any of the later rocks; they cut the rhyolite and are not known to extend into the later rocks. The veins formed at this time contain a considerable variety of minerals; the chief gangue mineral is quartz accompanied in places by subordinate quantities of calcite and a little sericite; the chief ores include chalcopyrite, arsenopyrite, pyrite, bornite, stibnite, galena. They often contain an important amount of silver as well as copper and lead. Under favorable conditions they would yield fair returns, but on account of the comparative isolation of the district they have not yet produced any considerable amount of shipping ore.

Gold ore is the important resource of the district. The vein of the National mine contains phenomenally rich gold ore in quartz. It occupies a fissure which was produced later than the veins containing base ores, and later than the older andesite. Faulting along this fissure has lowered the andesite (which probably formerly overlay the older rhyolite) of the hanging wall to a position on a level with rhyolite in the foot-wall. The fissure was filled by quartz containing argentiferous gold or electrum with small amounts of pyrite and stibnite, and very little stephanite, native arsenic, galena, sphalerite, and chalcopyrite. After the formation of the ore, faulting continued along the vein; consequently, the ore is much broken and granulated, and rolled fragments are often found in the fault gouge. This post-mineral faulting movement along the vein occurred after the extrusion of the auganite, since fragments of this rock are now in the fault gouge. The metallic part of the ore consists of gold and silver usually in the ratio of about 1 to 1, as in electrum. The latter is intimately intergrown with finely granular quartz, and partly enclosed by elongated prisms of quartz rudely parallel or radial. Stibnite and native arsenic intergrown with the quartz give it in places a dark gray to black color. The sulphides in this vein are intergrown with the quartz, but (except stibnite in a few cases) are not so closely associated with the electrum. Even the pyrite is rarely if ever directly intergrown with the gold. In occasional samples the gold ore is broken and recemented by white quartz containing a little pyrite. There is little evidence of secondary enrichment, and no abundant formation of secondary minerals of any kind in the National vein, but small quantities of the following secondary minerals have been observed: calcite, orpiment, realgar, sericite, limonite, and pyrargyrite. Marcasite, native gold, and polybasite are reported as secondary minerals, but I have not observed them.

The ore occurs in a shoot of rather indefinite boundaries which has been proved to extend on the dip for a distance of about 700 ft. and on the strike for a distance of 400 ft. The shoot is not known to extend to the surface at any point, and for about 60 ft. from the surface downward the vein contained some silver, but no high-grade ore. No placer mines have been discovered in this vicinity, although erosion has been at work cutting down the surface and the outcrop of this vein for some time. It seems probable that the bonanza ore-shoot never reached the surface of the earth, and also that the upper portion of the vein which has been removed by erosion did not contain any similar lens of high-grade ore. Most of the ore from the mine is worth from $30 to $60 per pound, and the total production since the discovery of the lode in 1907 is reported to have been between $3,000,000 and $4,000,000.

ORIGIN OF THE ORE

The problem of the origin of such ore is of great importance, as well as of a peculiar fascination, because it has engaged the attention of so many eminent students of ore deposits without receiving any satisfactory solution.

It is commonly believed that many ore deposits in veins have been formed by precipitation of metals, sulphides, or other compounds from flowing water or from flowing aqueous vapor. It seems reasonable to believe that such a mode of origin would produce a banding or crustification in the ore. At Steamboat Springs,[7] Nevada, where such a process is now forming deposits of stibnite, pyrite, metastibnite, and silica, and unrecognized minerals containing gold, silver, copper, lead, arsenic, and other metals, crustification on the walls of the fissure is distinctly visible through the recent sinter.

At National crustification is not uncommon in the quartz of the main vein, but it is wholly lacking in the high-grade gold-quartz, so far as I observed. It seems improbable, therefore, that precipitation occurred from a flowing fluid. I would suggest that the gold quartz was precipitated, not from a thin aqueous solution, but from a viscous, and perhaps gelatinous mass which occupied the fissure in much the same way as an igneous magma fills an opening in country rock. The amount of motion during crystallization may have been no greater in the former instance than in the case of the magma.

The constituents of the viscous mass which formed the National vein may be inferred (from the components of the vein) to have been silica, gold, silver, and very little antimony, arsenic, iron, and sulphur. In accordance with generally accepted views, it is believed that these constituents did not exist merely in mutual solution, like those of a magma, but that they existed in solution in water or aqueous vapor. It is considered probable that the amount of water present was small, and that supersaturation was prevented by the presence of certain compounds which increase the solvent power of water, or may be themselves efficient solvents. Such compounds are carbon dioxide and alkaline sulphides. The present condition of the wall rocks, with abundant carbonates apparently both primary and secondary in origin, renders it very probable that carbon dioxide existed in the ore-forming solution. It is from chemical considerations that a belief in the existence of alkaline sulphides in the solution is derived.

In seeking for a solvent of gold in the National vein

[7] G. F. Becker, U. S. Geol. Surv. Mon. XIII, 1888, p. 331-353; W. Lindgren, *Trans.* Am. Inst. Min. Eng. XXXVI, 1906, pp. 27-31; J. C. Jones, *Science*, XXXV, 1912, p. 775.

it must be remembered that the ore contains not only gold, but also silver. It is clear that the two metals solidified simultaneously, and therefore from a single solution. Consequently it is necessary to find a solvent for both. Hydrochloric acid under pressure less than 100 lb. per square inch and at moderately high temperatures (about 120°C.) dissolves gold,[8] but is not a solvent for silver. Nitric acid dissolves silver, but does not affect gold. Sulphuric acid attacks silver, but is not a good solvent for gold. In short, there is no common mineral acid which is a solvent for both metals. On the contrary, alkaline sulphides, even when present in small amounts, are efficient solvents for gold, while silver sulphide is soluble in water[9] alone at temperatures as low as 89°C. Such solutions are also solvents of iron, antimony, arsenic, lead,[10] zinc, and copper, all of which are found in the National vein in sparse to rare primary minerals. Moreover, Lenher, of the University of Wisconsin, finds that an alkaline sulphide solution of gold is stable[11] under a considerable variety of conditions, whereas most other solutions are relatively very unstable, especially in the absence of oxidizing conditions.

Accordingly, it is probable that the solutions which filled the National fissure contained alkaline sulphides, and that these sulphides kept the gold and silver in solution.

If such a vein-magma did at one time fill the National fissure it would certainly slowly cool, and perhaps at the same time slowly come under decreasing pressure on account of slight upward movement and surface erosion. Supersaturation would finally ensue, and centres of crystallization would be established. On account of the high tenor of silica, quartz would probably be one of the earliest products of crystallization. The immediate result of the formation of quartz would be the liberation of water, previously combined with the silica in the condition of unconsolidated opal. Under suitable conditions of temperature and pressure, the water would promptly combine with carbon dioxide to form carbonic acid. Alkaline sulphides are wholly unstable in the presence of any mineral acid, including carbonic acid. Alkaline carbonates and hydrogen sulphide would probably be produced. The destruction of the alkaline sulphides would remove the solute for the gold and silver, and these would be precipitated. In the absence of gold the silver would probably combine with sulphur of hydrogen sulphide to form argentite. But in the presence of gold it seems to form an alloy (electrum) with the latter, rather than to decompose the sulphide.

Whether the precise chemical processes[12] involved have been correctly stated or not, it seems clear from the mode of occurrence that the electrum was precipitated from a solution containing large proportions of the precious metals, and that it was precipitated with the earliest products of crystallization from that solution. Alkaline sulphides are known to be remarkably efficient solvents, and they are regarded as the most probable solvents in this case; their destruction, probably to form carbonates, is believed to have caused the precipitation of the electrum.

The existence of pockets or lenses of high-grade ore (electrum quartz) may be due, in part at least, to the process of crystallization. The electrum must be precipitated around those spots where centres of crystallization liberate the water. The noble metals may have been fairly uniformly distributed through the vein magma at the beginning of crystallization. As soon as crystallization commenced the metals would diffuse toward the centres of crystallization. Thus the electrum would form local masses in a vein quartz elsewhere nearly or wholly barren. After the precipitation of the electrum, the alkaline carbonates and sulphuretted hydrogen would escape from the crystallizing mass upward through the unsolidified portion (if any still existed) and outward into the adjoining rocks. These compounds would produce the secondary carbonates (calcite, ankerite, siderite) and sulphides (pyrite) which are found in the country rocks.

The process here outlined as a possible mode of origin of the electrum quartz of the National vein would have as consequences the crystallization of electrum with the earliest quartz formed, and the existence of cavities in the ore due to the escape of water and gases. As a matter of fact, a careful study of the ore makes it plain that the electrum crystallized with the first formed quartz which is finely granular, and is scanty or absent in the quartz of later crystallization, including that which lines vugs. Also, it is a fact that vugs are fairly abundant in the high-grade ore.

As a result of a study of the National vein, I have one other suggestion to offer in regard to the origin of the ore. Geologists and engineers often speculate regarding the origin of ore-shoots. As I interpret the National vein, it furnishes an excellent illustration of a paragenetic[13] ore-shoot due to a structural feature, but not a structure cited by Van Hise.[14] It is a 'shoot of variation'[15] not due to any chemical effect of wall rock nor to intersecting veins. The National vein strikes about north and south and dips about 50° to the west. Near the middle of the West Virginia claim the course changes, going southerly from nearly due south to south 25 to 30° east. The opening of the mine on different levels to a depth of about 500 ft. shows that this bend in the course of the vein pitches to the south so as to make an angle of perhaps 20° with the line of dip of the vein. Careful study of the striations on the walls of the vein has shown that the general direction of the faulting motion was nearly straight down the dip. Therefore, the direction of motion of the hanging wall makes an angle of about 20° with the pitch of the curve in the vein. It may readily be seen that the result of such conditions would be a tendency to relieve the pressure of the hanging wall, to produce less fault gouge, and to make an open space in the fissure north of the bend. Another result to be expected is a breaking of the hanging wall. All of these results are realized in the National vein. And it is in the open space thus produced that the ore-shoot of the mine is found. This shoot pitches in the same direction as the bend in the vein; it terminates to the south near the bend, and extends rather indefinitely to the north for a horizontal distance of about 400 ft. Since the pitch of the ore-shoot is not parallel with the direction of faulting motion along the vein as shown by striation, this shoot is not n harmony with Clayton's law[16] that such parallelism usually exists.

According to the United States Geological Survey, there was no production of cobalt, molybdenum, nickel, rutile, or tantalum in this country during 1911. The United States cobalt supply comes from Cobalt, in Canada, imports for last year being 579,520 lb., worth $48,104. Imports of molybdenum and ferro-molybdenum were 8.5 tons, valued at $11,409. All nickel used comes from Sudbury, in Canada, the imports being 29,829,268 lb., valued at $4,022,716. Ferro-titanium amounting to 51.17 tons, and worth $22,700, was imported for consumption. A considerable quantity of tantalum wire was imported from Germany in 1911, for making incandescent electric lamps, but the quantity and value is not published.

Production of gold in Russia during the last four years has increased over 50%, or from 22,275 poods to 35,084 poods per year, a pood (36.11 lb.) of gold being worth about $9000 according to the fineness.

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[8] Victor Lenher, *Econ Geol.*, IV, 1909, p. 562.

[9] P. DeClermont and J. Frommel, *Ann. Chim. Phys.*, 5th ser., Vol. 18, 1879, p. 189.

[10] C. Doelter, *Tsch. Min. Petr. Mitth.*, Vol. II, 1890, p. 319; G. A. Binder, *idem.*, Vol. 12, 1892, p. 332.

[11] Victor Lenher, unpublished manuscript, 1912.

[12] It is quite possible that the chemical reactions were more complicated and involved other substances, such as NaSH and KSH. It may be questioned, also, whether CO_2 alone would not destroy the alkaline sulphides.

[13] H. V. Winchell, *Econ. Geol.*, III, 1908, p. 425.

[14] C. R. Van Hise, *Trans.* Am. Inst. Min. Eng., XXX, 1900, p. 166.

[15] J. D. Irving, *Econ. Geol.*, III, 1908, p. 143.

[16] J. F. Kemp, 'Ore Deposits of the United States and Canada,' 1900, p. 49.

The Gitsham Process

This new variation of the cyanide process is attracting a good deal of attention in Australia. The *Journal* of the Chamber of Mines of Victoria, makes the following statement regarding it: A subject of interest to the mining community is the process of the Gitsham Gold Extraction Co. It is claimed for this process that it will extract gold from refractory materials where the cyanide process has wholly or partly failed. Antimony and copper ores are readily treated by the solvent, which is a weak solution of hydrocyanic acid. The company has treated at a profit about 4000 tons of material at Costerfield, Burke's Flat, and Clonbinane, which has been a stumbling block to many cyaniders. Experimental work on pyritic tailing from various parts of the Commonwealth has shown excellent results, a notable case being tailing from Randall's, Western Australia, which needs no comment. Unlike the cyanide solution, the Gitsham solvent is a weak acid, and it is claimed that owing to this fact material can be treated by leaching which otherwise would require agitation. The percentage of regeneration of the solutions, it is stated, is high, and averages from 40 to 50% of the chemicals used. The company claims that, given on ore partly amenable to the cyanide treatment, their process will give an increased extraction at a lower cost; and even on clean material the costs of chemicals are less, the only exception being on ores containing carbonates of lime, and so far this difficulty has not been overcome. As this type of material is very rare, it is not a serious matter. The control and testing of the solvent is soon learned by the man of average intelligence. The company has been doing experimental work for the past eighteen months, and is now open to the criticism of the metallurgical world.

The following supplementary details were given in a recent issue of the Kalgoorlie *Miner*: The process consists of the use of an acid solution formed by the combination of potassium cyanide and sulphuric acid, giving rise to hydrocyanic acid. Its strength varies from 0.05 to 0.1%, and is worked on the same system as ordinary cyanide. The solutions are allowed to percolate in the ordinary way, but before passing through the extractor box they are drawn off into a solution of limewater, which regenerates the cyanide and makes the solution ready for precipitation. Should the solutions be used in the weak state, a little cyanide is added at the head of the zinc-box and the solution brought up to about 0.08%. After passing over the zinc the solutions are again made acid and applied to the ore.

The following equations show what the inventor believes really takes place:

$$2KCN + H_2SO_4 = K_2SO_4 + 2HCN$$
$$4HCN + 2Au = 2HAu(CN)_2 + H_2$$

after the zinc-box:

$$Ca(CN)_2 + H_2SO_4 = CaSO_4 + 2HCN$$

or

$$2KCN + H_2SO_4 = K_2SO_4 + 2HCN$$

The metallurgist of the company claims that all copper ores, likewise antimony, bismuth, and arsenic, are insoluble, and do not affect the solution and its selective action for the precious metal. Even the most refractory copper carbonate, with mixed oxides, has been sucessfully experimented on. About four thousand tons of ore, containing antimony and copper, have been treated by this process for a yield of £1600 worth of bullion, of an average value exceeding £4 per ounce.

Although very delicate, the process is easily controlled by a chemist, the important feature being the combination point of KCN and H_2SO_4. Some ores have quite enough acidity to generate with the cyanide the acid. When the latter is in excess it is removed or neutralized. Where not present, the use of sulphuric is resorted to. The inventor (Mr. Gitsham) claims to be able to treat ores which have before not been amenable to the cyanide process. Costs are from 3 to 6s. per ton on the most refractory types. The process has been patented in the principal countries of the world, and the shareholders have decided to raise the additional capital necessary to introduce it in mining fields outside the Commonwealth. With this object in view, G. Gitsham and T. H. Davies are shortly leaving for London. As far as Australia is concerned, the company announces that they are prepared to deal with mine-owners on a royalty basis.

The suggestion recently made by W. D. Williamson in a communication to the *Journal* of the Chemical, Metallurgical & Mining Society of South Africa, is of interest in this connection. Mr. Williamson states that the addition of sulphuric acid to a solution containing the double cyanide of copper will cause the following reaction:

$$Cu_2(CN)_2 2KCN + H_2SO_4 = Cu_2(CN)_2 + K_2SO_4 + HCN$$

The insoluble copper cyanide can be separated by filtration, and the filtration neutralized by a slight excess of alkali. It is obvious, however, that there is still cyanogen in the copper precipitate which ought to be recovered if possible. If the precipitate be suspended in water, and treated with hydrogen sulphide, the following reaction occurs:

$$Cu_2(CN)_2 + H_2S = Cu_2S + 2HCN$$

The solution resulting from filtration of the mixture can then be neutralized with alkali and used as solvent for fresh ore. The two reactions can be combined by adding sodium sulphide and the requisite amount of acid to the cupriferous cyanide solution, with this reaction:

$$2KCN.Cu_2(CN)_2 + Na_2S + 2H_2SO_4 = Cu_2S + 4HCN + Na_2SO_4 + K_2SO_4$$

The precipitated copper cyanide carries down with it the precious metals and can be collected, dried, and shipped to the smelter. The clear liquor is then neutralized with a slight excess of alkali to combine with the free HCN.

An obvious drawback of both of these processes is that any attempt to neutralize an acid sulphate solution by the addition of milk of lime will cause the formation of a copious precipitate of $CaSO_4.2H_2O$, which occludes considerable quantities of cyanide and which is too fine grained to permit filtering and washing unless the solution is kept cold and allowed to stand several days during precipitation. Since the hydrate of calcium is only slightly soluble in water, being less soluble than the sulphate, any attempt to neutralize in this way would greatly dilute the cyanide solution. It might prove feasible, however, to use dried or ground slaked lime for neutralizing, drive off and collect the HCN gas, and allow the sulphate solution to run to waste, or to otherwise modify the process so as to reduce it to a better working basis. The article on the regeneration of cyanide solution by B. G. Nicholl in the *Mining and Scientific Press*, March 16, 1912, and its discussion by R. P. Wheelock in the issue of April 6, will be of interest in this connection, as will the description of the cyanidation of antimonial tailing in the Hillgrove district of New South Wales, given in our issue of June 29, 1912.

Only four states had a mineral output in 1911 valued at less than $1,000,000, and 10 states had a production valued at over $50,000,000 each. No state or district appears to have a monopoly of the mineral industry. Pennsylvania produced a total mineral yield more than one-fourth that of the whole United States, leads in coal, cement, and stone; Minnesota leads in iron ore; Arizona in copper; Ohio in clay products; California in petroleum and gold; Missouri in lead and zinc; and Nevada in silver. The centres of production are ever shifting.

An American company is being formed to develop a coal deposit on the Guasare river, in the Guajira peninsula, Venezuela. The coal has been pronounced equal to the best American steaming coal and practically free from sulphur, which is usually present in Venezuelan coal. The quantity of coal available seems to be enormous, but there may be some diffienlty in providing cheap transportation to deep water.

Construction of Triangulation Stations

By E. R. Rice

Having occasion recently to lay out a fairly extensive mine triangulation system, I designed the type of station here described, which for permanence, efficiency, and ease, and low cause of construction leaves little to be desired. In all, eighteen stations were put in, in two days time at a total cost of $24.50, subdivided as follows:

Labor, 2 men, 2 days, at $3	$12.00
¾-in. black pipe, 36 ft.	4.50
⅜-in. black pipe, 90 ft.	6.30
Portland cement, 150 lb. at $1.10	1.65
Paint	0.05
Total	$24.50

or a cost of $1.34 per station.

The principles of construction of the station are evident from Fig. 1. It consists essentially of a 2-ft. piece of ¾-in.

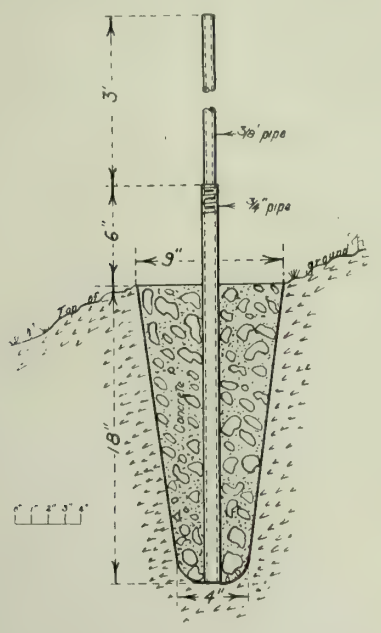


Fig. 1.

pipe, set 18 inches in the ground and imbedded in concrete. A piece of ⅜-in. pipe, 5 ft. long, is set in the ¾-in. pipe when observations are being made on the station, and, in fact, the ⅜-in. pipes are left in the stations as long as surveying is being carried on. These ⅜-in. pipes exactly fit the ¾-in. station pipes. If no surveying is to be done for any length of time, the ⅜-in. pipes should be taken out and regular ¾-in. caps screwed on the station pipes. These caps should be marked, by means of dies, with the number of the station and its elevation.

The 5-ft. lengths of ⅜-in. pipe are painted as follows: the bottom 2 ft. is painted black, the next 1 ft. white, the next black, and the next white. The black end is inserted in the station, and as the station pipe that projects above the cement is painted black, the lower edge of the first white division of the ⅜-in. pipe coincides with the top of the ¾-in. pipe and there results a signal composed of alternate black and white divisions, on which to make observations.

In putting in the stations, the most important point is to get the ¾-in. pipe vertical, so as to eliminate errors due to eccentricities of station. This is accomplished by means of the apparatus shown in Fig. 2. This is made of ⅜-in. pipe, T's and L's as shown. The end *C* is inserted in the ¾-in. station pipe, when the station pipe is ready to be concreted in the hole. There is a punch-mark on the top of the nipple *A*, and when the plumb-bob *B* is exactly over the punch-mark, the pipe *CD* is truly vertical.

The location for the punch-mark on the nipple *A*, Fig. 2, is best found as follows: a piece of ¾-in. pipe, 2 ft. long, is connected to two short nipples, *N* and *N'*, by means of two L's, as shown in Fig. 3, and the fittings screwed up tight. The nipple *N'* is then tightly clamped in a vise, and the 2-ft. pieces of pipe made approximately vertical by turning the L *E* on the nipple *N*, and the L *E'* on the nipple *N'*. The plumb-rod shown in Fig. 2 is then inserted in the 2-ft. length of ¾-in. pipe and rotated in it. If the bob *B* remains over the same point on the nipple *A* throughout a complete revolution, then the point directly under the bob is the location for the punch-mark. If the bob does not remain over the same point throughout a complete revolution, the L's are turned on the nipples *N* and *N'* until it does. The principle involved is the same as adjusting the plate-levels of a transit—'revolve 180° in azimuth and correct one-half of the error.' Fig. 1 shows an ideal station in which the hole is 9 in. across at the top, 4 in. at the bottom, and 18 in. deep. These holes are best dug by means of a piece of ⅞-in. drill steel, about 3½ ft. long, and sharpened to a point on one end and to a chisel edge on the other.

When putting in stations, cement, sand, and water can easily be carried about on a burro or horse, and the rock for the aggregate is usually close at hand. An ordinary old water pail is a good thing in which to mix the mortar. In

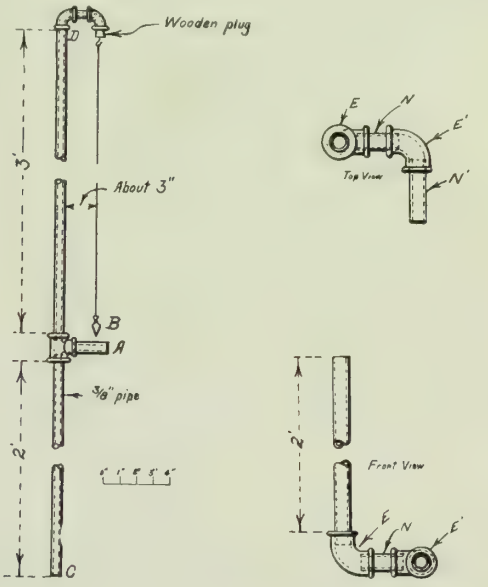


Fig. 2.

making the concrete for a station it is not best to try to mix the cement, sand and rock together, but to make the mortar separately and incorporate the rock in it while filling the hole. Of course, the concrete should be well rammed while being placed. In putting in a station, care should be taken to keep the ¾-in. station pipe vertical while the concrete is being placed. This is easy to do if the workmen do not get careless.

In setting up over the tringulation station, the plumb-bob of the transit is lowered into the ¾-in. station pipe until it has a clearance of about 1/16 in. all around. The ⅜-in. pipes that are inserted in the stations are sufficiently large enough for all ordinary triangulation work, as they can easily be seen for a mile with the average transit. If longer sights are to be taken, or if it is necessary to elevate the station signal so that it can be seen over obstacles, a ¾-in. coupling can be screwed on the station pipe and a ¾-in. pipe, 20 or 30 ft. high, stiffened by suitable guying, can be used. A pipe larger than ¾-in. can also be employed by means of suitable bushings.

American engineers are exploring the region surrounding Lake Maracaibo, Venezuela, for petroleum in behalf of an American concern. A Venezuelan citizen has also obtained a concession to develop the asphalt, petroleum, and mineral deposits of the Maracaibo and Bolivar districts, in the state of Zulia.

Mineral Resources of the Kenai Peninsula

By W. M. Brewer

The known gold-bearing area of the Kenai peninsula, north of Seward and tributary to the Alaska Northern railway, comprises a zone about 70 miles long north and south and nearly 30 miles in width at its widest point, along the south shore of Turnagain arm. The earliest discoveries were made about 1896 in the neighborhood of Hope and Sunrise, two settlements on Turnagain arm. These discoveries were placer gold, and a little later, in 1898, placer gold was also discovered on Cooper creek, which empties into the Kenai river a short distance below the foot of Kenai lake.

In 1905 the first gold-bearing quartz discoveries were made in the mountains bordering on Falls creek, near the 26-mile post on the Alaska Northern railway. The next discoveries were made in 1908 in the Moose Pass district, to the north of Kenai lake. Later discoveries were made adjacent to the town of Seward, where outcrops are exposed along the shore line a short distance south of the townsite. These discoveries were followed by others made near the 4-mile station on the Alaska Northern railway, also near the 7-mile station, 18-mile station, 21-mile station, the 29-mile station, and northwest from the 34-mile station. Gold-bearing quartz was also discovered in the vicinity of Hope and Sunrise, to the west of the 71-mile station, as well as on the north side of Turnagain arm, near the head of Glacier creek, and near Bird point.

The country rock throughout this area is slate and graywacke with many intrusive dikes, composed of a much-altered quartzose material which up to the present time has not been classified. The orebodies are found in fissures, many of which have their lines of strike crossing the bedding planes of the country rock nearly at right angles. These fissures are apparently deep seated. Other instances occur where the fissures cross the bedding planes at various angles from 10° to 35° or 40°, and in some cases the orebodies occur lying conformably with the stratification of the slates, resembling gash veins.

The high gold content is one of the most noticeable features of the quartz in this district. This is not confined to any one type of orebodies, but is the rule rather than the exception, especially at and near the surface. The underground development has not yet been sufficient to afford evidence for what may be expected in depth. In the Kenai Alaska Gold Co.'s property on Falls creek, on the 100-ft. level, the ore averages $60 per ton, while on the surface above practically the same result is obtained. These results are from the plates, mortar, and concentrate, and not from assay samples.

On the Primrose property, on Porcupine creek, which empties into an arm of Kenai lake opposite mile 18 on the Alaska Northern railway, ore taken from 70 ft. below the surface and up is reported to yield $50 or $60 per ton in a Little Giant mill. Mill-runs have also been made at the Skeen-Lechnor property on Falls creek with a 2-stamp triple-discharge Hendy mill which gave such satisfactory returns that a Milwaukee man who was visiting the district invested several thousand dollars in the property. Since then development work on a much larger scale has been started.

On Lost creek about 4 miles west from the 7-mile post on the Alaska Northern railway, a group of ten claims has been under development since September 1911, the capital being furnished by a syndicate of businessmen of Victoria, British Columbia. The underground development here totals 420 ft., while open-cuts and trenches totaling about 300 ft. have also been dug. Thirteen apparently distinct orebodies have so far been discovered, situated in a zone about 300 ft. wide and 7000 ft. long. The surface ores yield $20 to $500 per ton in free gold, while the underground workings indicate the probability of a lower content over a considerable width in the mineralized zone, through which the rocks are very much sheared. The property has somewhat similar characteristics to the very extensive shear-zones in southeastern Alaska, such as the Treadwell and Perseverance groups. A 2-stamp triple-discharge Hendy mill would have been in operation on this property early in September, but the construction was delayed by bad weather. No returns from mill runs can, therefore, be given at present, although it is hoped and expected, because of the favorable situation of the property, that operations can be carried on during the entire winter. The owners have every reason to hope for good results at an early date.

On the property near the 4-mile post on the Alaska Northern railway development work is in progress, and it is planned to send a shipment of ore to the Tacoma smelter at an early date. This ore is reported to have about the same content as the general average of the surface ores in the district. On the beach near Seward considerable development work has been done during the past year, and the owners report satisfactory results. This ore, as well as that near mile 4, is more refractory than the ores usually found on the Kenai peninsula. The width of the various orebodies that have so far been developed is found to vary considerably, but where the high-grade ore is found the orebodies are usually about 12 to 30 in. wide.

The placer operations that have been carried on during the past season have been confined to Cooper creek, the Kenai river below the foot of Kenai lake, and on various creeks in the vicinity of Hope. The operations on all of these have been either by dredging or hydraulicking, and the reported outputs satisfactory. The fact that the company operating the dredge on the Kenai river has purchased quite extensive holdings on Cooper creek indicates that the dredging operations on the Kenai river have been successful.

The new Act of Congress relative to placer mining in Alaska, as interpreted by lawyers, puts a new value on the association ground located and held prior to the passage of the act, and it is considered highly probable that capital seeking investments of this character will be more active during next season than ever in the history of Alaska.

In the Moose Pass district, situated about 15 miles west of mile 29 on the Alaska Northern railway, operations have not been very active, although several properties, notably the group owned by John Gilpatrick between Summit and Slate creeks, bear all the earmarks of considerable value. But heretofore transportation from the railroad has been very unsatisfactory, and the cost for freighting by pack-trains almost prohibitive when added to the excessive charges for freight on the Alaska Northern railway. The cost of freighting from the railroad should in the future be merely nominal, as the Alaska Road Commission this past year has completed a wagon-road over which, it is reported, heavy loads can be hauled with ease. John Gilpatrick has been operating on his property with an arrastre during the past summer and has been cleaning up fair returns, considering the crude methods employed.

Choking of Ore-Chutes

Choking in a chute underground is a frequent incident of work, and none of the methods commonly employed to start the ore running is completely satisfactory. A method satisfactorily employed at the Lord Nelson mine, in Victoria, Australia, was recently described by W. J. Nicol in the *Mining and Engineering Review*. A flexible pole of convenient length and cross-section is provided with a head made of pieces of hoop iron bent into a curve and nailed over the end of the pole. The curve of the hoop iron prevents the end of the pole from catching in the timbers of the chute. By connecting on successive lengths of pole this device can easily be thrust up a chute for long distances, and has been used to start a chute which had 'hung up' over 100 ft. above the level.

The Moore-Butters Decision

In an appeal from the Circuit Court of the United States for the district of New Jersey, before George Gray, Joseph Buffington, and J. B. McPherson, circuit judges, in the United States Circuit Court of Appeals, for the Third circuit, October term, Joseph Buffington, circuit judge, handed down the following opinion in the case of The Moore Filter Co. *v.* the Tonopah-Belmont Development Company.

In the court below, The Moore Filter Co., the owner of patent No. 764,486, granted July 5, 1904, to George Moore for a filtering process, filed a bill charging the Tonopah-Belmont Development Co. with infringement thereof. On final hearing, that court, in pursuance of an opinion, reported in 195 Fed. Rep. 530, dismissed the bill on the ground that infringement was not shown. Thereupon the complainant took this appeal.

As applied in the present case, the patent concerns the process of filtering metal-bearing slimes and is known as the Moore process. The respondent's filter is for the filtration of like slimes and embodies the Butters process. Both processes utilize the cyanide ore treatment and the question before us is two-fold: first, does Moore's process involve invention; and, second, does the respondent's Butters filter make use of the Moore process. The cyanide ore process came into use about 1887 and is the real foundation of the tremendous increase of gold production in the last two decades. It is now the prevalent method of treatment. In it the ore is first crushed and then placed in tanks containing a solution of cyanide of potassium. This solution percolates through the crushed pulverized mass, and being a solvent of gold carries off such gold as is subjected to its action. This is called leaching, and any crushed ore through which percolation took place was termed leachable. For example, if the ore treated was of such a character that when crushed it was reduced merely to the condition of sand, then the recovery of its metal by the cyanide solution might be effected by two methods. In the first method the cyanide solution would be poured on a bed of sandy crushed ore and be allowed to percolate through it. In its passage the solution dissolved the metal and passed off as a clear liquid to zinc-boxes, or other well known means of reclaiming metals in solution. This very simple method was called leaching. The second was decantation, wherein the crushed sandy material after having been agitated in the cyanide solution was permitted to settle, so that the clear liquid containing the dissolved metal might be decanted. Thus so long as the crushed grain was so sand-like as to permit leaching, or would settle quickly and completely enough to permit decantation, reasonably satisfactory results were reached by the cyanide process with rich ores, but even with these the treated ore thrown on the dumps often contained large in the aggregate, though small per ton, unleached metals. This was due to the fact that the solvent had not and could not penetrate the coarse ground particles. If, however, the ore was crushed finer to permit the more intimate action of the solution a pasty mass called 'slime' was formed which was unleachable. The result of this was that great quantities of treated ore went to the dump-heap, and while laboratory filtration methods showed the presence and indeed the extraction of such metals, yet no one devised any commercial means or process by which this metal-laden dumpage or slime would be avoided or utilized. As a value-containing but unavailable feature these dumps occupied a relation to gold and silver mines like that of a slag pile to a blast-furnace or a culm bank to an anthracite mine. The proofs show the acute recognition of this grievous waste and the vain efforts of a great industry to avoid it. Thus, in *The Engineering and Mining Journal*, under date of October 8, 1892, in an article on 'The Cyanide Process in South Africa,' by Charles Butters and another, it is said:

Another difficulty frequently encountered in the application of the cyanide process in the treatment of 'battery slime,' *i. e.*, the very finely divided material produced during the crushing, and which has a tendency to accumulate in pasty masses. These either resist the penetrating action of the cyanide or retain the dissolved gold during the leaching operation. No satisfactory method of breaking such material has yet been devised—the evil may be lessened by mixing the slimly tailing with clean coarse sand.

An editorial in the same journal, dated April 15, 1893, says:

After a certain amount of experience with any process, its weak points are seen and opportunities for improvements present themselves. To this rule the cyanide process is no exception. One of the great difficulties experienced in this process, or indeed in any lixiviation process, is the treatment of the slimes of an ore otherwise well suited to reduction by the method. They pack upon the filter, forming beds impermeable to the solution, and even if mixed with large quantities of coarser material are rarely attacked, *although laboratory experiments will show that their precious-metal contents are extremely soluble.* Of such material the Robinson Gold Mining Co., of South Africa, operating one of the largest cyanide plants on the Transvaal, has accumulated 60,000 tons, and the management has long despaired of treating it successfully, as the gold would not amalgamate nor would the cyanide permeate the mass if it were charged into vats. The average assay value was between $7 and $8 per ton, but the fineness, it is estimated, is such that it would pass a 225-mesh screen.

The same journal on August 11, 1894, contains an article on 'The Cyanide Process in the Transvaal Mines,' which says:

One of the great bugbears of the cyanide men on the Witwatersrand has been the treatment of slime, by which is meant the very fine, or in the case of free-milling ores the clayey portions of the tailing. Many suggestions have been made for the treatment of these, but the only really practical scheme so far appears to be to allow them to dry thoroughly and by screening or otherwise to reduce them to a fine powder. This powder is thoroughly mixed with sand tailing, and the mixtures will usually percolate fairly well.

In an editorial in the same journal, in speaking of the cyanide process, it is said:

Undoubtedly the process is well adapted to certain ores, but these appear to exist in but few localities and we have yet to learn how to extend the use of the process to more common material.

In an article on that process contributed by Virgoe to the same journal in 1894, he says:

Filter presses have been tried in South Africa, but without satisfactory results owing to their cost and the power required to work them. No mechanical means have yet been devised for the satisfactory separation of pulp and solution in the case of poor leaching ores. Such an invention would revolutionize the metallurgical world as far as the wet reduction of ore is concerned.

Commenting on this article a correspondent in September 1894, wrote the *Journal*:

Regarding the leaching properties of the ore or tailing to be treated, I am quite in accord with Mr. Virgoe, for badly percolating material (such as battery slime) is quite the greatest bugbear of the cyanide man.

The following year (1895) Charles Butters, writing to the *Journal*, said:

The treatment of slime is a question of importance, as at present there are many hundreds of thousands of tons of unleachable material lying useless on the hands of the various companies on the Witwatersrand.

And not only was the problem recognized and the need felt, but the agitation of it continued for years. In 1898, the same journal, after discussing the various efforts in the Transvaal to treat rejected slime, says:

Speaking generally, about 75% of the tailing from the Witwatersrand mills has been treated by cyanide in the usual practice, leaving about 25% to go into the slime-pit. There is therefore a large accumulation of this slime, besides that which comes from current working. What pro-

portion of the old heaps can be treated at a profit is yet to be ascertained; but it seems possible that an appreciable addition to the gold output may come from this source hereafter.

In the same year, referring to the Australian mines, the *Journal* says:

A great number of experiments are at present being conducted on the Kalgoorlie ores. Nearly all known processes, and several never before heard of, have their advocates. Of course some valuable knowledge will be gained by all this experimenting, and just as surely a great deal of very expensive machinery will in a short time be consigned to the scrap pile.* * *

As yet the finer slime has not been successfully treated on a large scale, but some of the ingenious adaptations of the agitation or filter-press processes, now in the experimental stage, will undoubtedly solve the problem.

Indeed the whole matter was summed up four years later when in an article in the *Journal* of July 1902, on 'A New Treatment of the Slime Problem in Cyaniding Talcose Ores,' a writer, Stackpole, says:

Any metallurgist can appreciate the obstinacy of these sticky masses of mud, which, no matter how treated, would take almost a prohibitive length of time to percolate. Although experiments show that over 90% of the values in the clay is soluble, the ordinary methods only permit an extraction of 50 per cent.

The first suggestion for the solution of this world-wide problem is found in the *Journal* of December 5, 1903, being a communication from George Moore, wherein he described the process for which the patent in suit was issued to him the year following.

We deem a quotation from that article proper at this point not only as being in the line of historical sequence of the art, but for the further reason that our conclusion that Moore fully realized the scope of his invention and disclosed the same in his specification, is fortified by the fact that he had explained and disclosed it fully to the engineering world a year before his patent issued. In his article, after describing his process as installed at a certain mine and asserting that the advantages of his process were: "First, a saving of from 40 to 60c. per ton in labor; second, a saving of a like amount in extraction; third, a saving of over 50% in the cost of installation," he says:

The saving on extraction is due to the fact that, while *the filter is in the slime-tank, and the suction in operation*, an equalizing action is taking place, rendering all parts of the cake of equal resistance to the flow of solution and wash-water, so that, when placed in the washing tanks, a perfect displacement of solutions is accomplished. For example, we might consider that it would be possible for one spot on the 2880 sq. ft. of slime cake to have more of the coarser slime or fine sand than the other parts; then there would be less resistance to the flow at this point; therefore, the flow would be accelerated here, the slime would be brought up, and would cover this point more rapidly than the other parts until, by this increased coating, the resistance to the flow would become the same as at all other points. Thus, when lifted out from the slime compartment, the entire basket of filter is in condition for washing, and in practice, we extract all of the soluble gold.

After a careful study of Moore's patent, we have reached the conclusion that his process is a radical departure from the whole prior art and was an original and pioneer step in metal recovery by filtration. Like all important inventions its merit is its simplicity, and its novelty consists in his utilizing the simple elemental processes of nature. These processes he has, of course, neither discovered nor invented, but he has utilized them in combination in a manner never before used and has thereby secured a new result.

Briefly stated, the gist of Moore's instruction to the mining world was to filter an unleachable mass in such a manner as to cake the pasty slime so uniformly and evenly that the resistance of the slimy mass to percolation became uniform and even in every part of the cake. The result of such uniform and even cake-resistance was that when the cake was attacked by the percolating solvent its percolation was correspondingly uniform, and diffusive through the uniformly resisting cake. The solvent having by this uniform and even resistance been itself uniformly and evenly percolated through the mass, it followed that when this percolated solvent was in turn subjected to a propulsive washing current, that such propulsive current, finding no path of least resistance in the uniformly-resisting cake or the uniformly-percolated solvent, moved forward uniformly and evenly to expel such uniformly distributed percolated solvent. The creation of this uniform and even resistance in the cake is the gist of Moore's process, and such uniformity, as we shall see, is secured by the slime being submerged when subjected to suction. The crux of Moore's process cannot be better or more tersely summarized than in his own words quoted above:

The saving on extraction is due to the fact that while the filter is in the slime-tank, and that means submergence, and the suction in operation, an equalizing action is taking place, rendering all parts of the cake of equal resistance to the flow of solution and wash-water, so that, when placed in the washing tanks, a perfect displacement of solutions is accomplished. For example, we might consider that it would be possible for one spot on the 2880 sq. ft. of slime cake to have more of the coarser slime or fine sand, than the other parts; then there would be less resistance to the flow at this point; therefore, the flow would be accelerated here, the slime would be brought up, and would cover this point more rapidly than the other parts until, by this increased coating, the resistance to the flow would become the same as at all other points. Thus, when lifted out from the slime compartment, the entire basket of filters is in condition for washing, and, in practice, we extract all of the soluble gold.

And this is only stating in other words what he set forth in his specification. Referring to the accompanying drawing the specification states:

In carrying out the process with the means disclosed in the accompanying drawings adapted particularly for use in connection with the slimes of precious metals, I introduce a solution to be filtered into a suitable tank, 1, in which I place a filtering device or means, 2, in the present instance made up of a series of filter-plates communicating with a common discharge tube, 3. A flexible or other suitable tube, 4, connects the tube 3 with any preferred form of hydraulic pump 5, and compressed-air pump 5a, and the filtering means 2 is permitted to remain within the tank 1 until the solid matter within the liquid being filtered has coated the walls of the filtering device to the desired thickness, say, for example, about ¾ in. or more in most cases, but varying somewhat with the character of the slime which is being handled; and then the same is lifted as by pulley-and-cable mechanisms 6, out of and away from the tank, and the pump 5 stopped and pump 5a operated so as to apply air-pressure to the back of the canvas or to pass a current of air or cleansing current in an opposite direction to the movement of the liquid in the prior step, whereby the solid matter collected by the filtering device 2 will be discharged therefrom.

Applying this description to the illustration, it will be seen that the filter-leaves are completely submerged in a tank filled with fluid slime, and suction is then applied to the interior of the leaves. Applying suction to a filter completely submerged is to form an enveloping case or cake of a pasty nature in the filter. As the cake builds up it develops a thickness and compactness which gives the entire cake a capacity of uniform resistance to percolation. For so long as the resistance is not uniform the consequent increased rate of deposit at that point would set up and continue until the rate of flow there became equal to the rate of flow at all other points. The significance of this uniform resistance capacity of the cake, and that it was obtained by filter submergence, is stated in the specification where the patentee, in order to show that after the filtering process is completed an entire enveloping cake of uniform resistance capacity can be simultaneously discharged by compressed air, says that such action is owing to the process having produced an enveloping cake of uniform and even resistance capacity. His language is:

In order to effectively discharge the encrusted slime from the filter by the agency of compressed air, it is important that the slime be in the form of a compact layer of requisite resistance and of sufficient thickness, because otherwise when the air-pressure is applied portions only of the slime are blown off, thereby relieving or reducing the air-pressure and rendering it ineffective for the removal of the slime which remains and necessitating the use of other means—such as scrapers, brushes, and washing—for the complete

cleaning of the filter surface. This difficulty is wholly overcome in my process by immersing the filter into the tank containing the slime in suspension and depositing it in the manner described, the effect of which is to automatically deposit the slime in a homogeneous layer, as will be readily understood. Hence, when the slime has been thus deposited to the requisite thickness the compressed air does not blow holes in the layer of slime and only partly clean the filter, but it strips off the entire layer of slime and effectively cleans the filter without the use of auxiliary cleansing mechanism.

Indeed of the fact that the result of subjecting a submerged filter to suction is an enveloping cake of uniform and even resistance, there can be no doubt under the proofs in the case. To question it is to dispute the operation of the laws of nature. In his 'Cyaniding Gold and Silver Ores' (edition of 1907), H. F. Julian, who was called as an expert by respondent, and nowhere questions his prior statement, in describing the advantages of submerged-leaf filters subjected to interior suction, says:

One of the chief characteristics of this class of filters is that during the formation of the cake, if the resistance to percolation should vary at any point over the filter surface, an adjustment immediately sets in, owing to the parts of greatest permeability taking on the deposit quickest. This increases the resistance at those points until it brings the rate of percolation equal all over the cake. Washing out the dissolved metals is then done uniformly.

And in his testimony C. F. Chandler, the distinguished scientist and expert for respondent, says:

Uniformity of resistance of the cake is the natural result of the laws of filtration. Increasing thickness of cake at any one point greatly reduces rapidity of filtration at that point and thus equalizes the thickness of the cake. When the thickness of the cake reaches a point at which filtration becomes very slow, the continuance of filtration at one part a little longer than at another part will not make any material difference in thickness; even doubling the time of filtration would have little effect if filtration is carried to the point of nearly maximum thickness and resistance, a condition which the Moore patent seems to indicate is desirable.

In view of these well understood natural laws of filtration and of the subject matter of the specification and the application of the process as illustrated by description and drawings, there can be no question that, to those skilled in the art, the cake of uniform and even resistance produced by Moore's process is aptly described by him in his specification as "immersing the filter into the tank containing the slime in suspension and depositing it in the manner described, the effect of which is to automatically deposit the slime in a homogeneous layer, as will be readily understood."

The specification in the language following:

However, this cleaning step of the process need not be taken until an intermediate auxiliary step has been performed, which consists in introducing the element 2, after having been coated with the solids, into a tank 7 of water, the drawing or sucking operation of pump 5 being continued while the element 2 is being subjected to the said water-bath. When this step is employed, the next succeeding is the operation just described. It will be obvious that the water bath may be employed or not, as described, the same being preferable when the filter is used for filtering precious ores, the said step tending to wash out the remaining metal held in solution or solvent thereof within the solids coating the filtering device.

discloses an optional additional step in the process, which step is made an element in the claims herein in controversy. The proofs show that in this step important results are obtained in that substantial quantities of the gold-carrying cyanide solution still remaining in the cake are recovered and that this recovery is due to the uniform and even resistance capacity conferred on the cake by the disclosed process.

It is contended, however, that the Moore platent is invalid by reason of the disclosures of the prior art. But in our view this contention is based on a failure to recognize the true significance of what Moore really did. Practically his problem was to make commercially possible the recovery of a minute amount of valuable metal from a large quantity of mud. Of the fact of the metal being there, there was no doubt, for that fact, and indeed that it was possible to extract it, the tedious and costly method of laboratory filtration showed. It suffices to say that no one of the numerous patents cited did such work, used such process, or effected such results, and if none of them led their inventors or users to the use of any process whereby such work could be done, or even led to a suggestion in their descriptive matter of the possibility of the use of any such process as Moore's, it follows they taught Moore no more than others. So far as the patent here in question is involved, Moore's disclosure was the process he originated and not the machine with which he illustrated the use of his process in accordance with the statutory requirements that he file a written description "of the manner and process * * * of using it." To find, therefore, here and there in prior patents, and disassociated from each other, all the mechanical appliances of the combination apparatus which Moore thus illustratively used is not to prove that Moore's process is not original.

Viewed from a patent standpoint, the significance of a machine lies not in its form but in the principle on which it works, as will be seen in the requirements of 4888, "in the case of a machine, he shall explain the principal thereof." It suffices therefore to say that very few of these patents are even for a process, and as none of them operated on the principle or process of Moore, they cannot be held to forestall or minimize the originality of Moore's subsequent disclosure. And in giving these patents their due relation to Moore's disclosure the fact must not be overlooked that the slime problem which Moore solved only came into existence from the use of the cyanide process, which began, as we have seen, about 1887. It will therefore be manifest that no patents preceding that date and none subsequent thereto which did not apply to the cyanide process, were calculated to solve the cyanide percolating difficulties, that arose in the use of that process. So also, to say that following prior laboratory practice, it was possible to leach and extract the unrecovered ore left in a pasty mass by the cyanide process is not to destroy Moore's patent; for this is to lose sight of the practical working value of Moore's process as a workable economic treatment, as compared with theoretical possibility of laboratory practice. By repeated dilution the laboratory could and, we will assume, did recover with practical completeness all such unrecovered metal, but this has been done with an expenditure of time, labor, and expense out of all proportion to the value of the metal. When therefore Moore disclosed a process by which such recovery was made enormously profitable and by which he turned a dump heap which under all known processes, machines, and laboratory methods was worthless into profitable ore, we are constrained to give little weight to the suggestion that his process was either anticipated, a mere advance incident to the art, or involved no invention.

So, also, it is said that the step described in his claim, viz.: "further impoverishing the solids by a cleansing operation," was merely the washing or dilution of the prior art. Considered in its literalism and in isolation, such contention may seem plausible, but considered as a step in Moore's process it takes on new significance and value. Bearing in mind that in the prior steps of the process covered by this claim, the completely submerged filtering medium has formed a cake of uniform resistance at all points and by reason of such uniformity the solvent has percolated and is permeating the cake, it follows that the step which follows is a non-diluting and bodily displacement of the solvent and not a diluting intermingling. This displacement in contrast with dilution, not only saves the time and expense of repeated dilution and refilling, but also obviates excessive dilution of the solvent solution and the necessity of rehandling large volumes of diluted solutions in the recovery of the metal. It seems, therefore, that the "further impoverishing the solids by a cleansing operation" of Moore's process, owing to the prior step whereby a cake of even and uniform resistance is secured by submergence, is not a mere washing or diluting step, but is one wherein there is exerted a uniform pressure or pushing action

through the entire cake surface, thereby in effect advancing a wall of water pressure to force ahead of it from the cake the value-bearing solvent liquid and leave in the cake an equal volume of non-value-bearing water. This final result is secured by first having built up a cake of uniform resistance to solvent fluid flow, and, secondly, by again submerging the filtering medium and its built-up cake in the non-value-bearing displacing fluid. By this displacement by pressure difference only Moore pushes ahead instead of washes through the cake a contained-metal-carrying fluid. As showing the practically complete metal extraction by the Moore process, we restrict ourselves to the uncontradicted testimony of results at a South Dakota mine, where the original slime contained gold at the rate of $7.90 per ton of dry slime. After filtration alone the cake still contained $2.75 per ton of dry slime. After being then subjected to the displacement step there was left in the cake but 4c. of gold per ton of dry slime.

Being of opinion, therefore, that Moore's process was novel, useful, and inventive in character, his patent is valid, and we next turn to the question of infringement.

As claims 4 and 5 furnish sufficient basis for deciding that question, so far as the respondent's device is concerned, and as some questions, not necessary to be here decided, exist as to claim 10, we restrict ourselves to a consideration of claims 4 and 5. In considering the question of the infringement of a process patent, it must be borne in mind that the monopoly secured by the claims is, generally speaking, a monopoly of the process, and the test of infringement is whether such process is utilized by the infringer. As the apparatus shown in a process patent is only to show that the process may be practically applied, it follows that such illustrative apparatus does not limit the process patentee to that type of machine alone. If that were the case a process patent would be of little value. So distinctive and separate in the patent law are process and apparatus for utilizing such process that where, after a patent for a process by one inventor a second inventor might patent a novel apparatus for utilizing the process, the situation would arise that the inventor of the process could not employ his process in such machine without license from the machine patentee and the latter could not use the process in his machine without license from the process patentee. It will therefore be evident that the test of process infringement is not the similarity of apparatus, but rather whether the apparatus, no matter what its form, utilizes the process. Tested by this standard, it is clear to us the respondent's device infringes. In form the particular apparatus shown in Moore's patent and the apparatus of respondent vary in the number of tanks, in the differences between changing the fluid which envelops the filtering medium, as in respondent's device by allowing the filtering medium to remain stationary in one tank while the submerging fluid is first drawn off and the second submerging bath is then drawn into the same tank, while in Moore's the filtering medium is raised from the submerging bath in the first tank and then lowered into the second submerging bath in a second tank. But this difference in numbers of tanks and of respective withdrawal and replacing of different baths in no way affects the identity of the process, for it is manifest that Moore could in his patent specification have shown the use of his process, just as well by using respondent's apparatus, had he known of it, as his own. Both alike use the principle of submergence and intra-leaf suction to create the uniform and even resistance of the cake and both alike use the principle of intra-leaf pressure, Moore using air and the respondent water, to shed the uniformly resisting cake from the filter. For the mere fact of the output being carried off as a dry product in Moore's case to a dump heap and in respondent's in fluid form to a slime pit, does not go to the substance of the process. In the essentials that involve the invention the two are alike. Had an apparatus such as respondent's, been in use prior to Moore's there would have been no invention either in the process or in the apparatus shown in Moore's patent. And what, if preceding a patent, would have anticipated it, equally infringes if subsequent. We therefore hold the fourth claim is infringed.

As we are of opinion and so find from the proofs that there is in respondent's device a "removing the medium while continuing the drawing action," the fifth claim is also infringed.

The decree of the court below is therefore reversed and the cause remitted with instruction to enter a decree adjudging claims 4 and 5 valid and infringed and for such action by that court in the way of injunction and accounting as it shall deem fitting.

Low-Grade Ore Treatment at Kalgoorlie

Some remarkable work is being done at Kalgoorlie among the low-grade mines, situated mostly about three miles from the 'Golden Mile,' and the following details of the August output of the Golden Dream mine will be of interest. Mining is both in open-cuts and underground, at about 150-ft. depth; hoisting is by friction hoist driven by motor; small jaw-crushers are used; the Huntington mill is driven by gas-engine, as is also other machinery. The sand is cyanided in small vats of about 30-ton capacity, and the slime is stored in ponds for future treatment.

Treated during August, tons	1602
Yield from amalgamation and cyanide plant	$2810
Yield per ton	1.76
Cost:	Per ton.
Water	$0.25
Electric power and lighting	0.04
Suction-gas power	0.05
Cyanide treatment	0.10
Wages	0.98
Manager and secretary	0.05
Bullion charges	0.03
Stores and sundries	0.17
Total cost per ton	$1.67
Less Government subsidy for low-grade mines	0.10
Net cost per ton	$1.57
Profit per ton	0.19

Manganese Production in Russia

The renewed activity of the iron industry in Russia, especially noticeable in the southern districts, has exercised a favorable influence on the production of manganese ore, which is principally found in the South Russian district of Nikopol. During the first half of this year the aggregate production of manganese ore in Russia, according to the *Kolnische Zeitung,* amounted to 6,724,000 poods, an advance of 1,642,000 poods, or 32.3% as compared with the corresponding period of 1911. The annual output of the Nikopol manganese mines is estimated at 17,500,000 poods. For the first six months of this year 7,288,500 poods, or 1,878,000 poods more than in the corresponding period of 1911, were shipped, of which quantity 1,564,660 poods—being, however, 390,200 poods less than last year—were destined for abroad. Taking the first eight months of the current year, the export of manganese ore from the Caucasus amounted to 38,669,416 poods, as against 30,880,990 poods for the corresponding period of 1911 and 33,909,685 poods in the course of the first eight months of 1910. The principal export countries are Great Britain, Belgium, Holland (for Germany), America, Germany, Austria-Hungary, and France. During the first half of the present year the rates for manganese ore were well maintained, the first reduction being registered in the month of July, when the average price for the first half-year of 6 to 7 kopeks, as against 4½ to 5½ kopeks for the corresponding period of 1911, and 5 to 6 kopeks two years ago, was reduced to 5½ to 6 kopeks.

Nome Customs Report

The followng statement of commercial business at the port of Nome during the navigation season of 1912 was made public by R. W. J. Reed, deputy collector, October 31.

Arrivals of vessels:	
From United States ports	36
From foreign ports	29
Passengers arrived:	
From States at Nome	1,603
From St. Michael	440
General merchandise received, tons	26,231
Coal received:	
Domestic, tons	1,978
Foreign, tons	14,427
Total coal received, tons	16,405
Lumber received, feet b.m.	1,747,775
Live stock received, head	125
Sailings of vessels:	
For United States ports	30
For foreign ports	32
Passengers outward:	
Ocean vessels, from Nome	1,913
Ocean vessels, from St. Michael	1,452
General merchandise shipped, tons	704
Placer tin shipped, tons	129
Placer tin mined in this vicinity, tons	173

Gold dust and bullion shipped:

	Ounces.	Value.
Custom House	144,981.31	$2,656,661.94
Post Office	15,098.38	274,816.32
Totals	160,079.69	$2,931,478.26

It is estimated by engineers in the district that the total gold output for the season will probably be increased $100,000 by dredges operating in November.

A Convenient Telescoping Burner

By Fritz Friedrichs

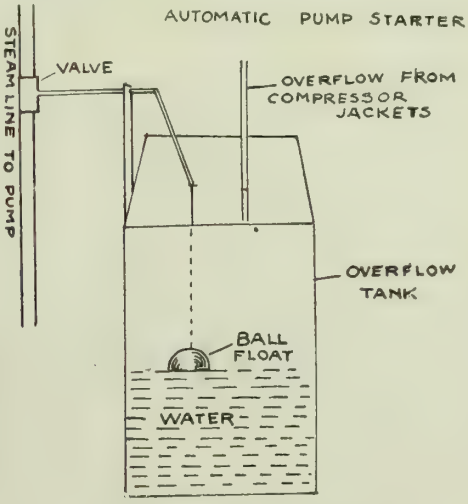
In regulating the supply of heat to an apparatus by means of a gas burner, two methods may be employed, either the height of the flame may be changed by opening or closing the gas and air supply, or the distance between apparatus and burner may be suitably adjusted. The first of these methods is applicable only within narrow limits, because of the striking back of the burner. Recourse is therefore had in general to the method of regulating the distance of the burner from the apparatus by the use of wooden blocks or of some other support for the burner, since the raising or lowering of the entire apparatus is usually difficult, if not impossible. One burner of adjustable height has been recently constructed, in which metal tubes of different length are screwed to the base of the burner. This method possesses the disadvantage (1) that the burner may be adjusted only to the heights corresponding to the length of the tubes, and (2) that a change of the adjustment is not possible without shutting off the flame.

TELESCOPING BURNER.

These disadvantages may be most satisfactorily avoided by telescoping the tube of the burner as shown in the accompanying sketch. By means of this apparatus it is possible to regulate the height of the burner from the usual size up to 25 cm. with a single, or up to 30 cm. with a double telescope tube. In the great majority of cases the single or the double telescope tube will suffice. There is, however, theoretically, at least, no limit to the number of tubes used. Since the end of the uppermost tube is tapered to the original diameter of the burner, there is no danger of the flame striking back.—*Jour. Amer. Chem. Society.*

Automatic Pump Starter

A simple arrangement is used at the Giroux Consolidated Mines Co., at Kimberly, Nevada, for automatically governing the steam-driven pump which forces the water from the compressor overflow tank for cooling water to a cooler and storage-tank situated on the hill above the works. This operation allows the water to be used over and over again. A small tank near the compressor receives the cooling-water from the jackets. A hollow metal ball floats on the water in the tank and is attached by rod and lever connections to the valve in the inlet steam line to the pump. As the water rises in the tank the steam is gradually turned on and operates the pump. As the water recedes in the tank the steam is shut off and the pump is stopped.



AUTOMATIC PUMP STARTER.

Taranaki, New Zealand, has been noted for many years for the large quantities of black sand, consisting largely of magnetite, on its beaches. Like the oil industry, there have been many attempts to treat this mineral, but with little success. The sand contains from 56 to 70% of metallic iron, titanium 1.5 to 9%, and low percentages of sulphur and phosphorus. A blast-furnace worked satisfactorily near Auckland for a time in 1892, but repeated efforts since have not been marked by success. Briquetting has been tried, producing a fair quality of iron. The whole question must be systematically investigated before capital can be interested.

Discussion

Readers of the MINING AND SCIENTIFIC PRESS are invited to use this department for the discussion of technical and other matters pertaining to mining and metallurgy. The Editor welcomes the expression of views contrary to his own, believing that careful criticism is more valuable than casual compliment. Insertion of any contribution is determined by its probable interest to the readers of this journal.

Persistence of Ore in Depth

The Editor:

Sir—In T. A. Rickard's article, 'Persistence of Ore in Dept,' appearing in your issue of August 31, there is an error, the vertical depth of the Ooregum mine, Kolar goldfield, being given as 2420 ft. The vertical depth of the present deepest level in this mine is 4240 ft. below the surface.

T. PRYOR.

Oorgaum, India, October 9.

Mexican Conditions

The Editor:

Sir—Not long since at the annual meeting of a company operating one of the large dividend-paying mines of Mexico, the manager stated that conditions generally were worse than at any previous time, the reasons being the general apathy and the sympathy between the Federal and rebel soldiers. His company had been 'held up' for $50,000. He said, further, that there was a mutual understanding between the English, German, and French companies operating in Mexico, that they would compile in authentic shape all claims for damage, robbery, and murder committed by both Federals and rebels, and would demand payment from the United States Government, because, in accordance with the Monroe Doctrine, the United States Government had not permitted those countries to interfere. If such claims be taken before The Hague tribunal, we seem likely to have to pay them.

When one considers that in every English, German, or French colony in the world life and property of foreigners is safe, that under the Monroe Doctrine the United States will not allow foreign interference by any European government on the Western hemisphere, that most of them has suffered frequently from revolutions, while our Government has done little or nothing to safeguard the peace, is it to be wondered that other nations demand that we foot the bills? The Monroe Doctrine has only retarded the development of the whole of Central and South America. Is it not time that we get off the fence, pursue an active course, and make all of the Western hemisphere safe and secure for everyone to transact business and live in safety, wherever one likes?

G. L. SHELDON.

Ely, Nevada, November 4.

Utilization of Power

The Editor:

Sir—In the editorial on utilization of power in your issue of November 9, it is said that the cost of construction and the difficulties of operation of the gas-producer upon a small scale render it unavailable for plants of small or moderate size, though highly efficient in large installations. This hardly states the case quite correctly, because the maximum limit is very soon reached. The largest producer plant in the world is in this city, and is a failure solely on account of its size. I have been advised by leading makers of producer-gas engines that 1000 hp. is as large as is practicable to use. The destructive effect of suddenly applied strains is well known, as seen in the water-hammer jar caused by quickly closed valves, and each stroke of the gas-engine is the result of an explosion.

Steam-turbine electric generators of more than 5000 hp. are quite common, and are required for the economical operation of power-plants. In the article on 'Power at the Waihi Mine' the comparative cost of water-power must not be taken literally, as the rate stated would just about pay the wages of a single attendant, although it might perhaps be claimed that such a water-wheel needs no attendant. Hydro-electric plants generally need steam or gas auxiliary generators to tide over peak loads. These have the advantage of not using fuel when the power is not needed, while the water that is not used at once is generally lost, so that in some cases it has even been found better to revert entirely to the fuel generator.

R. B. SYMINGTON.

San Francisco, November 15.

[The cost of water-power at Waihi is so astonishingly low that it will be worth while to give the detailed figures from a report of the company, December 31, 1911.

COST OF DEVELOPING 558 BRAKE-HORSE-POWER, WAIHI

	£	s.	d.
Wages	433	6	11
Oil and lubricants	19	10	6
General supplies	66	3	5
Foundry	10	9	3
Total cost for year	529	10	1

This is at the rate of $4.56 per horse-power-year, as given by Mr. von Bernewitz. This does not include maintenance of ditches, flumes, and dams, however, this item being grouped with other repairs to plant, buildings, and machinery in the 'revenue account,' characteristic of English methods of book-keeping. Neither does it include interest and depreciation, which are also given separately. These considerations equally apply to the costs given for steam and gas-engine power, all three appear slightly lower than they actually are in fact.—EDITOR.]

Ore Reserve and Life Extension

The Editor:

Sir—I have read the article entitled 'Ore Reserves and Life Extension,' by Morton Webber, published in the *Mining and Scientific Press* of October 19. To the first part of this article no exception can be made, as it is apparently original. The latter part, however, commencing near the bottom of page 494, is for the most part a direct copy, with some slight alterations in the wording, of extracts from the best chapters in H. C. Hoovers' 'Principles of Mining.' Read on this page the five geological heads under which life extension should be considered and compare them with the five factors in 'Principles of Mining,' page 23. Also on page 27 of 'Principles of Mining,' the second paragraph states: "No engineer is properly equipped to give judgment on extension in depth without a thorough grasp of the great prinples laid down by Van Hise, Emmons, Lindgren, Weed, and others." Mr. Webber in his article, in which no reference is made to Mr. Hoover's book, writes in the paragraph preceding the five geologic heads: "They are so important that no valuing engineer is properly equipped to deliver judgment on the life extension of a mine without a thorough grasp of the underlying principles laid down by Lindgren, Emmons, and Van Hise."

The rest of the article is mainly a somewhat embellished and decorated rehash of Hoover's best points, with Hoover's style poorly disguised, and in some places not disguised at all, which anyone can see by reading carefully chapters III, IV, V, and VI, in 'Principles of Mining' and then reading Mr. Webber's article. I will make one more quotation from Hoover's book, which states at the end of chapter VI, in the general summary, that "The wise engineer will put before his clients the scale, the weights, and the conclusions arrived at. The shrewd investor will require to know these of his adviser." Mr. Webber closes his article by saying: "The able engineer who has profited by experience will place these facts unreservedly before his employer. The serious minded operator will require them of his engineer."

I think it only right that this should be brought to the

attention of your readers, as I know it is not the custom of your paper to publish such flagrant plagiarism from a well known book with no reference made to either the book or author.

D. C. LIVINGSTON.

Moscow, Idaho, October 24.

The Editor:

Sir—I have read the letter of D. C. Livingston relating to my article, 'Ore Reserves and Life Extension.' Some four years ago I was managing a mine in Central America with no other companions but the millman, a mine accountant, and H. C. Hoover's book. The latter I read from beginning to end several times. I have not seen it since, although I am perfectly willing to concede that much of the more important chapters were firmly impressed in my memory. I am also glad to say that the principles gathered therein have helped me in applying my college training to practical ends.

I have since read much of the works of Lindgren, Emmons, and Van Hise, and it is to these writers that I am largely indebted in the more geological part of my article, and not to Mr. Hoover, who is just as much indebted to them as I. I have borrowed Mr. Hoover's book and quote from the preface:

"The bulk of the material presented is the common heritage of the profession, and if anyone may think there is insufficient reference to previous writers, let him endeavor to find to whom the origin of our methods should be credited. The science has grown by small contributions of experience since, or before, those unnamed Egyptian engineers, whose works prove their knowledge of many fundamentals of mine engineering, six thousand eight hundred years ago. If I have contributed one sentence to the accumulated knowledge of a thousand generations of engineers, or have thrown one new ray of light on the work, I shall have done my share. I therefore must acknowledge my obligation to all those who have gone before. * * *"
This expresses my own feelings exactly.

Regarding the similarity in phraseology, I have to say that there are similar likenesses between some parts of my article and the recent contribution by T. A. Rickard, 'Persistence of Ore in Depth,' and the discussion thereupon. My article was submitted for publication last August, before Mr. Rickard's contribution appeared in print. As Mr. Livingston appears to have a fair amount of time on his hands, he might use up some of his energy along the lines of finding some connection here. I also wrote an article for the *Mining and Scientific Press* entitled 'Conservation of Capital in Gold Mines,' to which you referred editorially, as I remember it, as "novel and original." Here is another field for Mr. Livingston. After that he can again apply himself to connecting up an article by me entitled 'Unavoidable Errors in Mine Sampling'; for Mr. Hoover has written something on that subject also.

I am at the present time working on an article on economic speed in the removal of orebodies. Mr. Hoover has written something similar in his book. Does Mr. Livingston therefore maintain that where my conclusions agree wth those of Mr. Hoover, I must accord all honor to him or choose another subject? In 'Ore Reserves and Life Extension' I referred to the change in the nature of ore with depth in certain mines. I quoted the Mount Morgan gold mine, Queensland, and also referred to the changes in depth at Butte and Leadville. On referring to page 26 of Mr. Hoover's book I find that he has mentioned identical examples. It would appear from Mr. Livingston's reasoning that I have again been encroaching on Mr. Hoover's preserves.

It is interesting in this connection to quote two extracts from my article 'Ore Reserves and Life Extension' and two extracts from a contribution by H. C. Hoover to *The Mining Magazine* of London entitled 'Mine Valuation and Mine Finance.' My article was published in San Francisco on October 19, and the contribution by Mr. Hoover was published in London on October 15. My article was submitted for publication during last August. I did not see Mr. Hoover's article before publication, and I judge that it is equally certain that he did not see mine. Notwithstanding these facts, the two articles show striking similarities.

For example, in my article I write: "the relative magnitude of the ore reserves in any particular mine is largely a matter of administrative policy." Mr. Hoover writes: "The quantity of ore that may be proved is largely the result of managerial policy." Again I write: "Such a method of valuation disregards the primary basis on which the appraisal of life extension should rest, namely, geological evidence. It disregards the widely varying geologic nature of two different mines, and it ignores the important collateral evidence supplied by adjacent properties." Mr. Hoover writes: "Further, any such basis of valuation fails to take into account the widely-varying geologic character of mines; it disregards any collateral evidence such as that of continuity from neighboring mines of the general experience in the district."

For my part, any engineer is entitled to what I have written. I believe that there is little truly original in either contribution, as the facts are more or less the common property of the profession. I merely draw attention to these similarities as Mr. Livingston has quoted likenesses between certain passages in my article with those of Mr. Hoover's former work. It is a poor rule that will not work both ways. For the benefit of Mr. Livingston: this proverb is not original with me.

MORTON WEBBER.

New York, November 11.

Canada and the Nickel Supply

The official reports of mineral production in Ontario show that in 1910, the latest year for which such figures are available, there was hoisted from the nickel-copper mines of Sudbury 652,392 tons of ore, of which 628,947 tons was smelted in the blast-furnaces and put through the converters. The product was 35,033 long tons of matte, 23.6 tons of ore being thus required on an average for one ton of matte. In this quantity of matte there was contained 18,636 tons of nickel. The production of 1910 was much the largest since the nickel mines of Sudbury were opened, a quarter of a century ago, and this field is the most important source of nickel in the world. The value of the nickel contents of the matte, on the basis of what it is worth—or estimated by the producers to be worth—at the point of production was $4,005,961. To the output of the Sudbury mines must be added, for the sake of completeness, the nickel content of the silver ore mined at Cobalt, estimated to amount to 504 tons, bringing the total yield of nickel in 1910 up to 19,140 tons. The use of nickel for coinage purposes is spreading. In 1909 the Government of Turkey was authorized to put out an issue of coins made of nickel or aluminum. The latter metal, upon being tested, not having given satisfactory results, nickel was decided upon, and it has been resolved to issue 120 millions of 5-para pieces, 120 millions of 10 paras, 70 millions of 20 paras, and 20 millions of 40 paras; in all, 330 millions of pieces. The money is all to be coined in 4 years and issued in 20. The only other important source of nickel is the island of New Caledonia, whose output, however, in proportion to the whole, is now much less than that of Sudbury. Société le Nickel, whose production is from New Caledonia ores, operates refineries in France, England, and Germany. From 1900 to 1909 the French production fell from 1700 to 1200 tons, while that in England rose from 1500 to 2800 tons, and in Germany from 1400 to 3100 tons. Thus in 1909 the total output of nickel from New Caledonia was 7100 tons.—*Monetary Times.*

EXPORTS from Tampico to the United States during the quarter ended September 30, 1912, totaled $1,198,597, of which crude oil constituted $1,125,148. The declared exports in the same quarter last year aggregated only $174,648.

Special Correspondence

NEW YORK

THE METAL MARKET.—THE SHATTUCK-ARIZONA.—HOPES FOR THE REA.

So far as the mining markets are concerned, the unsettled condition created by the presidential election, coupled with the war crisis in southeastern Europe, still remains. The copper-metal market is dull, and owing to the prices being 'pegged' the Producers' report was without its normal effect. The increase of 13,000,000 lb. connected with the record-breaking delivery of 84,104,734 lb. to domestic consumers might ordinarily be expected to produce some marked recessions. The October output was 145,405,543 lb., within about 200,000 lb. of the record production of last August. The war situation has been the underlying factor in the metal market for a good many months. A year or more ago, when the copper surplus was in process of disappearance, the real explanation was the large purchases abroad for ordnance purposes, and at the present time the real factor in metal is this element of consumption and how far stocks held for this purpose must be and will be replenished. During the past week buying for export in New York is reported to have been mostly at a standstill. Domestic consumers are said to be buying for immediate needs only, and there is no tendency to build up stock piles at 17¾c. per pound.

The rejuvenation of Granby is looked upon as an accomplished fact. The stock has advanced to 75, the best price at which it has sold since the slump, which ensued after the report made by Otto Sussmann, in which he said the available ores of the Granby were almost exhausted. The Granby's financing of the Hidden Creek property out of its earnings, instead of making an issue of convertible bonds, is a healthy movement toward conservatism in mining finance, and should commend itself to the general public. The deal for the control of the Shattuck-Arizona is apparently in stays. The latest rumor is that the property is to be taken over by the Calumet & Arizona. It is easily to be recognized that the Calumet & Arizona is really the logical purchaser, and could probably handle the property to better advantage than any other. Shipments have just been started from the Shattuck-Arizona to the Calumet & Arizona smelter under a new contract, which provides for a minimum production of 500 tons daily after next July. Louis Hill, of the Great Northern railway, is the largest owner in the Shattuck-Arizona, and it is said that the new deal is to be made on a basis of exchange of shares, two shares of Shattuck to be given for one share of Calumet & Arizona.

The La Grange Mining Co., operating very large placer properties in Trinity county, California, has re-elected its old board of directors, consisting of D. M. Riordan, Roberts Walker, former chairman of the board of the Rock Island railway, and W. H. Jones. The Lightning Creek Gold Gravels & Drainage Co., Ltd., and the Chesterfield Copper Co. have both been listed on the New York Curb. The former is placer property in the Kootenai district, while the Chesterfield Copper Co. property is in Pima county, Arizona, and is officered by Philadelphia people. Harking back for a moment to the process of fine-tooth-combing of the globe for new mineral deposits, it is worthy of note that the Yukon Gold Co. is said to be about to emulate the example of the Oroville Dredging Co. and is now looking for a dredging property in South America. Engineers' reports have been examined, but no negotiations have as yet been concluded.

The Rea Consolidated Gold Mines of Porcupine, a property in which John T. Milliken, of St. Louis, was interested, was at one time considered one of the most promising properties in Porcupine, and its later collapse was one of the severe blows from which the district suffered. Mr. Milliken and his associates made some very strong efforts to interest the Consolidated Gold Fields of South Africa in their mining ventures. The Golden Cycle mine and mill was at one time reported to have been sold to the English company, and later this company was reported to have purchased a large interest in the Rea in Porcupine. Neither deal was ever brought to a successful conclusion. The refinancing of the Rea is reported to have been concluded, and it is to be hoped that the report is correct. The reopening of the mine will do much to bring back confidence in Porcupine, and if present plans as to the erection of a 10-stamp mill can be carried through, it will restore hope to many holders of the stock who purchased at high prices, and have been forced to carry their holdings down to a point where there was absolutely no price recorded for them. What new interests, if any, have been brought into the company, has not as yet been disclosed. The McKinley-Darragh company, of Cobalt, has just declared its regular quarterly dividend of 3% and an extra dividend of 17%, this being an increase in the extra distribution of 10% and making a total of 50% declared this year. Some of the New York people with connections in Butte report that speculation in mining properties in and around that city is as feverishly active as any previous movement, and Butte has had many booms.

The El Oro Mining & Railway Co., Ltd., under the management of the Exploration Co., Ltd., of London, returns for the months of October are: mill ran 30 days; treated 21,090 tons of ore and 15,920 tons of tailing, yielding bullion $170,990; working expenses, $91,170; expenditure on development, $25,490; total expenditures, $116,660; profit, $54,330; railway profit, $9070; total profit, $63,400. Expenditures on permanent mine improvement were $6650. The Tomboy Gold Mines Co., Ltd., under the management of the Exploration Co., Ltd., of London, reports for October that the mill ran 29 days and crushed 11,000 tons of ore yielding bullion valued at $45,000; concentrate shipped, $41,000; total, $86,000; expenses, $46,000; profit, $40,000; expenditure on permanent improvement amounted to $11,752.

BOSTON

NEW BIG MINE IN CHILE.—RISE OF BURRAGE.—SPLIT IN THE COLE-RYAN SYNDICATE.

Chile is to have another big copper mine, in which the Guggenheims are interested. That noted family has joined Albert C. Burrage, the Boston copper man, in his enterprise at Chuquicamata, on the plateau 100 miles east of the port of Antofagasta. The property is 9500 ft. above sea-level. The Chuquicamata mines are particularly fortunate in having railway connections through a 6-mile branch from the main line of the Antofagasta & Bolivia railway. Some time ago Mr. Burrage, who has not been very active on the surface in copper affairs, and who is not at all communicative, allowed himself to be interviewed in London, in which he gave a hint of his interest in copper properties, particularly in South America. The new property is to be held by a close corporation called the Chile Exploration Co., owned and officered by the firm of M. Guggenheim's Sons and Mr. Burrage. Daniel Guggenheim will be president and Mr. Burrage the vice-president. It is announced that neither the American Smelting & Refining Co. nor the Guggenheim Exploration Co. is in any way interested in the new enterprise, and no public or private flotation of the company will be made. The property is suited to steam-shovel mining, but the ores require a new method of treatment, being unsuited to direct smelting and are especially adapted to leaching. Native miners have worked the properties in a crude way for the past generation, and they have been known quite well to mining engineers and metallurgists on account of the peculiarities of the ore, there having been considerable discussion as to how it should be treated. Another difficulty is that the deposit is situated in a desert 50 miles from any water supply. Because of the small scattered units of Chilean ownership it was impossible to raise money for piping an adequate supply of water across the desert from the mountains to the mines. Mr. Burrage optioned these properties in London two years ago, and since that time has been acquiring millsites, lime-

stone and native sulphur deposits, also a concession to take fresh water from the San Pedro river and all available water-power rights on the Loa river, 20 miles away, amounting to 30,000 hp. Mr. Burrage is a picturesque character. Going back to the days when J. Edward Addicks, of the Bay State Gas Co. and allied gas companies of Boston, controlled the gas situation of this city, and Henry H. Rogers was trying to 'butt into' the field, Burrage's name was on record in the Poor Debtor's Court. He conceived the idea of securing for Rogers control of the Brookline Gas Co., which had a charter that permitted it to enter Boston, and with this weapon he and Rogers gave battle successfully to Addicks and finally drove him from the field. Following that coup, Burrage was taken up by the Standard Oil Co., and afterward Thomas Lawson was also called into service. Burrage and Lawson, in connection with Standard Oil, framed the Amalgamated deal and also the Arcadian, the first copper exploitation in the Lake country with which Standard Oil men became identified. Burrage and Lawson

NATIVE WORKINGS, CHUQUICAMATA.

also put out Trimountain, which afterward entered the Copper Range fold. On the transfer of Trimountain to Copper Range hangs a tale which in August 1905 resulted in the 'Copper Range war', as it is known to this day in Boston. William A. Paine stopped the transfer of a lot of Copper Range stock which had been sold, claiming that Burrage and Lawson had broken the pool into which they had entered when Copper Range took over Trimountain. A deadlock resulted which gave State Street the appearance of Wall Street in May 1901, when the Harriman and Hill fight boosted Northern Pacific to $1000 per share. William A. Paine took a stand against Burrage, Lawson, and the entire Boston Stock Exchange, but it was ruled that the Copper Range stock would have to be transferred. Paine then took his case to the courts, suing Burrage and Lawson for $6,000,000; a suit that may still be pending, never having come to trial. Burrage, from a lawyer who at one time had to take the pauper's oath, has become one of the richest men in Boston, with costly residences here and in California and a palatial steam yacht.

It is reported here that there is at least just a suspicion of a split in the ranks of the Cole-Ryan Syndicate. John D. Ryan has caused it to be made known that he is not interested with his old-time partner in the acquisitions of territory being made in the northern and northwestern part of Butte, beyond the North Butte and Butte & Superior properties. It is said that there has been increasing separation of these two men for some time. A great many people confuse Amalgamated and Cole-Ryan, one a corporation and the other a syndicate. In Bisbee neither Calumet & Arizona nor Superior & Pittsburg were Amalgamated-Cole-Ryan properties. It is also true that in Bisbee the so-called Cole-Ryan syndicate has never had any influence in these two companies other than that exercised by Thomas F. Cole personally. The Amalgamated policy of forming a copper merger of United States Steel Corporation calibre has never appealed to the principals of the Bisbee companies, who do not believe that the price of copper can be controlled that way. James Hoatson first interested his brother-in-law, Thomas F. Cole, in Calumet & Arizona, and the probabilities are that the Cole and Hoatson interests in the future will act together more than the Cole and Ryan interests. Mr. Ryan is considered to be a party to the Keweenaw consolidation in the Lake country, but only in a formal way. The Cole-Ryan syndicate may remain intact as to past enterprises, but it is quite well known here that there is little or no disposition on the part of either Cole or Ryan to increase their joint interests. The exploitation of the northern and northwestern part of the Butte district is interesting Thomas F. Cole, A. B. Wolvin, and a number of other Duluth men, the Duluth interests probably being dominant in that movement.

JOHANNESBURG, TRANSVAAL

SEPTEMBER RETURNS.—DEEPEST MINE IN THE WORLD.—OTHER DEEP MINES.

September being a 30-day month, the output of gold for the whole of the Transvaal was 16,844 oz. less than during August, the total production being 747,893 oz., value £3,176,846; of this, 716,495 oz., value £3,043,475, came from the Rand. The Randfontein Central crushed and treated 201,652 tons, with a recovery valued at £259,944; the Crown Mines, 156,300 tons, with a recovery of £245,366; and the East Rand Proprietary Mines, 140,800 tons, with a recovery valued at £240,931. It seems strange that the East Rand Proprietary Mines should be able to supply the mills with a better grade of ore than the Crown Mines, which for many years has been counted among the richest properties of the Rand. The Ferreira Deep milled 53,140 tons, yielding £106,265, and the Robinson mine 51,400 tons, yielding £101,457, so that there shortly ought to be about half a dozen mines on the Rand producing gold in excess of £100,000 per month.

The tendency has been of late to amalgamate those outcrop properties now on the point of exhaustion with the deeper neighbor, more especially where both the mines are under the same control. The Village Main and the Village Deep seem likely to follow this example soon. It cannot be said that the reduction in the railway freight on coal to the gold mines seems to have had the anticipated improvement upon September profits, as the group profits, which cover nearly the whole of the Rand profits, were less in September than July. It was calculated that the rates would make a saving to the gold mines of over £200,000 per month, but so far the saving does not materialize in either lower costs or higher profits. Perhaps the Victoria Falls Power Co. reaps most of the benefit from the lower coal rates.

It is believed that the Jupiter mine, near Germiston, long the possessor of the deepest vertical shaft on the Rand, is now the deepest gold mine in the world. At its lowest point the face of the incline is at a total depth from the surface of 5040 ft. The vertical shaft, known as the Catlin shaft, has a depth of 4243 ft. and a further vertical depth of 800 ft. is obtained by following along the reef on the incline. The Jupiter mine is situated about half way between Germiston and Johannesburg, to the immediate dip of the Geldenhuis Deep mine, which of late has fallen somewhat in its grade, although the Geldenhuis Deep was the first deep-level mine on the Rand to produce gold. The Jupiter company has a nominal capital of over a million sterling and was registered in 1896, but so far has only paid one dividend of 5% to its shareholders, the monthly profits varying from £2000 to £4000. The mine is well developed and equipped with a modern ore-reduction plant and has passed through various vicissitudes, especially as to the grade of its developed ore. It is recognized as being in a low-grade area, a common fault of all the three deepest mines in that section of the Rand.

The Jupiter, now the world's deepest gold mine, adjoins the Simmer Deep on the west, where the lowest level has

now reached a depth of 4580 ft. from the surface. The capital of the Simmer Deep is £1,650,000. It has never paid a dividend, and working at such a depth on ore estimated to yield only 18s. per ton does not, with present Rand working costs, seem likely to do so in the immediate future. Like the Jupiter, it is a splendidly equipped mine, and no efforts or expense have been spared by the controlling house, the Consolidated Gold Fields of South Africa, to enable the mine to give a good account of itself. It may almost be said to have been worked in unison with the Jupiter mine and a good deal of what has been said about the Jupiter also applies to the Simmer Deep. Another very deep mine on the Rand is the Cinderella Deep, close to the town of Boksburg and immediately to the dip of the eastern extremity of the property of the East Rand Proprietary Mines. The shaft here, however, has only a vertical depth of 4000 ft., but the total depth from the surface at the lowest point of the incline is 4770 ft. All these three deep mines have had numerous mining and ventilation difficulties to contend with, particularly the Cinderella Deep, which at present is only in possession of a single shaft. The connection made to the rise with the East Rand Proprietary Mines is of such little value that in some of the workings the temperature is as high as 92°F. Air-blasts, too, have played sad havoc with all these deep mines, particularly with the Cinderella Deep, where, due to this cause, the mine was worked for two months recently without making any profit. Judging, however, from the difficulties surrounding the deep gold mines in South America and Australia, the Rand is destined to become the home of deep mining. No matter how troublesome deep mining may appear on the Rand, it is quite easy work compared with other countries, and only the value of the local banket reefs will in the future place a limit on deep mining here, for undoubtedly the reefs will be followed down so long as it is proved profitable to do so. But it must be pointed out that so far the deepest mines have not been at all satisfactory as producers of profit.

LONDON

A World-wide Exploration Company.—New Management for East Pool.—The Mayfield Syndicate.

On the exhaustion of some of the Kalgoorlie mines a few years ago, F. A. Govett, the chairman of the controling companies, asked H. C. Hoover to scour the world for new properties. Thus began the foundation of a promoting business which is now beginning to loom large on the London horizon. The rearranged controlling company is at present called the 'Lake View & Oroya Exploration,' but it will be necessary to find some more suitable name before long. Among its holdings are blocks of shares in the Leonesa mine in Nicaragua; the Kyshtim and the Orsk Goldfields in Siberia; the Fitzroy mine in Queensland; the Block 10, South Blocks, Zinc Corporation, and Amalgamated Zinc companies at Broken Hill; the Black Range, Mountain Queen, Transvaal, and Queen of the Hills mines in Western Australia; and the Granville and Boyle's Concession in the Yukon. Some of these are promising, and some are yielding handsome profits. The geographical range is great and bespeaks the wide experience of the controllers. They have as much knowledge of mining, in its world-wide aspects, as any group in London. Besides Messrs. Govett and Hoover, there is A. Chester Beatty, well known in America, though he is not yet a director. Among the directors of the company are Tyndale White, the chairman of Tanganyika Concessions, and W. F. Turner, the chairman of the Anglo-Continental, both gentlemen who must have learned a good deal from experience. Besides Mr. Hoover himself, the board includes another mining engineer of high standing, J. H. Cordner-James. Thus the talent is ample for big work, and much will be expected from the company.

Mr. Hoover became interested also in oil some time since, and with Mr. Beatty has been the dominating figure in the Continental Oil Co., owning lands in the Midway and Coalinga fields of California and 5500 acres in the oilfields of Eastern Mexico. The company has made no attempt to force production and has now sold out to the General Petroleum Co., controlled by Eugene De Sabla and his friends. It is understood that Messrs. Hoover and Beatty become stockholders in the enlarged General Petroleum.

I have often recently mentioned that Cornwall is once more coming into its own. The news of greatest importance this week is that Bewick, Moreing & Co. has taken the management of East Pool, one of the last of the cost-book mines, situated close to Dolcoath, South Crofty, and Carn Brea & Tincroft. For eighty years this mine has been yielding profits from tin, tungsten, and arsenic, and the directors and managers have a fair claim to the honor of being the leading initiators of up-to-date methods of ore treatment. On the other hand, the development work has of recent years been allowed to lag behind. Frankly, the depth and the water conditions have been such that more money was required for capital expenditure than could be raised by assessing cost-book shareholders. For some time the directors have been looking for an opportunity to break away from tradition and introduce a large amount of new money. The details of the new deal with Bewick, Moreing & Co. are not yet fixed, but in all probability I shall be able to give fuller information next week.

The details of the Rayfield (Cornwall) Tin Syndicate have been published this week by Oliver Wethered, the chairman, and as it promises to be one of the most important companies connected with mining ventures in Cornwall, a résumé of its scope and objects should be given. The capital of the Syndicate, £75,000, has all been subscribed in cash, by shareholders in the Rayfield (Nigeria) company, and there are no promotion shares or money to be paid. The cost of formation and brokers' commissions was only £1000, so the Syndicate had £74,000 in cash to start with. Interests have already been acquired in the Gwithian Sands, the Basset & Grylls mine, Geevor Tin Mines, the Zennor and Ludgvan leases, the North Dolcoath, and the Killifreth mine. Of all these the Gwithian Sands will probably be the most attractive at first. As is well known, the Red river carries tailing from the Camborne mines to the sea at Gwithian, in St. Ives bay, and though this tailing is re-treated several times on its way down, it still contains an appreciable amount of cassiterite. This is gradually concentrated by the action of the sea, and has provided David Stevens with a substantial living for forty years. A year ago a Cornish group undertook to work the sand on a larger scale by modern methods, and instructed C. G. Lush to examine and report. Mr. Wethered came in with a bid for a half interest, and at the instruction of Percy Tarbutt & Co., R. C. Nicolaus made another inspection.

Mr. Nicolaus took 841 samples from 447 pipe boreholes, 155 pits, and 37 drill-holes, and reported the presence of 1,208,725 tons of sand averaging 6.45 lb. metallic tin per ton. The thickness of the deposit is reported as 36 in. Some is above and below the high-water mark, and Mr. Nicolaus recommends that that below, amounting to 594,905 tons, should for the present be eliminated from the estimate. He has since issued a supplementary report adding 82,392 tons to the reserve, making it 696,212 tons above high-water mark. The cost of treatment is estimated not to exceed 4s. per ton against an average content worth 18s. 3d. per ton with tin at £229. The recovery was figured at from 60 to 70%. With regard to the other properties mentioned, the Basset & Grylls mine, in the Wendron district, has been entirely purchased by the Syndicate. It is proposed, in the first place, to re-grind and re-treat the dump ores and the plant for this purpose should be ready in a month or two. The mine will be developed later. E. S. King & Co. have this matter in hand. The Zennor, Ludgvan, and North Dolcoath properties were acquired jointly with the Rayfield (Nigeria) company. As regards the Killifreth, that mine yielded profits in former years and was closed when the price of black tin fell to £40. The Syndicate had undertaken jointly with other parties to provide £40,000 for its reopening and rehabili-

tation. Altogether, therefore, the Syndicate has some important and promising business in hand, which will be watched with unusual interest.

BUTTE, MONTANA

PROPOSED HYDRO-ELECTRIC CONSOLIDATED.—NEW ZINC COMPANY.—LA FRANCE TROUBLES.

The proposed consolidation of electric power companies in Montana is a matter of decided importance to the mining industry. The Butte Electric & Power Co. at the next stockholders' meeting will vote on a proposal to consolidate with the Missouri River Electric & Power Co., the Madison River Power Co., the Billings & Eastern Montana Power Co., and the Montana Power Co. If the terms are accepted by the stockholders, a new company will be formed to be known as the Montana Power Co., capitalized at $100,000,000. Of this capital, $75,000,000 will be apportioned to common shares, and $25,000,000 to 7% cumulative preferred shares. The company is to have the right to redeem the preferred stock after three years at 120. Ten preferred shares of Butte Electric & Power will be exchanged for eight preferred and two common shares of the new stock. One common share of the old stock will be exchanged for four common shares of the New Montana Power Co. The other companies absorbed will receive $3,900,000 for their properties. The Montana Power Co. will secure the money for the purchase by issuing preferred stock at par. This issue may be purchased by Butte Electric stockholders to the extent of 50% of their present holdings in preferred or common stock of the old company. Payments for the new preferred stock will be called for January 12, 1913. When the present plans of financing are completed there will be left in the treasury of the new company about 80% of the preferred stock and 60% of the common stock, or 68% of the total capitalization. The new organization will be controlled by Butte Electric interests. O. W. Wetmore, of Boston, is to be president, and Max Hebgen, of Butte, is to be vice-president and general manager. The Great Falls Power Co. is not to enter the new merger, but some of the largest stockholders are interested in both companies, so that the interests will probably not conflict. At first thought it might seem that such a consolidation would be detrimental to the consumer, but with the present limited development of the country the reverse will be the case. The available power is far above the present needs of the state.

The Rainbow Lode Development Co. has been organized by Duluth capitalists to prospect a group of claims east of the property of the Butte & Superior C. M. Co. The claims controlled by the new company are the Third Sphinx, Michigander, Morel, Valley Queen, Forest Rose, Wanda, Cornbrea, and a fractional interest in the Sarah. The company is also interested in the Butte and London Copper Development Co., to the extent at least that an arrangement has been entered into whereby the latter company will cross-cut the Rainbow property at a depth of 1600 ft. The present depth of the Butte and London shaft is 1100 ft. This is to be sunk an additional 500 ft. Edward C. Congdon is president of the new company, and among those associated with him, are Chester A. Congdon, and Thomas F. Cole, all of Duluth. The Rainbow Lode Development Co. is capitalized at $8,000,000 divided into 800,000 shares of a par value of $10.

The United States Government has brought suit against Albert W. McCune to recover $2,512,955, the alleged value of cordwood cut by McCune and associates from Government land. The wood was cut during the years 1883 to 1895, and amounted to 717,987 cords, according to the complaint. The wood was delivered under contract to the old Anaconda smelter. The Government's excuse for the long delay in bringing the action is that the defendant has been out of the country much of the time, and that his fortune has been kept in such a shape that the Government could not recover on it.

While drilling last fall for a water supply for the new Clark concentrator, a flow of artesian water was developed. Speculation was rife concerning the possibilities of such a supply and government aid was secured to advise on the matter. O. E. Minzer of the United States Geological Survey was detailed to investigate conditions, and has submitted a preliminary statement to the Butte Chamber of Commerce. In brief, Mr. Minzer says that the flat south of Butte will not furnish artesian wells, but that it is a large debris-filled basin covering about 100 square miles and surrounded on all sides with mountains, the streams from which are largely absorbed by the basin. Wells sunk in the basin will tap this supply, which can be made available by pumping. The supply is regarded as ample for all probable uses.

Another of F. Augustus Heinze's flotations is in trouble. On November 7, Judge McClernan of the local district court granted a default judgment against the La France Copper Co., in favor of the Lincoln Trust Company of New York, for $2,735,600, and directed that the property be sold at sheriff's sale. La France Copper Co. was organized in 1905 to take over the old Lexington mine and mill owned by French capital. A surface plant was erected, and some underground work was done. The ores were mixed sulphides, and concentration was attempted in a 200-ton experimental mill using an electrostatic separating process. The company has failed since 1908 to meet the interest on the $2,000,000 worth of outstanding bonds. It is the intention of the bondholders to reorganize the property, and endeavor to find a satisfactory method for treating the ores. There is said to be a large tonnage in the mine, running about 1% copper, 3% lead, 18% zinc, with $4 in precious metal content.

The East Butte Copper Mining Company produced over 1,300,000 lb. of copper in October, with average net earnings in recent months of better than $100,000 monthly. It is the desire of the company to enlarge its furnaces to a capacity of 2,000,000 lb. of copper per month, but no attempt will be made to do this as long as the present high price of copper continues, because the enlargement would necessitate a delay of possibly two months. Shaft-sinking has been resumed at the Pittsmont, and the shaft will be deepened to 1800 ft., and possibly 2000 ft. The shaft sinking will be carried on without interruption of the present production from the upper levels of the mine.

TORONTO, CANADA

DISCOVERIES AT CART LAKE.—THE SENECA-SUPERIOR.

Recent discoveries on the Seneca-Superior lease, Cart Lake district, Cobalt, have revived interest in a portion of the district, well within the productive area limits, which has been regarded more or less unfavorably, although it has been admittedly but partly explored. All of Cart Lake is included within the property lines of the Nipissing company, except at the south end, where the Savage and Provincial companies have productive properties. The lake bed is under control of the Peterson Lake company, under separate location, and the Seneca-Superior is leasing from that company. The work of exploration was renewed about six months ago, a shaft being sunk to 200 ft. on the east edge of the lake and a cross-cut drift advanced to the east across the lake bed. Several barren leached veins were cut in the first 200 ft., and at about 400 ft. a small ore stringer was found, succeeded by the strong vein, 4 to 6 in. wide and containing solid ore assaying 2000 to 4600 oz. in silver. The vein has been opened laterally about 40 ft. and is still strong and high grade. This discovery will give strength to the large area of Nipissing east of the lake on which a shaft is now down 300 ft. in the conglomerate, and to the Nipissing area east of the lake on which the No. 86 vein is partly developed. The Seneca-Superior ore is cut in the conglomerate probably 50 ft. above the Keewatin contact. It is not yet possible to correlate this vein with the other proved veins to the east and south. The Seneca-Superior operation is in charge of R. H. Lyman, formerly of Pachuca, Mexico. The development was undertaken under the advice and direction of W. E. Segsworth, of Toronto, as engineer, and Kirby Thomas, of New York, as consulting engineer.

General Mining News

ALASKA

Juneau

It is reported that 500 men are employed at the Alaska Gold Mines property. At the Perseverance claim no mining is being done. The mill is running full time and is being used to test the ore for the best treatment. At the mine one of the principal developments is the widening of the Alexander cross-cut. Three sawmills are at work cutting lumber for the different plants; the foundations for the power-plant are excavated, and all the wiring of transmission lines is completed, and electrical machinery is arriving. At the Sheep Creek tunnel, which will be driven to cut the lode at greater depth, concrete foundations are finished, and a compressor is being erected.

Valdez

Rich gold ore has been opened at the Minnie claim, situated about six miles from the head of Shoup bay, and near the property of the Cameron-Johnson company, Gold Hill, Mayfield, Rambler, and Bence-McDonald. An adit has been driven some distance, and work will be continued through the winter.

ARIZONA

Mohave County

High-grade lead and zinc concentrates are being shipped from the Banner mill, from ore from the de la Fontaine mine. Shipments of bullion from the Gold Road mill average about $25,000 per week, and it is expected to increase them to $200,000 per month when the new mill is in operation. It is reported that the Clark interests have bonded several mines at Brownsville, in the Cottonwood district. Kirk & Lavell have taken an option on the C. O. D. and will begin work soon. A bar worth $6000 was recently produced from a 10 days run of the Frisco mill.

Santa Cruz County

The Copper Queen company has taken over the Bradford mine, from which one car of carbonate ore per week is now being shipped. At the R. R. R. mine one 50-ton car of ore per day is being shipped to the El Paso smelter. A large tonnage of low-grade ore is accumulating on the dump. Six machine drills and a force of 70 men are at work. W. S. Sultan is in charge. The Chief group of claims has been bonded by the El Tigre company and a 500-ft. exploratory adit started. The ore contains copper, lead, and zinc. The Hosey mine has been bonded by Posey and Frazier. Shipments of copper-silver ore are now being made at the rate of 3 cars per month.

Yavapai County

Work will be resumed at the Pittsburg-Jerome mine, situated southwest of Jerome, and a burro train of 19 animals recently brought supplies to the property. The principal work at present will be in the main adit, which is in several hundred feet. The Haynes Copper Co. will also resume development, and power will be obtained from the Arizona Power Co. The Haynes mine is northwest of the United Verde. It has been decided to increase the Juanita mill by 10 stamps. After lying idle for many years, the Crown King mill is to be started. Six concentrating tables have been installed, and the large dump of tailing left when the mine shut down will be reground and concentrated. Besides the gold in the tailing, zinc will also be recovered. Sixteen men are employed in development at the Copper Queen, near Mayer. A few men have started work at the Mark Twain, in the Slate Creek district. The ore has a high content in lead and silver.

Yuma County

A 90-ton Lane mill, 4 Johnston vanners, a 40-hp. engine, and a 3-ton motor truck have been ordered for the D. & W. mine. Large orebodies averaging $12 to $16 per ton in gold have been developed in the 700-ft. shaft and 40 men are at work on the property. J. W. Flinck is superintendent. Extensive claims are made as to the value of the property of the Arizona-Empire Copper Mines Co., and it is said that large shipments of ore will soon be made. It is proposed to eventually build a railroad to the property and to erect a smelter. C. W. Mitchell is manager. Development work at the Mack property is so encouraging that a new contract has been let for development work. Good ore is being sacked on the Empire Flats property, which was recently bonded by W. W. Andrews to San Diego investors.

CALIFORNIA

Butte County

(Special Correspondence.)—The Hupp Gold Mining Co. has acquired the Hupp placer claims in the Magalia district and is driving to intersect the Indian Springs channel. G. K. Orr is superintendent. The mine is situated near De Sabla. The P. B. Steifer Mining Co. has unwatered its Magalia property for the first time in four years. New machinery has been installed in the power-house, and it is planned to continue development throughout the winter. A dam has been constructed across the west branch of the Feather river for the generation of water-power. Los Angeles and Eastern people are interested. The Superior Channel Mining Co. has been formed to operate on 600 acres near the Steifer property. The Cohn company continues to mine a good grade of gravel and is the largest operator in the Magalia district. San Francisco people are said to be interested. L. Cohn is manager. The Robbers' Roost company is arranging to begin work. A three-mile pipe-line is being built to the claims from the reservoir of the Pacific Gas & Electric Co. San Francisco people compose the company. R. T. Hooper is president and W. F. Anderson manager. Ten companies are operating in the Magalia district at present.

Chico, November 11.

The Gold Bank, near Forbestown, has been taken over by San Francisco interests, and a 40-stamp mill is being built. The Brown Bear M. Co. has been formed with a capital of $250,000 in shares of $1 each. The incorporaters are: C. B. Whitmoyer, Marvin Gary, J. W. Charge, James N. Crabb, and L. A. Snow.

Fresno County

W. P. Hammon has completed the purchase of 160 acres of oil land in the Coalinga district from the Empire, Republic, and De Luxe oil companies, on which payments have been made for about a year. There are 12 producing wells on the property.

Inyo County

L. D. Godshall has taken over the old Tecapa property, near Resting Springs, and will soon have a large force of men at work shipping ore to the smelters near Salt Lake. The ore contains an iron excess and the gold, silver, and lead content is worth $8 per ton. It is reported that a 16-mile railroad will be built from the Tonopah & Tidewater, at Silverlake, into Death Valley to facilitate shipping of salt from that region.

Mariposa County

The Oro Rico, which has been shut down for some time, has resumed operation in its 20-stamp mill. The Clearing House, which had been shut down from lack of water, has resumed work. Work on the power-line to the Melonia and the 40-stamp mill of the Merced M. Co. is nearing completion. A company has been formed to develop the Virginia, four miles east of Coulterville.

Modoc County

(Special Correspondence.)—The Ft. Bidwell Mines Co. has been organized under the laws of California to acquire the holdings of the Ft. Bidwell Con. Mines Co. The properties were purchased at sheriff's sale for $12,167 by representatives of old stockholders. An assessment of 1c. per share was recently levied, and old stockholders have until December 2 to make payment. According to the statement of officials, such stockholders will be given a just share in the new company. The new concern is capitalized at $1,000,000. It is said steps may be taken to continue de-

velopment work at the Mountain View claim. Los Angeles people are interested, but bulk of stock is held by Detroit residents. J. M. Stone is president.

Ft. Bidwell, November 14.

NEVADA COUNTY

(Special Correspondence.)—With the payment of its third quarterly dividend for this year, September 28, the North Star mine has distributed a total of $3,661,986 in profits under present ownership. It is expected the fourth quarterly dividend, and a possible Christmas payment, will be paid before the close of 1912. Much of the ore now crushed comes from a depth exceeding 4000 ft. on the incline. The two 40-stamp North Star and Central mills are operating at full capacity. The North Star company is also arranging for the erection of a cyanide plant at the Champion mines, Nevada City. It is understood that construction will commence within a few weeks. Good ore is reported at several points in the Champion workings. Arrangements are under way for the completion of the power-line to the Normandie group of claims, about four miles below Grass Valley. Recent storms caused a temporary suspension of work at the property. San Francisco people are interested. Horace Jones is manager. Several sacks of rich quartz have recently been sent to Nevada City from the Morning Star mine, on Badger hill. John Curnow, of Cherokee, is owner. Salmon Bros. report good ore showing in their claim, in the same district. Development at the Oustomah mine is encouraging. Klinker Bros., of Los Angeles, are operating the property under option. L. W. Klinker is manager.

Grass Valley, November 18.

COLORADO

CLEAR CREEK COUNTY.

(Special Correspondence.)—Hurley & Co., leasing in the Harris mine in East Argentine district, have started shipping high-grade ore which mills as high as 2200 oz. silver per ton. Work through the shaft has been resumed on the Manhattan Union property. The Silver Glance mine on Democrat mountain, a heavy producer of high-grade ore in the early days, is to be reopened through the La Plata adit, a right of way having been secured. Ore is found with a silver content of 350 to 700 oz. silver per ton. A. McClelland, of Pueblo, is owner. Heavy shipments are going out from the Gold Fissure mine at Empire. The ore is concentrating grade and is being consigned to the custom mills for treatment. Willis Bristol is manager. The Toledo property in East Argentine is receiving attention. The lower adit is being driven and a small streak of ore is showing in a vein recently cut. Work is to be resumed on the Domino property on Green Lake mountain. H. Cochran is owner. F. Winters, Sr., is developing the Black Prince property and an 8-in. streak of quartz is showing in the bottom of the 30-ft. shaft that carries $42 per ton in gold and silver. Criley Bros., owners of the High Five group of claims on Alpine mountain, have resumed development in the lower adit.

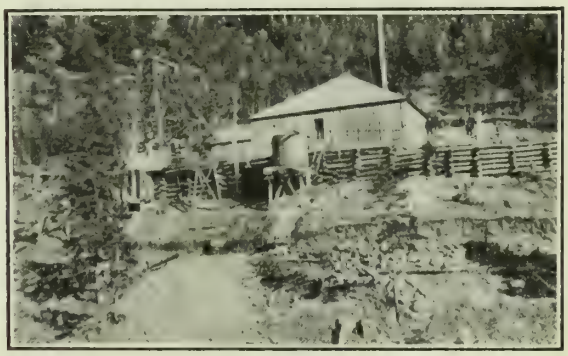
Georgetown, November 18.

LAKE COUNTY (LEADVILLE)

The Cramer mill, which was moved from its site at the head of East Fifth street to the old Elgin smelter, is now nearly in working order. Power is now supplied by steam. Ore from the old McHarg dump will be the first ore to be treated and will be crushed and passed through a set of jigs. Lessees at the Ella Beeler adit, Iowa gulch, have cut a good orebody containing lead, with some gold and silver. What is known as the 600-ft. level of the Emmett shaft, Carbonate hill, is being cleaned out and repaired by lessees of the Denver City and Blaine shafts. Lessees at Highland Chief and Eliza, Breece hill, are working on a fair vein of carbonate of zinc. At the 600-ft. level of the Denver City and Gambetta, carbonate ore averaging 33% zinc is being opened. At the North Moyer, Nevada, Adelaide, Annie, and Modoc, lessees are busy on development or shipping ore.

TELLER COUNTY (CRIPPLE CREEK)

The output at the Mary McKinney during October was 30 cars of $30 ore by the company and 8 cars by lessees. E. T. Smith has found rich ore in the Howard shaft. The water has receded from the 900-ft. level, and driving is in progress on that level, the company having 45 men at work. Production at the Jerry Johnson during October was 15 cars of 1-oz. ore. There are four sets of lessees, but Frank Caley produced nearly one-half of the total ore. The Kavanaugh mill, constructed to treat the ore on the Jo Dandy dump, is handling 60 to 75 tons per day and is reported to have repaid the cost of construction in five months, though paying 12½% royalty to the Jo Dandy company. The quarterly report of the Doctor-Jack Pot shows that 993 tons of ore of an average content of $22.09 per ton was shipped, with a net profit of $2139. Cash on hand amounts to $23,000. Decision in the suit of the company against the Work M. Co. is expected at an early date. The Granite G. M. Co. has paid a dividend of 1c. per share, making a



ROOSEVELT DRAINAGE ADIT, CRIPPLE CREEK.

total of $286,500 to date. The total flow from the Roosevelt drainage adit was 9060 gal. per minute on November 10. The directors of the Gold Dollar M. Co. have declared a dividend of ½c. per share, amounting to $12,000. Production during October was 1212 tons. The electric pumps in the Golden Cycle have been started. Work has been started on the 450-ft. Masterpiece adit. A 100-hp. compressor will soon be installed at the Jo Dandy main shaft.

THE SAN JUAN

Recent reports from the Camp Bird mine indicate a probable additional profit of $300,000 to be derived from working. About 50 tons of ore per day is now being mined. The ore mined during the past year averaged $26 in gold content and an extraction of 94.7% was made. Machinery is being taken to the Humboldt and Mountain Top, near Ouray. The compressor has been installed at the Sweepstakes. The new zinc concentrator at Ouray, owned by Foerster & Lowe, started work the middle of this month. It will treat the concentrate from the Micky Breen, Barstow, Atlas, and Revenue. The annual report of the Tomboy for the year ended June 30, 1912, shows a profit of $430,000. G. H. Barnhardt has taken a 5 years option on the Tierra del Fuego group, on the north slope of Mt. Sneffels, on behalf of the Mountain Top M. Co. There is a 200-ft. adit on the property, and it is claimed that a 7-ft. vein is exposed, averaging $23 per ton.

J. N. Pascoe, under the auspices of the Silverton Commercial Club, is planning to build a 200-ton custom milling plant at Silverton next spring. The local railroad has offered low freight rates on ore shipments and it is hoped to make the venture a success.

IDAHO

CLEARWATER COUNTY

W. J. Harris has won his suit over 40 acres of placer ground on Quartz creek, in the Pierce district, and is planning to construct a $50,000 dredge. The other dredging properties in the district are making good operating profits.

IDAHO COUNTY

The Moscow group of mines has been sold by M. E.

Moore to E. T. Smith, representing Seattle and Los Angeles people, for $150,000 in cash. The property is on Logan creek, 90 miles by wagon-road from the railway at New Meadows, but a new railroad line up Long valley will decrease the distance to 20 miles. The underground development shows ore averaging $3 per ton over 150 ft. in width, the orebody being 4000 ft. long. A cyanide plant will be constructed.

SHOSHONE COUNTY

The Marsh mine at Burke has been purchased by E. J. Carter and Volney D. Williamson, who have taken the control of the 1,290,000 issued shares. The Black Horse, in Paragon gulch, near Murray, is working 20 men, and its 50-ton mill is crowded to full capacity. The suit of E. J. Carter against the officers of the Stewart Mining Co. has been dismissed, having been compromised. All moneys loaned by the Stewart company to the Ohio Copper Co. and other corporations have been repaid; all moneys due from different smelters to the Stewart company, as alleged in the Carter complaint, have been accounted for; all the stock of the Coeur d'Alene Development Co., and all the demands of the plaintiff relative to an accounting of the Stewart's business for the last several months prior to the beginning of the action have been complied with. It is further stipulated that the defendants pay all costs of the action and that a satisfactory accounting of the business of the company be rendered at stated intervals. M. W. Bacon, general manager, states that the company now has between $350,000 and $400,000 in the treasury and has been earning at the rate of $60,000 per month since the litigation was begun. It is stated that the company should be able to pay a dividend soon.

MONTANA

BROADWATER COUNTY

On good authority, it is stated that work is to be resumed on the Three Forks & Radersburg railroad, and that it will be completed into the Radersburg district before spring. This will give an important impetus to mining in that section, as several mines are ready to ship low-grade ore that would not pay with the old wagon haul to Toston. The Keating Gold Mining Co. has extended its inclined shaft on the Blacker claim to the 800-ft. level, and a new pump is being installed. A large tonnage of ore is blocked out ready for stoping. With the advent of the railway the mine will increase its shipment from 100 tons per day to 250 tons. The Ohio-Keating Mining Co. and the Black Friday Mining Co. are also prepared to ship. Although the veins of Radersburg are narrow, the orebodies persist in depth, and the ore is of a character favorable to cheap smelting rates. The average ore shipped will carry about $20 gold per ton.

DEER LODGE COUNTY

The completion of the Georgetown extension of the Butte, Anaconda & Pacific railway has stimulated prospecting in all tributary territory. The latest find is in Stuckey's gulch, seven miles west of Anaconda. Samples assaying as high as $270 per ton in gold have been taken. Copper in commercial quantities is also reported from this gulch.

JEFFERSON COUNTY

The Ex-Vein Mining Co. has been organized by Butte interests to develop the Bullock property on Basin creek, near the old Bullion mine. Some ore was mined from the property in early days. Operations are to begin at once, and the property will be developed by means of adits.

LEWIS AND CLARK COUNTY

The St. Louis Mining Co. at Marysville is constructing a 100-ton milling and cyanide plant. Tube-mills are to be used for regrinding. The mill is designed to handle the big bodies of low-grade ore still in the Drumlummon mine.

NEVADA

ESMERALDA COUNTY

The suit against the Merger Mines has been settled in favor of the company. Five Johnston vanners have been added at the Bonnie Clare mill, which is treating the ore from the Polverde; only 10 of the 20 stamps are in use. The Vernal has made a shipment of $40 ore. Rich ore is being shipped by the Florence. The shaft of the Goldfield Oro will be sunk to the 1000-ft. level.

LINCOLN COUNTY

The following Pioche mines have filed statements with the county assessor of shipments made during the quarter ended September 30:

	Tons.	Value.
Prince Con. M. & S. Co.	8846	$152,577
Day-Bristol Con. M. Co.	2027	44,889
J. A. Nesbitt, tailing shipped Conda canyon	2852	39,972
Mendha-Nevada M. Co.	993	9,803
P. Sheahan, dump ore	65	2,553
Home Run Copper Co.	57	2,431

The main shaft of the Nevada-Des Moines M. Co. is being sunk from the 350 to the 500-ft. level, where diamond-drill holes cut silver-lead ore assaying 608 oz. silver and 31% lead. B. J. Cavanaugh is president of the company.

NYE COUNTY

The West End shipped $53,600 worth of bullion and 50 tons of concentrate during October. The October yield of the Tonopah Mining was $135,765, while the McNamara output exceeded $26,000. A new hoisting plant has been constructed at the Halifax. The Tonopah Belmont net profit for the month was $166,000, and the total tonnage milled in the district 128,953.

WASHOE COUNTY

(Special Correspondence.)—The recently incorporated Reno Smelting & Refining Co. is going ahead with its project to erect a $500,000 custom plant at Reno. The site has been secured and it is planned to commence work within a few weeks. The Loder system of smelting will be used. John S. Loder is consulting engineer. A movement has been launched to organize a prospectors' association in Nevada, with headquarters at Reno, to assist in exploiting prospecting and legitimate mining, and protect prospectors in the development and disposal of their claims. A rich silver-lead discovery is reported from the Curry lease on the Arkell mine, northeast of Reno. Samples of the ore are stated to assay $100 per ton. Edwin Arkell is owner. It is reported that a company of Kansas City and Los Angeles people plan the prospecting of Peavine mountain for copper ore. Options have been taken on several tracts, and it is stated that churn-drills will be used. The find recently made at the Nevada Deep mines, Como district, is reported to be showing well with development. The shoot was intersected on the 50-ft. level of the Star of the West claim and parallels the Como vein. Samples of quartz are said to assay over $300 per ton, with gold predominating. H. L. Taylor is president and manager.

Reno, November 17.

NEW MEXICO

SOCORRO COUNTY

(Special Correspondence.)—At the Socorro Mines custom ore is now being received from three different properties and two more are getting ready to ship to the plant. Good ore is coming from the lowest levels of the mine. The shaft is going down steadily and will soon be at the 900-ft. level. The average daily tonnage handled in the mill is 165 tons. The output of the Ernestine Mining Co. for the last 11 days of October was 10,530 oz. of gold and silver bullion and 9600 lb. of high-grade concentrate; the total for the month was 33,080 oz. bullion and 25,100 lb. concentrate. The regular monthly dividend of 1% was declared November 1.

Mogollon, November 15.

UTAH

BEAVER COUNTY

Construction work is now in progress at the Moscow property and a new hoisting plant, additional boiler plant, and better roads to the property are being provided. One unit of the Cactus mill of the South Utah Mines & Smelters

Co. is being readjusted to handle the low-grade lead-zinc ore from the Horn Silver. It is stated that nearly 300,000 tons of ore of this grade has been developed. A fair tonnage of shipping ore is being sent to the smelters at present.

Juab County

The Lowland Tunnel, Water & Transportation Co. has been incorporated with a capital of 1,000,000 shares of 1c. each, for the purpose of driving a 10,000-ft. haulage adit to furnish an outlet for 12 properties in the district. E. P. Jennings is president, Louis Fugal vice-president and general manager, and Clark L. Whitney secretary and treasurer. These, with George F. Wasson and A. S. Sundberg, compose the directorate. The tunnel, it is declared, is now in 125 ft. and will give a depth of 4459 ft. in one place. In the Iron Blossom the vein is increasing in width above the 500-ft. level. South of the No. 3 shaft on this level there is a large body of ore of shipping grade. The vein has recently been opened on the 700-ft. level at the No. 1 shaft. Good ore has been found on the 1300-ft. level of the Eagle & Blue Bell and has also been cut on the level 115 ft. below. Ore of shipping grade has also been cut on the 1100-ft. level of the May Day and the property is likely to become a large zinc producer. The Bullion Beck will soon be shipping zinc ore, as L. C. Doty, the superintendent, is driving on the 1300-ft. level to develop a good body of zinc ore. Good ore has recently been developed on the 500-ft. level of the Gold Chain, about 1000 ft. from the shaft. W. D. Loose is assistant manager. In the Grand Central mine, under the same management, good ore has been found on the 2300-ft. level. Statement of earnings of the various Knight companies during October shows that the Iron Blossom earned net $51,000; Colorado, $5500; Dragon Consolidated, $2000; and Beck Tunnel, $1600. This shows that the Iron Blossom is exceeding its present dividend requirements by $53,000 per quarter.

Salt Lake County

The Columbus Consolidated, Columbus Extension, Flagstaff Consolidated, and Superior Alta have been merged into a single company, the Wasatch Mines Co. It is proposed to drive a drainage adit and to extend the custom tramway so as to serve these mines. The Montana Bingham is shipping about 200 tons of ore per week, three-fourths of which is concentrated at the Winnemucca mill, and the force will shortly be increased. M. T. Miller is superintendent.

Summit County

The *Park City Record* states that during the month of October the companies of that mining district shipped a total of 206 cars of ore, containing 7443 tons. Of this amount the Union Pacific Railroad Co. handled 5416 tons and the Denver & Rio Grande 2027 tons. The largest shipper was the Silver King Coalition, with 2632 tons of ore; the Daly-Judge was second, with 2196 tons; Daly West, 1470 tons; Grasselli company, 438 tons; Crother Ontario lease, 197 tons; E. J. Beggs, 51 tons; New York Bonanza, 57 tons; Barry-Coxe, 30 tons; and Charles Moore, 21 tons. Work on the new Ontario mill is at a standstill until the new roasters can be put into commission.

Utah County

Plans are being made to equip the Santaquin King and Santaquin Chief mines with electrical machinery. Work on the construction of the 100-ton mill for the Rico-Wellington company is being pushed, and 12,000 tons of ore is said to be blocked out in the mine. The company will be $100,000 in debt by the time the mill is finished.

WYOMING

Albany County

The Utopia Mining & Milling Co. is making arrangements whereby it will be able to resume work in the lower adit and open the orebody found last spring. An arrangement has been made with the Commercial mine, adjoining, for the use of electric power to operate a drill, and motor for ventilation. A fair quantity of ore has been opened in several adits 500 ft. above the main adit. Three properties in the Snowy Range district are shipping ore, and others could be made profitable if a local plant were built. The Fram, Klondyke, and Cable are hauling ore to the railroad. Assays are said to have returned up to $100 per ton in gold content. The North Park country is being boomed, and oil is being prospected by Denver people.

CANADA

British Columbia

About a car of ore per month is being shipped from the Apex, which is two miles from New Denver, and returns show an average of 135 oz. of silver, $4 to $6 in gold, and 10% lead. At the Sunset, three miles from Sandon, a new adit is being driven at 1050-ft. level, which is 250 ft. below No. 7 adit. It is in nearly 1500 ft., and veins are frequently cut. It is expected that the ore-shoot in the upper workings will be cut within 200 ft. The end of the Vancouver Island coal miners' strike is said to be in sight. There is much excitement over placer ground at Keremeos, in the lower Similkameen, over placer ground. William Willis and associates have been prospecting with a Keystone drill along the river for ten miles on each side of the boundary line at Chopaca, and if the results are satisfactory a dredge will be put at work.

Bruce White, one of the engineers of the Byron W. White Co., has located a group of claims near Crawford bay, which are stated to contain gold and platinum.

Cobalt

At the Nipissing, sluicing has been finished near the low-grade mill, and the monitor is working close to the high-grade mill. The formation is Keewatin, and several veins have been uncovered, some showing calcite, cobalt, and a little silver. On No. 4 level of the Penn-Canadian, at a depth of 285 ft., the drift has entered a large calcite vein at the west end of the property. The metal content is low, since the vein is in the Keewatin formation. During the week ended November 9, eleven mines shipped a total of 602 tons of ore, and three mines shipped 44,992 oz. of bullion. Activity is increasing around the Elk Lake district and the railroad is expected to reach there by December 15. The Beacon Con. has its shaft down 200 feet.

Dawson

Wood-cutters on the Yukon and Klondike have finished a busy season. F. Neill brought down 12,500 cords of wood, which was taken up Bonanza by the Klondike Mines railway and distributed at the Yukon Gold Co.'s thawing plants. This wood was sold for $9 per cord. It comes from the Yukon and the Stewart, some as far as 150 miles above Dawson. An average of 20 cords per acre is cut. As it is used in mining, the wood is not subject to 'stumpage' or royalty of 50c. per cord imposed by the Canadian Government. The Yukon Gold Co. used about 35,000 cords last year at an average cost of $13 per cord. Dawson used to burn 24,000 cords in the earlier times, and five or six years ago the quantity was 17,000 each winter. A considerable amount of coal is burned now.

MEXICO

Sonora

A rich body of ore averaging 5 or 6% copper has been found on the 800-ft. level of the Elisa mine of the Cananea Copper Co. In the Capote mine the orebody has been proved to continue to the 1000-ft. level. The new Capote shaft has reached a depth of 300 ft. and will be sunk to 1000 ft. The Moctezuma-Arizona is operating its 100-ton mill steadily, producing concentrate worth $40 to $100 per ton. A new unit will be added to the mill soon. Charles Schandelmeier has leased the West Cananea and is shipping 175 tons of 10% copper ore per month to the Cananea smelter. E. R. Arnold is preparing to ship ore from the El Pilar mine to the Cananea smelter. A. O. Koppes is in charge. Work has started on the Maria mine of the Carman Con. Co. and the 340-ft. shaft will be sunk to 500 ft. R. B. Phillips is manager. The 1400-ft. haulage and drainage adit of the Superior-Bonanza is practically completed, as is the 500-ft. shaft.

Personal

Professional men are invited to send news of their engagements and travels. Such news is interesting to friends.

C. F. RAND has gone to Cuba.

R. B. MCGINNIS is in Trinity county.

M. W. VON BERNEWITZ is at Tonopah.

H. P. HENDERSON is in San Francisco.

ALFRED VON DER ROPP is in San Francisco.

W. W. JOHNSON has returned from Alaska.

J. R. FARRELL has returned to San Francisco.

C. W. MERRILL has returned from New York.

W. H. BLACKBURN was in San Francisco last week.

FREDERICK BRADSHAW was in San Francisco Monday.

A. SELWYN BROWN was at the Tom Reed mine recently.

HOWLAND BANCROFT will leave New York for Venezuela Wednesday.

T. M. GIBSON is at Seattle and is expected in San Francisco.

WILLIAM BACH has gone to Siberia to report on gravel deposits.

HENRY C. MORRIS was in San Francisco this week on his way to Mexico.

EDWIN HIGGINS has joined the staff of the United States Bureau of Mines.

REIJI KANDA is developing a newly discovered gold mine on Kyushu, Japan.

R. D. SALISBURY was in Buenos Ayres recently and has gone to Rio Janeiro.

W. G. WEBBER has returned from abroad and will live at Salt Lake City hereafter.

H. FOSTER BAIN will attend the American Mining Congress at Spokane next week.

T. BARNEY has gone to Siam to report on mines for Pearse, Kingston & Browne.

DESAIX B. MYERS will be in Mohave county, Arizona, till December 1, when he will return to Los Angeles.

JUAN FELIX BRANDES has returned to California after an absence of some months and is at San Diego.

ARTHUR J. HOSKIN has gone to Tallapoosa, Alabama, and Dahlonega, Georgia, to start cyanidation mills.

D. W. JESSUP is general superintendent for the Home Run Copper Co., in the Bristol district near Pioche, Nevada.

B. F. NOEHL has returned to Los Angeles after making examinations in Arizona and Nevada for New York people.

GERALD M. BROWNE is expected in London during the early part of November, returning from the United States, where he has been on a tour of inspection.

K. ASANO, chief metallurgist at the Ashio copper mines and inventor of the process used there for neutralizing smelter fume, will visit California in December.

F. L. RANSOME succeeds WALDEMAR LINDGREN as chief of the section of economic geology of the metalliferous deposits, for the United States Geological Survey.

FREDERICK K. BRUNTON has resigned from the testing department of the new reduction works at Anaconda, Montana, to accept a position as assistant superintendent at the British Columbia Copper Co.'s smelter at Greenwood, British Columbia.

C. DAVID WHITE has been appointed chief geologist of the United States Geological Survey in place of WALDEMAR LINDGREN, resigned to become Rogers professor of geology and head of the geological department of the Massachusetts Institute of Technology.

Obituary

GREELEY FRENCH, an early pioneer of Nevada, died on November 7 at Silver City, Nevada, where he had resided for the past 38 years. He was born in New Hampshire in 1836 and came to California in 1859 and was among the first pioneers in the Carson valley. Later he turned his attention to ranching and politics, and was a well known figure in the life of western Nevada.

Market Reports

LOCAL METAL PRICES

San Francisco November 21.

Antimony	11—11½c	Quicksilver (flask)	$41.50
Electrolytic Copper	18—18¼c	Tin	52—53¼c
Pig Lead	4.75—5.70c	Spelter	8¼—8¾c

Zinc dust, 1400 lb. casks, per 100 lb., small lots $9.50—9.75; large $7.50—8.50

METAL PRICES

(By wire from New York.)

NEW YORK, November 21.—Copper prices are now firmer; with good demands from Europe for early shipment. Lead is quiet and weak. Spelter remains unchanged. Average daily prices for the past week, in cents per pound, based on wholesale transactions, standard brands, are given below.

Date.	Electrolytic Copper.	Lead.	Spelter.	Silver, per oz.
Nov. 14	17.35	4.63	7.28	62⅜
" 15	17.40	4.63	7.28	62½
" 16	17.48	4.63	7.28	62⅜
" 17	Sunday.	No market.		
" 18	17.48	4.60	7.28	62⅜
" 19	17.48	4.60	7.28	62⅜
" 20	17.48	4.60	7.28	62⅜

LONDON QUOTATIONS

(By cable, through the courtesy of C. S. Burton & Co., New York.)

	November 21.
Camp Bird Ltd	£ 6
El Oro	4½
Esperanza	10½
Oroville Dredging	27⅛
Santa Gertrudis	6½
Tomboy	6¾

COPPER SHARES—BOSTON

(By courtesy of J. C. Wilson, Mills Building.)

	Closing prices, November 21.		Closing Prices November 21.
Adventure	$ 6	Mohawk	$ 64½
Allouez	42½	North Butte	36⅜
Calumet & Arizona	78½	Old Dominion	58½
Calumet & Hecla	584	Osceola	112
Centennial	20	Quincy	87
Copper Range	57	Shannon	14⅜
Daly West	3⅜	Superior & Boston	2
Franklin	9⅜	Tamarack	42½
Granby	74	Trinity	5
Greene Cananea, ctf.	9½	Utah Con	13⅜
Isle-Royale	36½	Victoria	2½
La Salle	6½	Winona	4½
Mass Copper	6½	Wolverine	75

NEVADA STOCKS

(By courtesy of San Francisco Stock Exchange.)

San Francisco, November 21.

Atlanta	$ .17	Montana-Tonopah	$2.05
Belcher	.40	Nevada Hills	1.40
Belmont	8.70	North Star	.33
Big Four	.40	Ophir	.49
Con. Virginia	.30	Pittsburg Silver Peak	.87
Crown Point	.55	Round Mountain	.36
Florence	.72	Sierra Nevada	.26
Goldfield Con.	2.35	Tonopah Extension	2.62
Halifax	2.00	Tonopah Merger	.90
Jim Butler	.69	Tonopah of Nevada	6.37
Jumbo Extension	.29	Union	.31
MacNamara	.20	Vernal	.08
Mexican	1.75	West End	1.52
Midway	.37	Yellow Jacket	.40

MINING STOCK QUOTATIONS—NEW YORK

(By wire from C. S. Burton & Co., New York.)

	Closing Prices. November 21.		Closing Prices. November 21.
Alaska Mexican	$ 13	McKinley-Darragh	$ 2⅜
Alaska Treadwell	43	Miami Copper	28½
Alaska United	24½	Mines Co. of America	2⅜
Amalgamated Copper	85½	Nevada Con	23
A. S. & R. Co.	79⅛	Nipissing	8⅝
Braden Copper	8¾	Ohio Copper	1½
B. C. Copper Co.	4⅜	Ray Con	22⅛
Chino	48½	Tenn. Copper	40
First National	2	Tonopah Belmont	8½
Giroux	4½	Tonopah Ex	2½
Goldfield Con.	2½	Tonopah Mining	6⅜
Greene-Cananea	9⅜	Trinity	6
Hollinger	14½	Tuolumne Copper	2⅜
Inspiration	20⅛	Utah Copper	64
Kerr Lake	2⅜	West End	1½
La Rose	2⅜	Yukon Gold	3½
Mason Valley	12½		

Company Reports

TRANSVAAL GOLD MINING ESTATES, LTD.

This company was registered in the Transvaal in 1895 as the Lydenburg Mining Estates, Ltd., to acquire mining property in the Lydenburg district. The authorized capital is $3,072,000, of which $2,900,280 has been issued. There are also $595,200 5% first-mortgage debentures, in bonds of $480, $96, and $19.20 each. At the end of the financial year in 1911, its holdings comprised freehold farms with an area of 174,832 acres; mineral rights, 75,202 acres; and 989 mining claims of 155 by 413 ft. each, besides water-rights, etc. During the year ended March 31, 1912, the area was increased by 512 claims, and other property. An electric power station was built in 1911. The reduction plants consist of 75 stamps, 3 tube-mills, and cyanide plants at the Central, Elandsdrift, and Vaalhoek mines. Gold recovered at the three mills, during the year, totaled $1,910,000, and profit amounted to $1,060,000, while other revenue was $51,000. The Transvaal Government tax amounted to $91,000, and debenture interest $31,000. Dividends of $820,000 were paid and $384,000 was carried forward. In addition to the latter item there is $130,000 remaining from the issue of debentures, of which, however, $100,000 has been allotted to sundry items of further expenditure, including the Elandsdrift power-station, Peach Tree compressor plant, electrification of the Jubilee tramline, extension of crusher station, and a cyanide plant, which will give the central works a capacity of 13,000 tons per month.

BECHUANALAND COPPER CO., LTD.

This company was formed in 1909 by the Bechuanaland Exploration Co. for the purpose of acquiring the Bushman and other claims, situated 120 miles southwest of Bulawayo, South Africa. The capital is £135,000 in 10s. shares, and the issue of 100,000 shares was underwritten by L. Hirsch & Co., E. J. P. Jorissen is consulting engineer, and B. F. McDowell is manager at the mine. The development of the deposit of copper ore was commenced a year ago, along the lines recommended by A. J. Fraser, engineer to the Consolidated Gold Fields. The report for the year ended May 31 shows that altogether 7760 ft. of development work has been done, of which 2548 ft. was done during the year. A number of lenticular orebodies have been disclosed, and it is intended to pay special attention to those between the first and second levels. Mr. McDowell reports that on the first level four separate lenses have a total length of 608 ft., averaging 40 in. wide and carrying 5 to 17% copper; while on the second level, seven lenses aggregate 597 ft. in length, averaging 50 in. wide, and carrying 9 to 23% copper. Development on the third level has been hindered by the irregularity of the orebodies. A shipment of ore has been sent to England to determine the best method of extraction.

ARIZONA COPPER CO., LTD.

This company was formed in 1884 and has an issued capital of £703,985. It owns the Longfellow and Metcalf groups of copper mines, a smelter at Clifton, Arizona, and a railway serving the district. The half-yearly interim report for the six months ended March 31 shows a production equal to 9073 short tons of bessemer copper. The profit from the mine was £150,596, and £36,351 was received from the railway. Out of this £2733 has been paid as interest on debentures, £7767 as income tax, and £12,265 as dividend on the preference shares. The ordinary shares receive £94,993, being at the rate of 25% on 1,519,896 shares of 5s. each, and £69,187 is carried forward. This year £500,000 new debentures were issued for the purpose of raising the capital required for increasing the output, extending the dressing plant, and rebuilding the smelter. L. D. Ricketts has charge of the design and construction of the new plant, which will have roasters of the Herreshoff air-cooled type, three 12-ft. converters of the Great Falls type, and a stack 300 ft. high and 22 ft. diameter at the base.

James Lewis & Son's Copper Report

Copper has been under the influence of the great depreciation of securities on the European and American Stock Exchanges caused by the outbreak of war in the Balkans. After fluctuating between £78 17s. 6d. and £76 17s. 6d. cash, standard copper had a sharp fall to £72 2s. 6d. on October 14, but rapidly recovered to £77 5s. on October 16, subsequently declining to £74 2s. 6d. on October 22 and advancing to £76 8s. 9d. next day, only to fall again to £74 15s. on October 30. Closing prices on November 1 were £75 7s. 6d. cash and £76 three months prompt. Sales have amounted to about 57,000 tons. There has been but a very moderate demand for refined copper, manufacturers buying only for their immediate requirements. American refiners have sold but little electrolytic, of which sales have been made at 17¼ to 17⅜c., though the larger producers still hold for 17¾c. per pound. The present needs of American consumers appear to be covered by contracts still in force.

American shipments to Europe are advised as 24,670 tons for the past month. In view of this, a further considerable addition to the stocks held by refiners at the end of the month may be looked for, and, with the increased cost of holding them, due to dear money, there will be more desire to realize. European stocks have decreased 2529 tons, and the visible supply 1604 tons during the month. Imports are 310 tons and deliveries 7388 tons less than during the same period last year. The total arrivals in England and France for the month have been 17,188 tons and the deliveries 19,021 tons fine. The arrivals in England from Chile during the month have been 1475 and the deliveries 1451 tons fine, and from other countries 10,664 and 11,860 tons fine, respectively. The arrivals here and in Swansea from the United States have been 1872 tons bars, etc., 405 tons plates, etc., and 35 tons matte, equal to about 2276 tons fine copper, in London 510, and in France 4304 tons fine. The Chile charters for the month are advised as 3800 tons, including 2050 tons for the United States.

Quotations November 1: Standard, £75 7s. 6d. for cash and £76 three months' prompt; English best selected ingots, £80 10s. to £81 10s.; and tough cake, £80 10s. to £81 10s. per ton, less 2½% delivered Birmingham. Electrolytic wire bars, £80 10s. to £81 net cash c.i.f.; 13s. 6d. to 13s. 9d. for ore of 20%, and 14s. to 14s. 3d. per unit for Chile regulus or American matte free from silver.

STOCKS OF COPPER (TONS FINE)

	1912			
	Jan. 1.	Sept. 2.	Oct. 1.	Nov. 1.
Chilean in—				
Liverpool and Swansea..	4,225	5,558	5,279	5,303
France	714	981	987	951
American in—				
Liverpool and Swansea..	12,939	2,450	1,887	1,303
France	4,033	6,356	5,975	5,344
Sundries in—				
Liverpool and Swansea..	786	1,202	1,065	1,111
London and Newcastle...	6,462	3,840	3,969	3,580
Birmingham	346	470	470	453
France	507	549	622	628
English in—				
Liverpool and S. Wales..	17,346	16,030	16,879	16,627
Total in England and France	47,358	37,436	37,133	35,300
Sundries in—				
Germany and Holland...	13,400	4,696	3,737	3,041
Total European stocks.	60,758	42,132	40,870	38,341
Afloat (as advised by mail and cable to date)—				
From Chile	1,575	2,600	1,825	2,400
From Australia	8,350	5,600	5,250	5,600
Total visible supply...	70,683	50,332	47,945	46,341

Recent Publications

UNION DES INGENIEURS SORTIS DES ECOLES SPECIALES DE LOUVAIN. Bulletin. 173 pp., ill., diagrams. Brussels, 1912.

RESULTS OF SPIRIT LEVELING IN PENNSYLVANIA, 1899 TO 1911, INCLUSIVE. By R. B. Marshall. Bull. 515. 164 pages.

ACCIDENTS FROM FALLS OF ROOF AND COAL. By G. S. Rice. Bureau of Mines. Miners' Circular No. 9. 16 pp. Washington, 1912.

COAL MINING IN ARKANSAS. By A. A. Steel. State Geological Survey Bulletin. 632 pp.; ill., index. Fayetteville, Arkansas, 1910.

PRELIMINARY REPORT ON THE LEAD AND ZINC OF OKLAHOMA. By L. C. Snider. State Geological Survey Bulletin No. 9. 97 pp., ill., maps. Norman, 1912.

GEOLOGY OF THE BOULDER DISTRICT, COLORADO. By N. M. Fenneman. U. S. Geol. Survey Bulletin No. 265. 101 pp.; ill., index, maps. Washington, 1912.

SUMMARY REPORT OF THE MINES BRANCH OF THE DEPARTMENT OF MINES, CANADA, FOR YEAR ENDING DECEMBER 31, 1911. 208 pp., ill., maps, index. Ottawa, 1912.

THE IRON ORES OF MISSOURI. By G. W. Crane. State Bureau of Geology and Mines publication. Vol. 10. 434 pp.; ill., maps, index. Jefferson City, Missouri, 1912.

PRODUCTION OF LIME IN 1911. By E. F. Burchard. Advance chapter from 'Mineral Resources of the United States, 1911.' U. S. Geological Survey publication, 76 pp. Washington, 1912.

ENOLOGICAL INVESTIGATIONS. By F. T. Bioletti and W. V. Cruess. Agricultural Experiment Station, University of California Publication No. 230. 118 pp., ill. Berkeley, August 1912.

GEOLOGY OF DODDRIDGE AND HARRISON COUNTIES, WEST VIRGINIA. By R. V. Hennen. State Geological Survey Report. 712 pp.; ill., maps, index. Morgantown, West Virginia, 1912.

PRODUCTION OF COAL IN 1911. By E. W. Parker. Advance Chapter from 'Mineral Resources of the United States, 1911.' U. S. Geological Survey publication. 205 pp., ill. Washington, 1912.

LEAD IN 1911. SMELTER PRODUCTION. By C. E. Siebenthal. Advance chapter from 'Mineral Resources of the United States, 1911.' U. S. Geological Survey publication. 41 pp., ill. Washington, 1912.

ENGINEERING EXPERIMENT STATION. ROAD LEGISLATION AND ADMINISTRATION IN IOWA. By J. E. Brindley. State College of Agriculture and Mechanic Arts Bull. No. 1. 112 pp., table. Ames, Iowa, 1912.

ZINC AND CADMIUM IN 1911. SMELTER PRODUCTION. By C. E. Siebenthal. Advance chapter from 'Mineral Resources of the United States, 1911.' U. S. Geological Survey publication. 54 pp., ill. Washington, 1912.

PRODUCTION OF TUNGSTEN, VANADIUM, URANIUM, TITANIUM, MOLYBDENUM, NICKEL, COBALT, AND VANADIUM IN 1911. By F. L. Hess. Advance chapter from 'Mineral Resources of the United States, 1911.' 24 pp. Washington, 1912.

The following publications of the United States Geological Survey (Government Printing Office, Washington, D. C., 1912) have recently been received:

NITRATE DEPOSITS. By Hoyt S. Gale. Bull. 523. 36 pp., maps.

OIL AND GAS DEVELOPMENT IN NORTH CENTRAL OKLAHOMA. By R. H. Wood. Bull. 531-B. 31 pp., maps.

RESULTS OF SPIRIT LEVELING IN OHIO, 1911. By R. B. Marshall. Bull. 518. 108 pages.

SURFACE WATER SUPPLY OF THE UNITED STATES, 1910. Part IX. COLORADO RIVER BASIN. By W. B. Freeman, E. C. La Rue, and N. D. Padgett, under the direction of M. O. Leighton. Water-Supply Paper 289. 232 pages.

WATER RESOURCES OF CALIFORNIA. Part I. STREAM MEASUREMENT IN SACRAMENTO RIVER BASIN. By H. D. McGlashan and F. F. Henshaw, under the direction of J. C. Hoyt. Water-Supply Paper 298. 411 pages.

Book Reviews

Any of the books noticed in this column are for sale by, or can be procured from, the MINING AND SCIENTIFIC PRESS.

INDUSTRIAL CHEMISTRY FOR THE STUDENT AND MANUFACTURER. Edited by Allen Rogers and A. B. Aubert. 854 pp.; ill. D. Van Nostrand & Co., New York, 1912. For sale by the *Mining and Scientific Press*. Price $5.

GENERAL AND INDUSTRIAL CHEMISTRY. By Ettore Molinari; translated by Ernest Feilmann. 704 pp.; ill. P. Blakiston's Son & Co., Philadelphia, 1912. For sale by the *Mining and Scientific Press*. Price $6.

When two books upon the same topic and of approximately the same size appear simultaneously, it is natural to compare them, even though, as in this case, some injustice is thereby done to one volume. The forty-three chapters of the first volume have each been prepared by a specialist, many of whom have attained considerable distinction in the special field of which they have written. The second volume has been prepared by Mr. Molinari for the use of his classes at the Commercial University Luigi Bocconi at Milan, and is really two books in one, since the first part deals with general inorganic chemistry, followed by a discussion of inorganic industrial chemistry. Probably there is a field for such a work in Italian, and there is even some field for it in English, since the convenience for reference of having the whole subject of inorganic chemistry covered in one volume is considerable. Considering that the book has been translated from Italian into English by a German, its style is good, but its chemistry is so faulty as to greatly decrease its usefulness. Even in the part devoted to general chemistry the translator has corrected a number of erroneous statements occurring in the original, but since both author and translator are evidently unfamiliar with metallurgical chemistry, beyond the scope of European practice, the discussion of the recovery of gold, silver, copper, iron, and the other principle metals is so faulty from a general standpoint as to be almost useless except to one interested to know how these processes have been modified when worked on a limited scale in Europe. Italy is, for a European country, fairly well provided with mineral deposits, and has a notable place in the field of chemical engineering. As a survey of Italian practice this book will be of great interest, but it should only be used with caution by the general reader.

An adequate review of the volume edited by Messrs. Rogers and Aubert could only be written by C. F. Chandler or some one of similar attainment. The thirty-four collaborators who have aided the editors in the preparation of the book are all men entitled to speak with authority, and they have summarized the most recent American practice in the whole field of chemical engineering, even a chapter on laundering being included. A need for such a volume has long existed. Wagner's 'Chemical Technology' has long been out of date; the same may be said of the texts by Groves and Thorp. The excellent little volume of F. H. Thorp, though fairly recent and admirable as a text-book, is too brief for general reference, while the dictionary of applied chemistry by T. E. Thorpe is too expensive for the ordinary chemist. The text-book by F. H. Thorp is the only one written from the standpoint of American practice. The policy of the publishers in selling this volume at such a low price as to put it within the reach of all, cannot be too highly commended, and is likely to receive its reward in a correspondingly large sale for the book. Chemical engineering has some bearing on almost every form of industrial activity, and the number of those who will be grateful for the rendering available of so authoritative, concise, and cheap a work of reference is exceedingly large. T. T. R.

Concentrates

Most of these are in reply to questions received by mail. Our readers are invited to ask questions and give information dealing with the practice of mining, milling, and smelting.

'GOB' is a term used to signify waste left in the rooms or abandoned workings of coal mines.

TUBE-MILLS numbering 285, using a total of 27,511 hp., equal to 96.5 hp. each, were in operation at the end of 1911.

EMPLOYMENT of relatives by mine officials is a bad practice, and does not spell economy in any part of the world.

APPLICATION of graphite paint to the steel lining of a shaft in Wyoming has protected it from the action of acid water.

MACHINERY in the Transvaal mines, excluding 3157 motors of 179,947 hp. using purchased power, has a total of 590,590 horse-power.

COLLODION is recommended as a good material for restoring the surface of tracing cloth after erasing. It can be applied with a camel's hair or sable brush.

MEN employed in the different metal industries in Germany total 120,701, who average 94c. per day when paid by hours worked, and $1.26 when paid by piece-work.

BLASTING by electricity has not met with favor, and is not in use on the Kalgoorlie goldfield, and in instances where it has been tried it was found that holes frequently missed fire.

ACRE-FOOT is equivalent to 43,560 cu. ft., and is the quantity required to cover an acre to the depth of one foot. It is commonly used in connection with storage for irrigation work.

CRUDE-OIL production at Baku, Russia, in 1911, amounted to 6,870,967 tons, and shipments of illuminating, lubricating oils, and liquid fuel, were 1,370,966, 303,225, and 3,883,063 tons respectively.

ICE WATER supplied to men in hot mine workings is beneficial and increases efficiency. This has been proved at the Butte and Comstock mines. The men must only drink small quantities and at once return to work.

LUBRICATION is the life of a moving mechanical part. If you neglect this important attention to machinery, or do it on a hit-or-miss principle, you pay for it by broken parts, shut-downs, and other kindred troubles.

BALL BEARINGS on line shafting and other machinery show a large reduction in friction losses. A trial is to be made at the Perseverance mill, at Kalgoorlie, in fitting a No. 8 Krupp ball-mill with these bearings.

PAPER-PULP MILLS of Sweden require 72,800 tons of sulphur yearly, nearly all of which is imported from Sicily at a cost of $25 per ton at Baltic ports. Several years ago the question of importing American sulphur into Sweden was investigated; but nothing was done, owing to inability to solve the freight charges.

DETONATORS at the Panama Canal were found to be inefficient from two causes: (1) absorption of moisture, and (2) non-uniformity of detonator current explosive values. Investigations showed that the heavy charging of holes and condition of work often required detonators to be left in charged holes for 24 hours or more. It was discovered that some brands of detonators, after being immersed under varying heads of water for these periods, became saturated and the fulminate ruined. Others were not affected so much, but nearly all brands were found to absorb water. Three of the best brands made in the United States and one in Germany were tested under heads of 25 and 40 ft., and none was found impervious after immersion from 24 to 36 hours. Tests at the Ancon laboratory showed that deterioration was not due to free acids, as had been supposed, but primarily to composition and construction of the exploder itself. Manufacturers then supplied them impervious to heads of 40 to 60 ft. In one brand a cement plug is inserted just above the loose fulminate and at the point where shell deterioration had occurred. Above the plug a black viscous compound is inserted, and above this again the usual sulphur plug is put in as a cap. The other brand supplied is composed of a double jacket or shell, the inner one containing the fulminate at the bottom, a small quantity of guncotton, the bridge, and usual sulphur plug. This shell is fitted with the outer one, which is filled with a black compound completely surrounding the former. If the inner shell is deteriorated by sulphur action, the outer one and compound will prevent moisture reaching the fulminate.

Decisions Relating to Mining

Specially reported for the MINING AND SCIENTIFIC PRESS.

MINING COMPANIES—CONTRACTS

Where an attorney made a contract for services with a mining company, payment for which was, under the terms of the contract, to be made out of the proceeds of any sale of the mine, or if no sale be made, out of the net proceeds, from operation, not exceeding 10% thereof monthly, the contract limits the sources from which the attorney can compel payment to such proceeds or profits.

Lunch *v.* Keystone Consolidated Mining Co., (California) 126 Pacific, 968. October 18, 1912.

MINING CONTRACTS—REMEDY FOR BREACH

Where under an oral agreement that they were to receive a written lease for a term of years, the lessees of mining property took possession of it with the consent of the lessor and enter upon its operation, upon the refusal of the lessor to execute such lease, they may waive their right to specific performance, surrender the property, and recover in an action for breach of contract whatever reasonable expenditures they have made in preparation or taking out ore.

Rains *v.* Schermerhorn, (Kansas) 126 Pacific, 1085. October 12, 1912.

RE-LOCATIONS—PRIORITIES UNDER

Where the patent survey of a junior location was made prior to the patent survey of a senior location and the boundaries were corrected, in conformity with the calls of the location certificate, if a conflict is found with the surface covered by the senior location the lode line of which has been marked in the manner prescribed by law, the senior locator takes the conflict area. The failure on his part to file an amended location certificate with the recorder, prior to the patent survey does not invalidate the senior location, but merely puts the burden of proof upon the senior locator.

Where a claim is re-located so as to exclude prior patented ground, and in making such re-location, the claim owner takes in new ground, he in effect makes a new location and loses his priority under the former location.

Indiana-Nevada Mining Co. *v.* Gold Hills Mining & Milling Co., (Nevada) 126 Pacific, 965. October 7, 1912.

Commercial Paragraphs

The Braden Copper Co. of Chile has given the HARDINGE CONICAL MILL CO. an additional and repeat order for twelve more 8-ft. Hardinge pebble mills, making a total of sixteen now on hand or on order for this company. The Teziutlan Copper Co. has placed an order for four similar sized Hardinge mills. These mills are for semi-fine grinding, that is, to pass about 60 mesh.

J. W. STONEHOUSE, Victor, Colorado, reports sales of his patent enamel mine bell signals to many mines. These signs have a metal base and the codes are printed in enamel, the lettering being in white upon a dark blue ground. The signs are made to suit the laws and codes of the various states or any local requirement. Full information, with a large list of mines already supplied, will be furnished by the manufacturer.

THE TAYLOR IRON & STEEL CO. announces the acquisition of the Wm. Wharton Jr. & Co., Inc., of Philadelphia, Pennsylvania, with works at Philadelphia and Jenkintown, Pennsylvania, and its subsidiary corporation, the Philadelphia Roll & Machine Co. The Taylor company and the Wharton company have both had a successful history of more than fifty years. During the past eighteen years the business of each company has been largely supplemental to the other in the manufacture and application of manganese steel.

The C. O. BARTLETT & SNOW COMPANY OF CANADA, LTD., has been granted a Dominion Charter to deal in, manufacture, and install elevating and conveying machinery, power transmission machinery, engines, boilers, hoisting machinery, brick machinery, garbage reduction and destruction machinery, paint machinery, grain and cereal machinery, and to carry on a general line of engineering, manufacturing, and construction work. The head office of the company has been opened at 282 St. Catherine street, Montreal, with Herbert S. Hershey as general manager. This company is the outgrowth of the extensive Canadian business of the C. O. Bartlett & Snow Co. of Cleveland, Ohio, and although the connection between the Ohio company and the Canadian company will be very close for some time, the organization and management are entirely independent.

The remarkable properties of vanadium iron render it a peculiarly suitable substitute for common gray iron in castings subjected to heavy stresses. Tests have shown that vanadium tungsten iron has nearly three times the tensile strength of ordinary cast iron. It is, besides, remarkable for density of grain and hardness, hence it is almost impossible to break it by any ordinary means. It is an ideal metal for certain parts of rock-drills, such as the cylinder, chest, and air-heads, and the use of this metal in the Wood rock drills, made by the WOOD DRILL WORKS, of Paterson, New Jersey, accounts in a measure for the high efficiency and economy of these drills. They are strongest where most drills are weakest, hence are much less liable to suffer the accidents and breakdowns common in other drills. The use of vanadium tungsten iron in Wood rock drills marks a distinct advance in rock-drill construction.

THE TRAYLOR ENGINEERING CO., 30 Church St., New York, advise that they have had a great revival in business and that their works are now operating at their full capacity. Among recent orders are the following: Granby Con. Mining, Smelting & Power Co., carload of water jackets; C. H. Ziegenfus, complete crushing plant, consisting of crushers, screens, and elevator; Consolidated Mining, Smelting & Power Co., of Canada, one set of 42 by 16-in. 'AA' heavy-duty rolls; Miami Copper Co., six sets of 42 by 16-in. 'AA' rolls; El Rayo Mining & Development Co., one set of 30 by 14-in. and one set of 36 by 16-in. 'A' rolls; Stanwood Construction Co., three sets of 30 by 16-in. 'A' rolls; Cia. Minera Nazareno, two sets of 18 by 10-in. 'A' rolls, two sets of 9 by 10-in. 'B' rolls, and two sets of 7 by 10-in. Blake crushers; McIntyre Porcupine Mines, Ltd., complete 150-ton cyanide plant, consisting of rolls, tube-mills, Chilean mills, agitators, thickeners, classifiers, and a Traylor duplex continuous vacuum slime filter; Doe Run Lead Co., three sets of 42 by 18-in. 'AA' rolls; Teziutlan Copper Co., one set of 42 by 16-in. 'AA' rolls; Ducktown Sulphur, Copper, Iron & Mining Co., carload of water jackets; Balbach Smelting & Refining Co., complete equipment for doubling the capacity of the present smelting furnace; American Smelting & Refining Co.'s East Helena plant, 14 water jackets; Whitehall Portland Cement Co., one No. 7½ gyratory crusher; U. S. Gypsum Co., crushing plant, consisting of 60 by 84-in. screen and No. 7½ gyratory crusher; White & Bros., complete 100-ton copper smelting plant; Kennicott Mines Co., two 48 by 12-in. screens; U. S. Assay Office, complete grinding plant, consisting of crushers and 6-ft. improved Chilean mill; John Wunder, 20 by 24-in. Blake jaw-crusher, fitted with water-cooled bearings; Tacoma Smelting Co., two 15 by 24-in. Blake crushers, and two 24 by 36-in. Blake crushers; Mason Valley Mines Co., two carloads of water jackets. Wm. P. McGary, complete 100-ton rock-crushing plant.

Catalogues Received

A. LESCHEN & SONS ROPE CO., St. Louis, Missouri. House organ, 'Leschen's Hercules' for August and September.

T. H. PROSKE, Denver, Colorado. Catalogue of 'Imperial' Drill Sharpening Machine. 16 pages. Illustrated. 5 by 7 inches.

DODGE MFG. CO., Mishawaka, Indiana. Catalogue 106A-12, 'Power Transmission Machinery.' 48 pages. Illustrated. 6 by 9 inches.

LUMEN BEARING CO., Buffalo, New York. Booklet giving details of various alloys made by the firm. 9 pages. 3½ by 6 inches.

MCKIERNAN-TERRY DRILL CO., 115 Broadway, New York. Bulletin on 'Busy Bee' Hammer Drills. 16 pages. Illustrated. 6 by 9 inches.

CHICAGO PNEUMATIC TOOL CO., Chicago. Bulletin No. 121, 'Pneumatic Rammers and Foundry Equipment.' 8 pages. Illustrated. 6 by 9 inches.

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EDITORIAL

INCREASE in the public ownership of public utilities is strikingly evidenced in a recent German estimate that 30 per cent of the total railroad mileage of the world is state owned.

THE recent decision that the exhaustion of ore reserves does not depreciate the value of a mine is now supported by court testimony. In the case of the Silver King Consolidated Mining Company *v.* Silver King Coalition Mining Company, Mr. Solon Spiro testified that four and a half years' work, entailing an expenditure of $127,000, yielding $23,000, and leaving the claim with no ore developed that would pay for its extraction, had enhanced the value of the property!

UMEGAKA MARU, 'the odor of plum blossoms,' carries pleasant memories to many Americans. A fast naval auxiliary built by popular subscription during the Japanese-Russian war, this trim and comfortable steamer served in times of peace to carry passengers from Shimonoseki to Fusan. From this service she was detailed a year ago to carry the American mining engineers, visiting Japan, through the Inland sea, and none who enjoyed that trip will forget the comfort and pleasure afforded the travelers by their temporary home. In a recent storm the ship was wrecked and sank near Moji, ending a useful career fortunately through an accident of peace, rather than being destroyed gloriously but futily in war.

PROTEST is being made by Mr. W. R. Burdett over the action of the General Land Office in allowing patent to the Oxford and Gerold claims in Little Cottonwood canyon, pending a hearing before the local Land Office of a protest based on the alleged including by the claimant in his application for patent of work done long prior to his own location. It is now necessary to take the matter up with the Attorney General, and Mr. Burdett is involved in much additional expense. We know nothing of the merits of this case, but cite it as one of the sort that generates friction between the public and the Department of the Interior. It would seem that when the time for hearing a protest had been set by the local Land Office, a patent should hardly have been issued pending the hearing.

WHAT constitutes a public use, is a live question in Colorado, where the voters have apparently adopted a constitutional amendment designed to bring the 'smelter trust,' as orators there like to call the American Smelting & Refining Company, under jurisdiction of a public service commission. The wording of the amendment is so broad as to include all companies, associations, or corporations, engaged in "smelting, sampling, refining, reducing, milling, or otherwise treating ores, minerals, or metals." This may involve serious consequences for every milling company in Colorado, whether engaged in custom work or not. On the other hand, the corporation at which the amendment was aimed, can easily transfer the bulk of its business to other states. It is also, in the opinion of attorneys, still a question of fact whether an institution is a public utility, regardless of the amendment. Altogether the mat-

ter seems badly tangled at present. It is to be remembered that there would be substantial advantage as well as disadvantage if the whole mining and metallurgical industry was held to be a public utility. It would be pleasant and often economical to have the right to condemn land for a shaft or smelter, to mention only one such advantage. Furthermore, the good or harm flowing from the amendment just adopted will depend upon subsequent legislation and commission decrees.

SILVERTON, that most attractive mining city in the San Juan district of Colorado, is to have a new custom concentrator for the treatment of complex zinc ores. At present such ores yield but slight return because they are not properly dressed before shipment. With Mr. James M. McClave as engineer and the backing of the Silverton Commercial Club, a plant well suited to meet local conditions should result. To our way of thinking, this is much better than the building of a local experimental plant by the general government. What Silverton needs is facilities for producing commercial results with known process. The smaller amounts of ore needed for experimental work to discover new methods of treatment had much better be sent to the excellent plant at the Colorado School of Mines at Golden or the newly established laboratory of the Bureau of Mines at Denver. After methods have been formulated is time enough for the building of local plants, and even then, to get results, organization on a commercial basis is preferable. The disposition of Silverton's citizens to help themselves is a true expression of Western spirit at its best.

DIAMONDS have been found in Brazil since 1729, and for over a century and a half that country held first rank for diamond production. Bahia is even now a most important source of black diamonds such as are widely used in drilling, and at Bagagem and Agua Suja in Minas Geraes alluvial deposits yielding white stones of excellent quality are worked. In the last few years serious efforts have been made to interest capitalists in the United States in the development of these diamond fields, but the work has by no means been always well advised or even honestly conducted. The district attorney at New York is now investigating Mr. W. C. Meyer, who has been active in promoting diamond-mining companies in the United States, Canada, and England. An examination of one of the properties made by Mr. Louis S. Noble developed the fact that the total value of the gravel that it was proposed to work was about five cents per cubic yard, including in the estimate gold, platinum, and diamonds. In promoting this property a photograph of one of the dredges working at Oroville is said to have been represented to be that of a diamond-digging dredge at Jequitinhonha.

Constitution of the Institute

Elsewhere we print in full the Constitution and By-Laws recommended by the committee, Messrs. J. W. Richards, Charles Kirchhoff, and C. F. Rand, appointed at the Institute meeting on October 7 to consider the revision of the present fundamental documents of the Institute. It will be noticed that the provision for creation of a group of Fellows has been made as a separate amendment, so that discussion of this proposal may not interfere with acceptance of the documents as a whole. This and other features of the report of the committee are suggestive of comment for which this week we have no space, regular departments having been ruthlessly curtailed to make room for the full text of the report. We must add, however, that the principal change has already been carried into effect, since in the opinion of legal counsel, the action taken at the meeting in New York on October 7 and at Cleveland on October 30 was sufficient to authorize the present board of directors to increase the number of directors from nine to twenty-four. At the meeting held in New York November 12 a resolution was passed instructing the board to make the change, to be effective in February next. This removes from the realm of discussion the most important matter on which any difference of opinion has existed, and indicates that progress will henceforth be both rapid and effective. The names of ten new directors for election in February will be proposed by the committee on nominations, of which Mr. P. N. Moore is chairman, but the office of secretary will be filled by the board of directors, in anticipation of the adoption of the revised Constitution and By-Laws.

California Miners and Minerals

The meeting of the California Miners' Association in this city on December 9, 10, and 11 is an opportunity for effective action that should not be allowed to pass unutilized. The Association has been effective for good ever since its formation twenty years ago. At that time the situation was such that the future of the mining industry in this state seemed seriously threatened. County associations of miners, commercial bodies throughout the state, the Chamber of Commerce and the Board of Trade of San Francisco, and other organizations united in effective action which resulted in securing the passage of the Caminetti Act and other useful legislation. During the years that followed, the Association labored to further the interests of the whole mining industry of the state and accomplished much good, but more recently interest in the Association has flagged for the lack of a vital issue around which to rally support. Now there is no lack of one. Workmen's compensation legislation and the conservation policy, in its relation to mining, are of present importance and interest, but above all, plans and construction are already well advanced for the Panama-Pacific International Exposition, to be held in this city in 1915. Intended as it is to further the development of industry and trade on the Pacific Coast, its keynote must be natural resources. In an exposition held in the golden city by the Golden Gate, in the golden state of California, known for the gold of its rivers and mines, the gold of its sunshine, and its golden orange groves, it is inevitable that gold shall be the dominant note. But the wealth of California lies not in gold alone, but in a variety of other products which, though less potent to allure, are yet none the less important as sources of profit and progress. The mineral exhibit at our exposition in 1915 should surpass any ever gathered together at an exposition. For this we have the necessary materials and facilities, and if the final result shall be less than may rightfully be expected of us, it will be because the necessary efforts were not made, and made soon enough. The time remaining before the opening of the Exposition is not great, and the gathering together and arranging of a mineral exhibit is a tedious task. We urge the fullest coöperation of everyone interested, not only in the mineral industry of this state, but of all interested in the development of the West, for the fundamental character of the mineral industry makes it of importance even to those whose activities have no apparent contact with it. What a few cannot do, even with much effort, can easily be done by all working in harmony. The wind seems light upon a sailor's finger, but on the sails it exerts a pressure that speeds the ship along. Let everybody push, even if only a little.

Revision of the Mineral Land Laws

The report of the committee of the American Mining Congress on general revision of the mineral land laws, presented at Spokane this week by the chairman, E. B. Kirby, is summarized below:

The Report

The committee reports that it was unable to secure any action by Congress at the past session toward a general revision of the land laws. What was within the ability of the committee has been done. There has been much correspondence, and its chairman has personally made three visits to Washington. Two attempts were made to interest the Administration in the proposed measure, and it was also presented to the chairman of the Committee on Mining and the Committee on Public Lands in the Senate and House, but without result. Reed Smoot, senator from Utah, who is chairman of the Senate Committee on Public Lands, approves the measure, made genuine efforts to assist the committee, and went with its chairman to W. L. Fisher, Secretary of the Interior, to ascertain whether the Administration would not take up the revision as part of its program. The Secretary declared himself in favor of correcting certain special points such as the apex law and the unlimited number of locations. He did not then decide whether to take up a general revision, but has since done nothing in the matter, except to recommend the abolition of the apex law in Alaska, and it is evident that the attempt to show him the impracticability of patchwork revision was unsuccessful. On inquiry in the Senate, an unexpected opposition developed on the part of a certain senator who was opposed to any change in the laws. Mr. Smoot was therefore obliged to drop the matter, explaining that with his overwhelming burden of work he could not undertake to push a measure against opposition in the Senate unless the Administration supported it. In the House no one was found willing to undertake the laborious work involved without first knowing that the measure would be successful in the Senate. (It may be added that the opposing senator will not appear in the next Senate.)

This experience has made several points clear:

1. The plan of the American Mining Congress for a general revision is universally approved as soon as it is understood. It is now evident that it will have no opposition except that small percentage which always appears when anything new is proposed and which usually comes from extreme conservatives, who are by nature opposed to any improvement in existing laws. It is indifference and not opposition which must be overcome in order to secure the revision.

2. No measure of reform which is not widely known and understood can be carried through unless it is steadily pushed by some active aggressive men. Legislators are like other men, unwilling to move in a business which they do not understand, and only a very small percentage of the hundreds of individuals at Washington who have to act in the matter are familiar with mining laws or their effects. To make the situation clear enough to induce action there must be long persistent work by some one on the spot.

3. This must be done by the American Mining Congress itself. No legislator will do such trying work unless he is keenly interested in the subject. The men with initiative enough to undertake such things are soon overloaded, and it would take a prolonged search to find and interest some senator or representative who was willing and also free to undertake it. It will therefore be necessary for the American Mining Congress to follow the same procedure that was required in creating the Mining Bureau. It must have a representative at Washington pressing the revision measure. While the secretary of the American Mining Congress was there during the last session he was too much overloaded with other matters to undertake the revision business. It is necessary to face the fact that the American Mining Congress cannot secure revision or any other relief for mining unless it provides enough money to do the work required at Washington, and this committee is unable to proceed further until some effective means are provided for following up its efforts.

The attached memorandum was submitted with the report. In it are summarized the chief reasons for urging a general revision.

Imperfections of the Present Laws

The mineral land laws of the United States and Alaska, framed in 1872 and interwoven with a mass of supplementary state legislation, differing in every state, fail to meet the present requirements of the industry. Moreover they have developed various evils the injurious effects of which are steadily increasing. These have become so serious as to retard the development of mining and to create dissatisfaction and complaint everywhere.

At every annual session of the American Mining Congress during the past twelve years the prevailing discontent with the present code has been voiced by various resolutions calling attention to its evils and asking for the correction of this or that feature of the laws relating to mineral claims located upon the public domain. Such complaints steadily increasing in volume have found expression not only in the Mining Congress but also in the press of the mining communities, all the mining journals, in the societies of mining engineers, and, in fact, through every medium available for the expression of public sentiment. They have nevertheless been without result for the reason that the mining laws are largely interdependent and it is difficult if not impossible to correct one fault without straightening out the entire code. Moreover, the states affected, some of which have often attempted to make improvements, find that nothing effective can be done without the action of Congress. In short, patchwork is impossible and a general revision is necessary.

Difficulties of the Work

Since the problems involved in the work are peculiar to the industry and are unusually difficult, it is evident that their satisfactory solution will require the aid of the most experienced judgment together with a free and direct expression of views by the mining communities themselves. Among the many questions which will arise during a revision are the following, which will illustrate the nature of the work.

Some of the Problems

The apex law is responsible for many uncertainties of title and much litigation is caused by it. The latter includes not only the conflicts caused by the extralateral right, but also those occasioned by the consequent shapes of claims and the overlapping of lines. The creation of a definite procedure for acquiring rights to those claims in which the mineral is not near the surface and where discovery must in consequence be long deferred, is badly needed. Tunnel locations and the uncertainties of title caused by them in neighboring claims, must be adjusted. The present non-observance of the law of discovery is a grave matter. The partial or complete non-observance through various expedients of the law of assessment is an open scandal. The location of an unlimited number of claims by one individual is wrong and should be stopped, as should locations by proxy.

Reasons for Revision Now

A general revision now will be particularly timely because of the public interest in conservation and the new legislation now under consideration, for timber, oil, phosphate, and coal lands, and also power-sites. To omit the mining code from any program for the betterment of laws relating to natural resources would be to pass by the field where relief is most urgently needed.

The Action Requested

The American Mining Congress at its last annual session therefore reached the following decision:

That Congress be asked to undertake promptly a general

revision of the mineral land laws, which, in view of the difficult problems presented, should be in coöperation with the mining industry. The plan adopted for this coöperation should give all sections opportunity for public hearing and the discussion of remedies. The Mining Congress will suggest a practical plan for this purpose later on if desired.

In requesting action upon this matter it is therefore suggested that if Congress will authorize a committee to act, the representatives of the American Mining Congress will be pleased to furnish such detailed information and suggestions as may aid the committee in preparing a plan, whether for a commission or otherwise, which will accomplish the ends desired. A joint resolution like the following is suggested:

That ——— committee ——— is instructed to prepare and submit at this session a mode of procedure whereby Congress may undertake a general revision of the mineral land laws of the United States in the way which will best promote the public welfare and meet the peculiar needs of the mining industry. The plan recommended should provide a practical means whereby Congress may utilize the best experience and judgment available in the industry and which will give the mining regions of the United States and Alaska ample opportunity for public hearings and the discussion of remedies.

After Congress has empowered a committee to act, the committee of the American Mining Congress hopes to have the opportunity of presenting to the committee at Washington such detailed information and suggestions as may aid in preparing a plan whether for a commission or otherwise, which will be satisfactory to Congress and accomplish the ends desired. It is believed that this may be secured through a wisely selected commission, authorized to draft a revised code for the use of Congress. This commission should hold public hearings in the principal mining centres of the West and Alaska. It should call before it men prominent for their knowledge of prospecting, of claim locations, of mine operating, mine litigation, and the history of mining laws, and should invite opinions from the public bearing upon the specific points at issue. The authorities and experience of other mining countries should also be consulted and made public and the final recommendations of the commission should be presented to Congress in the form of a full drafted code.

It is clear that there is a best practical solution for each one of the difficult problems involved in a general revision of the mineral land laws, but in order to determine these best solutions all opinions must be brought to a focus before some authoritative body which has the power of decision. Moreover, in order to assure the general approval and acceptance of reforms affecting so many varied interests, the personnel of this body should be such as to command confidence, and the mining communities should have full opportunities to present their views before it. There is a wealth of learning and practical experience in the country, which is available for the work of framing a revised code, but it is distributed among many men and must be focused by the plan indicated.

Ore production of Silesia in 1910 and 1911, was, respectively, in metric tons: iron ore, 251,000 and 181,000; zinc ore, 591,000 and 572,000; and lead ore, 55,000 and 48,000. The following table shows the falling off in the iron-ore production in Upper Silesia since 1900:

Year.	Metric tons.	Year.	Metric tons.
1900	406,839	1906	244,863
1901	457,126	1907	282,515
1902	428,132	1908	263,745
1903	369,189	1909	233,368
1904	337,396	1910	233,823
1905	314,955	1911	150,197

The flooding of the Bibiella mine was the principal cause of last year's sudden drop; and as several leased mines are working without profit and only because of their contract obligations, the production is expected to remain low in the near future. On the other hand, the consumption of iron ore in Upper Silesia has exceeded 1,000,000 tons in each of these years, amounting to 1,112,120 tons in 1910 and to 1,120,213 tons in 1911. There is a good demand for all sorts of foreign ores in the province. Upper Silesia makes from galmei and zincblende about 150,000 tons of raw zinc, which is about 65% of the production of Germany, and Germany produces a large percentage of the world's supply of raw zinc.

Electrolytic Copper Extraction in Norway

By Charles Adams Holder

For several months a company at Aamdal, Norway, has been successfully extracting copper from the crude ore by an electrolytic process invented by Victor Hybinette, a Norwegian engineer, who has patented the process in Europe and the United States. The Aamdal works have proved so successful that plants are now under way for increasing the output to 3 tons of metallic copper per day. The treatment consists in leaching the crushed ore with a dilute solution of sulphuric acid, which dissolves out the copper; the copper sulphate solution is then electrolyzed and the copper precipitated. Experiments with copper pyrite from the Orkla and Sulitjelma mines, in which much foreign capital is invested, have been equally successful, and as a result these ores will probably be treated by the Hybinette process in the future. The ores were formerly shipped to Germany and Sweden, respectively, owing to their refractory character and to the lack of proper Norwegian reduction works, but of late the Sulitjelma company has not been able to mine with any profit by this plan owing to the cost of transportation. The new process will therefore mean a great deal to the copper industry of Norway.—*Daily Consular and Trade Reports.*

Gold in Seward-Sunrise Region

Gold was first discovered in Alaska in 1848, in the gravels of streams tributary to Kenai river, by P. P. Doroshin, who was then making an examination of the mineral resources of the district for the Russian-American Co. Owing to the low gold content of the auriferous gravels found at that time, there was little prospecting. Scarcely anything is known of any activity in the goldfields of Alaska between 1850 and 1894, though it is stated that gold was discovered on Cooper creek in 1884, on Resurrection creek in 1888, and at Anchor point in 1889. Placers were found on Bear and Palmer creeks in 1894 and on Canyon, Mills, and Lynx creeks in 1895. These discoveries were followed, in 1896, by a stampede of several thousand men to this field. Crow creek was staked at this time, but did not yield any gold until two years later. In 1898 a second rush, partly an overflow from the Klondike stampede, was made to the Turnagain Arm section.

In a report entitled 'Gold Deposits of the Seward-Sunrise Region, Kenai Peninsula,' by B. L. Johnson, recently issued by the U. S. Geological Survey as Bulletin 520-E, the distribution and occurrence of gold-bearing lodes and placers of the upper part of Kenai peninsula are discussed. Although the present known distribution of auriferous gravels in the district is widespread, the list of producing creeks is small. About 25 claims were being worked at one time or another in 1911, and from 75 to 100 men were engaged in placer mining during the open season. The production of placer gold in 1911 from Kenai peninsula is estimated at 1540 oz. crude, valued at $26,000 for gold and $150 for silver. The value of the placer gold of this region varies from $15.86 to $17.87 per ounce. Assays of the gold lodes of the region range from $1 to $718 per ton.

Although the temperature frequently falls as low as 40° below zero in midwinter, the conditions near Seward, Sunrise, and Hope are favorable for gardening, vegetables being raised in considerable quantities for local consumption. Cranberries, currants, blueberries, huckleberries, and a few salmonberries grow wild. Native grasses are abundant, furnishing good feed for horses during the summer. Considerable hay is now being made in the peninsula, especially in the vicinity of Hope and Sunrise.

The Black Oak Mill

By Charles H. Urquhart

The Black Oak mill at Soulsbyville, on the East belt of the Mother Lode in Tuolumne county, California, marks a new departure in Mother Lode milling practice. It is, I believe, the first all-sliming plant in the state. As it has proved successful, a description may prove interesting.

The mine has been operated intermittently for many years and has an enviable record for gross production. The former method of milling was the customary crushing with light stamps, amalgamating, and concentrating with vanners and a canvas plant. The mill had 40 stamps. The extraction was never good, and many thousands of dollars' worth of high-grade tailing went down the creek. The present company quickly realized that more modern methods of recovering the gold must be employed if the mine was to be a financial success. From results obtained by cyaniding the concentrate, followed by careful tests with the ore, it was found that no unusual or insurmountable difficulties stood in the way of successful treating the ore by cyanidation. The present mill is the result. Nothing remains of the old mill but the building within which all the new equipment is placed, the feeders and the ore-bin.

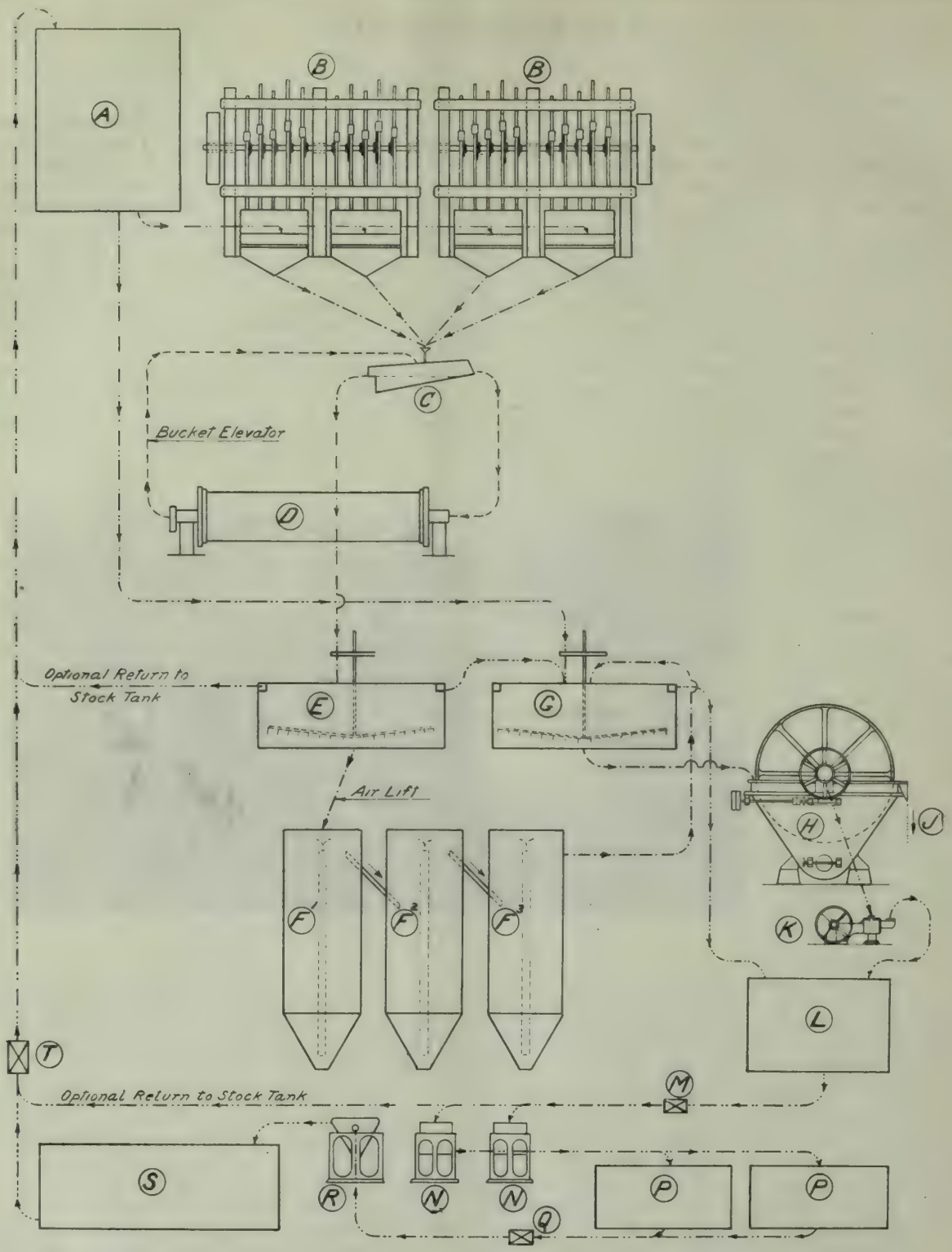
BLACK OAK MILL, SOULSBYVILLE, CALIFORNIA.

The ore is fairly high grade, is very hard and silicious, and requires much work to reduce it to pass a fine screen. Even when passing 200 mesh, it is still granular and not a slime in the accepted meaning of the term. It is roughly hand-sorted at the hoist, being dumped from the skip over a grizzly into a small bin holding but a few cars. The coarse material passes through chutes to the sorting platform and the sorted ore is crushed in a Blake crusher, after which it is trammed to the mill. Each car is weighed on platform scales and sampled before reaching the mill. The mill-bin is small, holding but 180 tons. This is not altogether a drawback, as it takes only a little time and labor to level off the ore and accurately measure the contents at any time. As a check on the daily tonnage crushed this has been found to be very valuable. The twenty stamps used in the old mill were light, 750 and 850 lb., and have now been replaced by new stamps weighing 1250 lb. The feeders are the Challenge, of the non-suspended type. The mortars are the high, rapid-discharge sort, with bases 12 in. thick, and weigh 8500 lb. each. The foundation for the mortars is a monolithic concrete block carefully constructed of selected quartz and granite. Screenings accumulated while coarse-crushing the quartz were mixed with clean river sand, thus making a sharp product for use in the concrete mixture. After shoveling of the concrete into the forms began, it never halted until the entire block was finished. After six months continuous use no signs of deterioration have been discovered.

The ore is crushed in 1.85% cyanide solution, or 3.7 lb. per ton, through Tyler ton-cap screens with openings equivalent to 10 mesh. The pulp passes to a Dorr standard duplex classifier from which the coarse material goes direct to the 5 by 18-ft. tube-mill, being diluted to 39% moisture. The slime-overflow passes to the treatment-tanks. The discharge from the tube-mill is returned to the classifier by a bucket elevator, so that the pulp must return to the tube-mill until fine enough to escape at the slime end of the classifier; the usual closed-circuit arrangement. A Morse No. 25A 6-in. silent chain and spring sprocket drive takes the place of the customary belts and countershafting. It makes a very neat and compact arrangement, the centres of the motor and tube-mill pinion shafts being but 42 in. apart. Absolutely no trouble from this drive has been encountered during the seven months that the mill has been operating, and it is evident that a considerable saving in power has been made over the belting and counter shaft method of driving.

Considerable trouble was had with the lower bearings of the bucket elevator. Sand and slime worked into the bearings and rapidly destroyed them. This was overcome by placing the bearings 7 in. from the elevator, outside the boot, and putting collars on the shaft between these outboard bearings and the boot to act as baffles. The bearings now keep quite clean and show no wear.

The liners of the tube-mill are smooth cast iron, a mixture of chrome, manganese, and white iron; and are made in a local foundry. They are very hard and, judging from the present rate of wear, should last about twelve months. They are 13½ in. wide, 41 in. long, and 2 in. thick, set staggered with shorter pieces at the ends. Lugs or pads back of the bolt-holes, 4 in. square and ¼ in. thick, prevent breaking the liners when bolting. No cement is used, as the narrow space behind the liners soon fills with slime. After the mill had been running a few weeks it became apparent that the tube-mill was not keeping up to its early performance. The pebbles were wearing flat and the inference was that they were skidding in the mill, thus losing the tumbling action requisite for effective grinding of this hard ore. Cast strips of hard iron were procured, 3 in. wide, 2 in. thick, and of the same length as the liners. These were bolted in the tube in such a manner that they made long strips 2 in. high the entire length of the tube; a strip for every alternate row of liners. Bolts passing through the strips and main liners take the place of the original bolts; a washer of old belting between the strips and the liner preventing the hard brittle strips from breaking when tightening the bolts. The results were marked, and the output was increased at once. Again the tube-mill was opened and



— LEGEND —

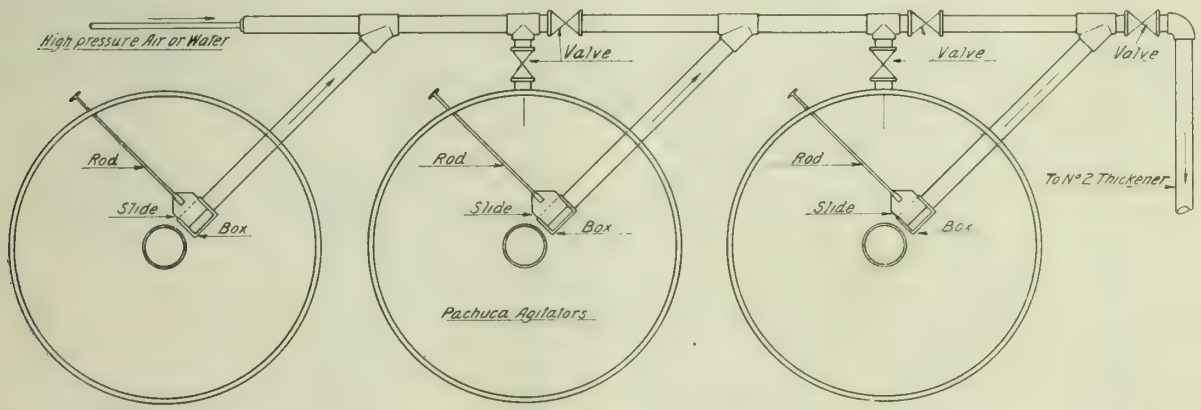
A – Stock Tank (140 Tons).
B – 20 Stamp Battery (1000 lb. Stamps).
C – Classifier (Dorr Duplex).
D – Tube Mill (5'x18').
E – Dorr Thickener (20'x10').
F – Pachuca Agitators (10'x30')
G – Dorr Thickener (20'x10')
H – Oliver Continuous Filter
J – Filter Residue Discharge
K – Vacuum Pump
L – Collecting Tank
M – Dow Duplex Pump (4"x6")
N – Shriver Clarifying Presses.
P – Gold Tanks. (15 Ton).
Q – Dow Duplex Pump (4"x6")
R – Merrill Precipitating Press
S – Sump (70 Ton).
T – Triplex Pump (5½"x8")

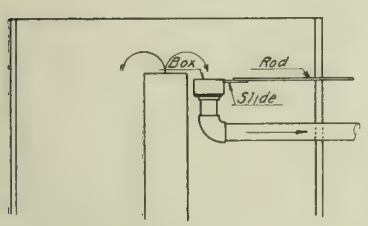
FLOW SHEET OF BLACK OAK MILL
SOULSBYVILLE, TUOLUMNE CO., CAL.

another set of strips put in, now making a strip for every row of liners. The grinding at once fell off and the starting-load of the motor became excessive. The second set of strips was taken out and the efficiency of the mill returned to the point first reached by the original arrangement of strips. Since these strips have been employed the output of the mill has been increased 13.4%, and the life of the main liners has been materially lengthened. After four months' steady work the strips show but a slight rounding of the upper edges. The mill revolves 23 r.p.m., taking practically 60 hp. to operate and 100% overload to start.

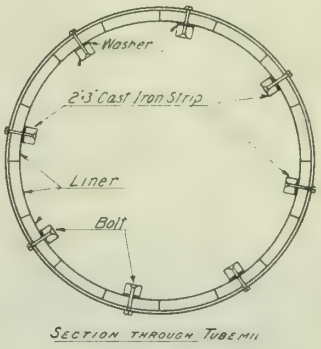
The pulp from the classifier goes to a 20 by 10-ft. Dorr thickener, where it is thickened from a 6 to 1 consistence to 2 to 1 for agitation. When the mill was started the pulp from the thickener was elevated to the agitators by a centrifugal pump, but in a very short time the compressor furnishes air at 40 lb. pressure for the agitators, the air-lift, and the vacuum-filter. The power consumed for agitation as shown by the meter is 3.4 hp. per agitator.

Having passed through the agitators the pulp flows to another Dorr thickener, the same size as the first. The overflow from No. 2 thickener goes to a small collecting-tank, as it is called, from which it is pumped to the clarification and precipitation presses. The thickened underflow passes to the filter. As the ore milled averages $20 per ton, the resulting solutions are high in value. In order to reduce the value of the solution in the pulp going to the filter, the contents of the No. 2 thickener are diluted as follows: The overflow from the No. 1 thickener, assaying about $3 per ton, is passed to the centre of the No. 2 thickener, mixing with the inflowing pulp coming from the agitators, containing solution which





ARRANGEMENT OF AGITATORS FOR CONTINUOUS AGITATION



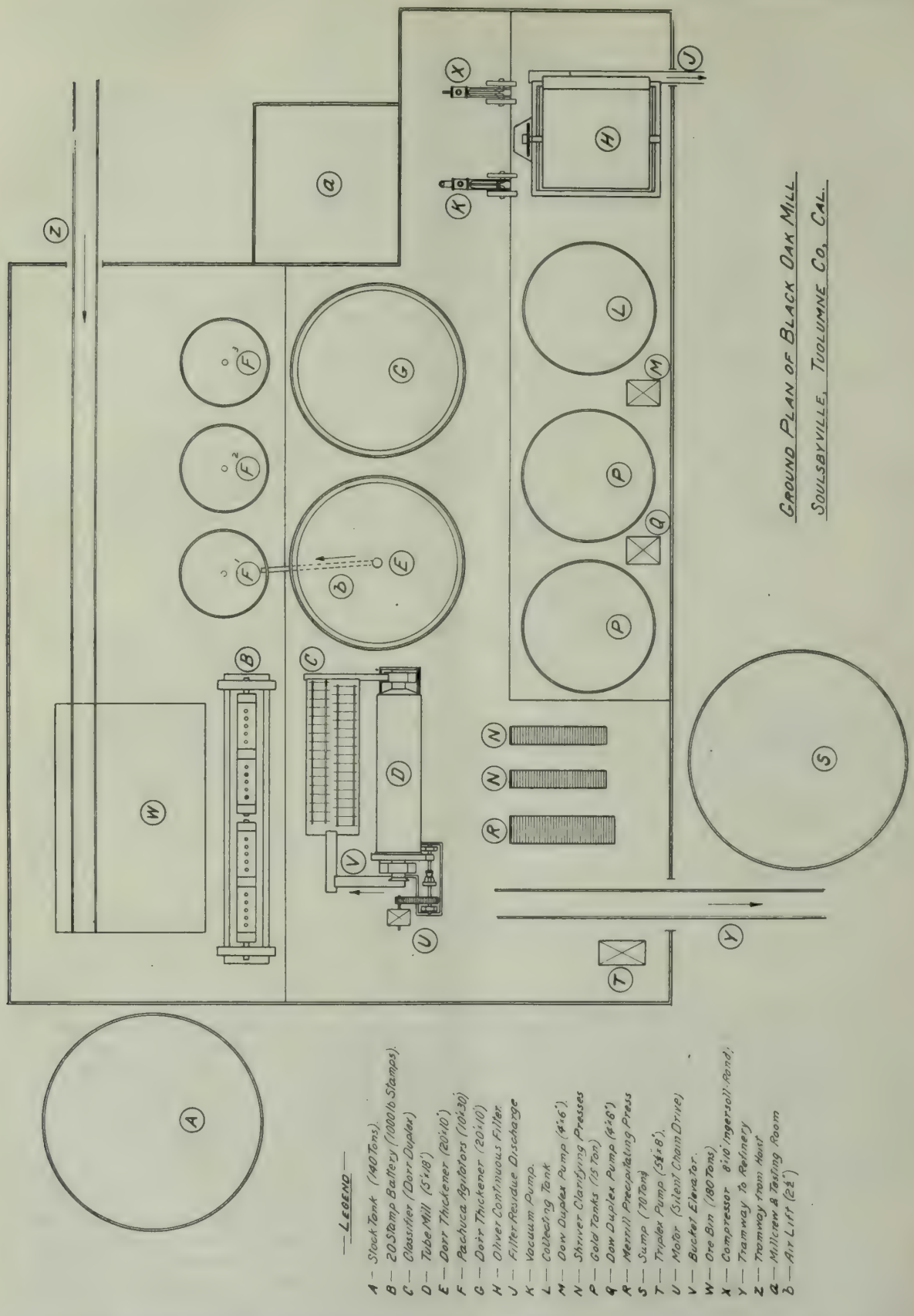
SECTION THROUGH TUBE MILL

BLACK OAK MILL
SOULSBYVILLE, TUOLUMNE CO., CAL.

hard gritty slime abraded the liners, flanges, and impeller to a ruinous degree. A 2½-in. air-lift was then substituted, and although the work to be done was not in accordance with good air-lift practice, the total lift being 18 ft. and the submergence but 50%, nevertheless the results have been quite satisfactory and no repairs nor alterations have been necessary. The power consumed is 6 horse-power.

The agitators are three in number and of the Pachuca type, 10 by 30 ft., and connected for continuous agitation. They are so arranged that any agitator can be by-passed and cut out of the circuit, as illustrated in the sketch. In order to make certain that the pulp of uniform grade passes continuously through each agitator, a very simple sampling box is arranged on the end of the pipes connecting them. On the top of the box is a slide which is readily adjusted so as to regulate the amount of pulp flowing in and out of each agitator. This takes an accurate sample of the pulp as it falls from the central tube; a very essential matter when treating a pulp which segregates as rapidly as does the granular product treated here. A spider with six radiating jets supplements the main working air jet as a help in starting at any time. The spider and the main jets are connected with both high-pressure air and high-pressure water, although the water has never been required. An Ingersoll-Rand 8 by 10-in.

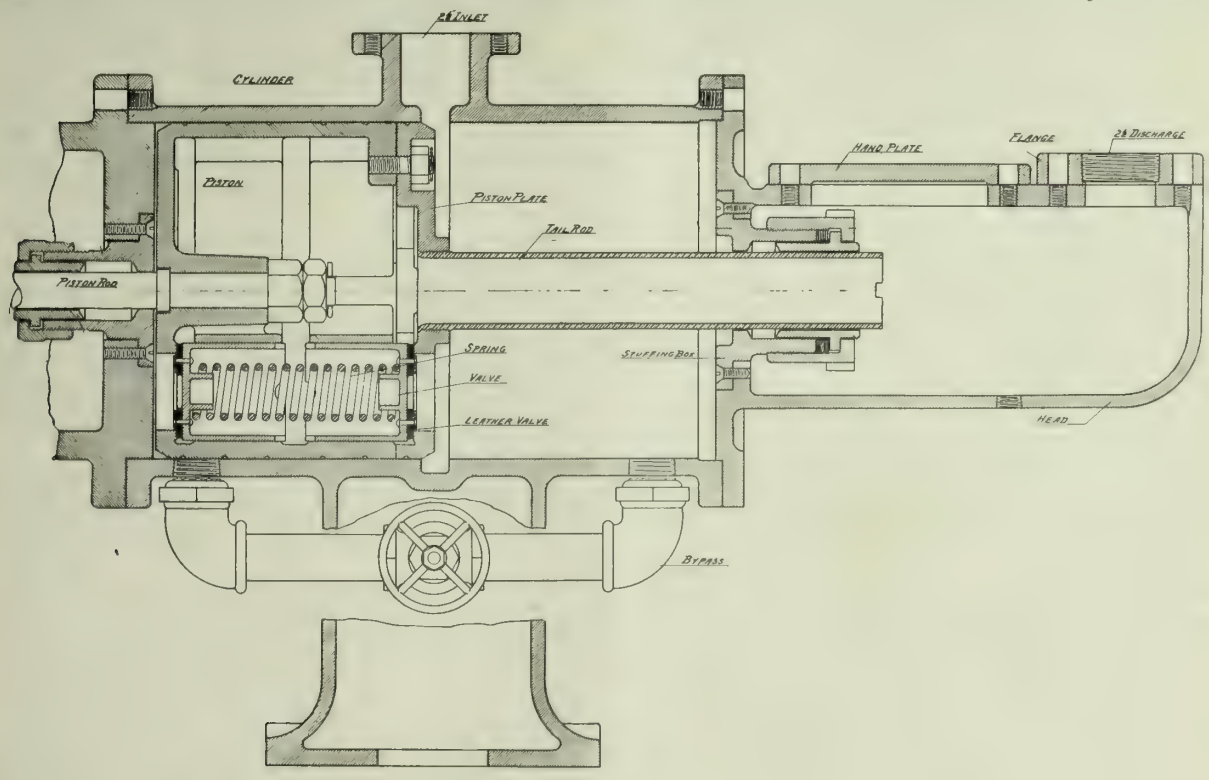
assays around $8. As there is twice as much solution coming from the No. 1 thickener as from the agitators, the resulting mixture of solutions in No. 2 has thus been diluted to about $3.30 per ton in value. To further dilute this solution, barren solution from the stock tanks is run into the second thickener inflow and also to the thickened underflow. Thus the solution that came from the agitators worth $8 per ton has been reduced by dilution to under $2. The filter is an Oliver with a drum 11 feet 6 inches in diameter and 12-ft. face. It is rated by the makers as a 75-ton machine, but with our ore it can easily take care of 100 tons per day. Considering the many excellent filters on the market, the problem of selecting the best one for a new mill is not an easy one. At the Black Oak the Oliver was chosen because in theory the washing of a thin cake seemed more practicable than the washing of a thick cake; because the filter was continuous, simple, and cheap to install and operate; and finally, because a special filterman was not required. Now that the mill crew has become familiar with the machine, it has been found that these conclusions have been borne out in practice and the filter has proved to be splendidly efficient. In the beginning poor results were obtained with the washing. The cake was ½ to ⅝ in. thick and the displacement was incomplete, as much as 20c. being lost at times in dissolved gold and cyanide with the tailing. A spraying


GROUND PLAN OF BLACK OAK MILL
SOULSBYVILLE, TUOLUMNE CO, CAL.
—LEGEND—
A — Stock Tank (1400 Tons).
B — 20 Stamp Battery (1000 lb Stamps).
C — Classifier (Dorr Duplex)
D — Tube Mill (5'x18')
E — Dorr Thickener (20'x10')
F — Pachuca Agitators (10'x30')
G — Dorr Thickener (20'x10')
H — Oliver Continuous Filter
J — Filter Residue Discharge
K — Vacuum Pump.
L — Collecting Tank
M — Dow Duplex Pump (4"x6").
N — Shriver Clarifying Presses
P — Gold Tanks (35 Ton)
Q — Dow Duplex Pump (4"x6")
R — Merrill Precipitating Press
S — Sump (70 Tons)
T — Triplex Pump (5"x8").
U — Motor (Silent Chain Drive)
V — Bucket Elevator.
W — Ore Bin (180 Tons)
X — Compressor 8"x10" Ingersoll Rand.
Y — Tramway to Refinery
Z — Tramway from Mine
a — Millman & Testing Room
b — Air Lift (2½")

device was later supplied by the Oliver people, and the difficulty was solved at once. The pulp-level in the tank is kept fairly low and an air wash given until the cake emerging from the pulp in the tank has traveled half the distance, when the line of sprays is met and the washing begins. Since the sprays have been installed the displacement has been almost perfect; the solutions are easily kept in accurate balance, and no excess has been built up by over-washing. The filter takes but a small proportion of the solution-man's time, and the power consumption is small. Repairs are infrequent and cost but little.

Soon after the plant was started a curious black deposit began to form on the filter cloth. It spread rapidly, clogging the cloth, and reducing the available filtering area almost one-half. Hard scrubbing with a 6% HCl solution twice a week eventually removed the deposit. Later the scrubbings were made but once a week, and the HCl solution reduced to 4%. The cloth has been on for seven

months and, barring accidents, should last many months to come. The weekly scrubbings are doubtless the secret of the long life. The filter is scrubbed once a week whether the cloth appears to need it or not. The Oliver filter requires a vacuum pump of much higher efficiency and greater capacity than a leaf type of filter of similar capacity, not only because it is essential to maintain a higher vacuum than is used on the leaf filter, but because a larger quantity of air has to be handled, due to the exposed portion of the drum. For these reasons the types of vacuum pumps commonly in use for leaf-filter plants give very poor results with the Oliver filter.



WET-VACUUM PUMP CYLINDER FOR T-O TYPE.

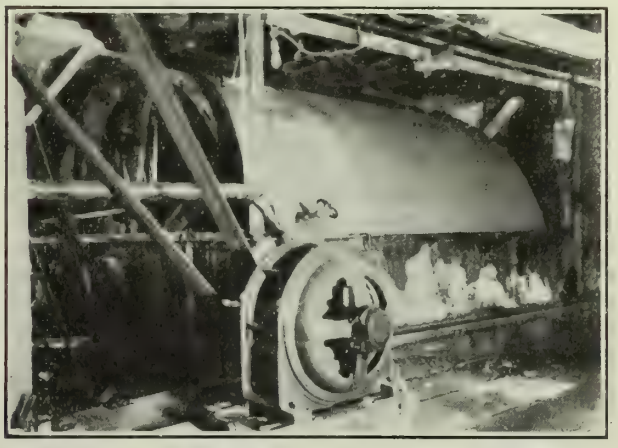
The pump installed at the Black Oak mill was built by the Doak Gas Engine Co., being a modified type of a pump especially designed by George D. Kislingbury, superintendent of Minas del Tajo, Rosario, Mexico, for the three Oliver filters there. It has a 12 by 10-in. cylinder, and differs from other wet-vacuum pumps in that there are no inlet valves, there is practically no clearance, and the discharge valves are in the piston.

The solution is admitted to the cylinder through ports in its centre, which are opened and closed by the passage of the piston. The solution is discharged through a hollow tail-rod into an enclosed false-head which serves the double purpose of allowing the solution to be discharged under pressure and acting as an air chamber to relieve the shock of the pump. Because of the unusually large valve area the pump may be operated at a speed of 125 r.p.m. without shock, and the small clearance space admits of discharging under relatively high heads without loss of efficiency. A peculiar feature of this pump which puzzles most operators is that it requires only half as much power to operate at 25-in. vacuum as at 12-in. vacuum. The actual power consumed while operating the filter at 22-in. vacuum is 6 horse-power.

The solution from the filter discharges into the collecting-tank mentioned above and is pumped to either of two 24-in. 36-frame Shriver filter-presses for clarification. From the gold-tanks that receive the clarified solution it is pumped to a 52-in. 16-frame Merrill press, zinc dust being added in the customary manner to the suction of the pump. While no difficulty has been found in precipitating the gold almost completely, by allowing the effluent to assay 10 to 15c. per ton, the tendency to accumulate excess zinc is avoided.

The barren solution passes from the precipitation press to the sump, from which it is returned to the stock tanks above the mill by a triplex 5½ by 8-in. Platt Iron Works pump. It is there brought back to normal strength. Lime is added at the batteries and in the agitators. As the quality of the lime varies, the alkalinity of the solutions is determined in terms of percentage of free alkali rather than in pounds per ton. The amount added by the solution-man therefore varies slightly from day to day, the working percentage being 0.15% CaO.

Until quite lately lead acetate, 30 to 40 lb. per day, was added with the cyanide in the stock tanks and in the agitators, but it was found that 24 lb. of commercial litharge would do the same work. As this was considerably cheaper the use of lead acetate was dropped and the litharge substituted. It is added in the tube-mill and in the agitators; an equal amount in each.



OLIVER FILTER, BLACK OAK MILL.

A car with a perforated false iron bottom receives the precipitate when cleaning the precipitate press. When the press is empty the car is taken to the refinery, a separate building 75 ft. from the mill. Compressed air which has been heated by passing it through a coil in a small furnace is introduced beneath the false-bottom of the car; as it proceeds up through the mass it rapidly dries the pre-

cipitate. It is weighed on platform scales, fluxed, and smelted in a No. 2 Rockwell double-chamber furnace, no previous acid treatment being necessary. The resulting bars of bullion are base, averaging 850 fine, and a change of the refining method is under consideration. This will possibly include the use of an English cupelling furnace.

High-pressure air from the mine compressor is piped to the mill, acting as an auxiliary in case of emergency. If for any reason the agitators stop and the pulp settles so that difficulty is found in resuming agitation, the high-pressure air is turned on. It is also piped throughout the mill, so that the various motors can be blown free from dust at regular intervals. It is connected to the filter-presses and to the refinery for the crude-oil burners. The main floor of the mill is cemented and provided with drains that all lead to the sump, so that all leaks or overflows are caught.

The mill is equipped with Mazda 'Street Series' tungsten lamps and is brilliantly lighted at night. For mill illumination these lamps are very satisfactory. They have extra heavy filaments, take but little current, cost but a nominal sum to replace, and when suspended with light springs have a long life. They have proved so satisfactory in the mill that the company has installed them over the surface workings and at the hoist and ore-sorting platform. The mill is operated entirely by electric power, which is purchased from the San Francisco & Sierra Power Co. Coming in at 15,000 volts, it is transformed to 440 for power purposes, and further stepped down to 110 volts for lighting.

Since the mill started, the average monthly extraction has never fallen below 95%, and for the last three months has been over 97%. This is the total extraction of gold and silver, and is the actual money shown by bullion returns, not the 'indicated.' The returns on bullion check very closely with the indicated or calculated extraction of the daily mill estimates, usually slightly exceeding them. The cyanide consumption averages 1.5 lb. per ton of ore; the lime 3 lb. One battery-man and a solution-man per shift run the mill with ease. A mechanic attends to the repairs on the day shift, and the mine assayer and a boy do the smelting. The daily capacity of the mill, using light stamps, was 66 tons, but with the new 1250-lb. stamps the output should be at least 100 tons per day with no increase in labor.

Report of the International Committee on Atomic Weights

*Since the annual report for 1912 was prepared, a number of important memoirs on atomic weights have appeared. There are also one or two earlier researches which were received too late to be noticed at the proper time. These investigations may be summarized as follows:

Nitrogen.—Wourtzel, by oxidizing NO to N_2O_4, has redetermined the ratio between nitrogen and oxygen. Five concordant measurements give, in mean, N = 14.0068.

Potassium and Chlorine.—Staehler and Meyer have made careful analyses of potassium chlorate, with especial precautions against contamination by the chloride. Their final series gives KCl = 74.5551, whence K = 39.097 and Cl = 35.458. For a discussion of their results, see also Guye, who concludes that the impurity above mentioned was, if not completely, at least sufficiently eliminated to be practically negligible.

Fluorine.—McAdam and Smith have published two preliminary determinations of the atomic weight of fluorine. Sodium fluoride was converted into chloride by heating in dry, gaseous hydrochloric acid, and from the ratios between the weights the atomic weight was calculated. The two values found are F = 19.0176 and 19.0133.

Phosphorus.—From analyses of phosphorus tribromide Baxter, Moore, and Boylston find, in mean of three series, P = 31.027 when Ag = 107.88. This agrees fairly well with the former work of Baxter and Jones on silver phosphate. Further work on phosphorus trichloride is promised.

Mercury.—Easley and Brann, by analyses of mercuric bromide, find Hg = 200.64. This confirms the previous work of Easley on the chloride.

Selenium.—Kuzma and Krehlik have redetermined the atomic weight of selenium by reduction of SeO_2 with SO_2. The mean of ten determinations is Se = 79.26.

Tellurium.—Harcourt and Baker have thrown doubt upon the work of Flint, who claimed to have split up the supposed element into two fractions of different atomic weight. They repeated his method of fractionation, and from the fourth fraction found Te = 127.54. This agrees with the figure found by Baker and Bennett in 1907. Similar fractionations have been carried out also by Pellini, who likewise failed to find any indication of a tellurium of low atomic weight.

Radium.—Hönigschmid, by careful analyses of relatively large quantities of radium chloride, finds Ra = 225.95. On the other hand, Gray and Ramsay, using very small quantities of material, and converting the bromide into the chloride, find Ra = 226.36, in agreement with previous work by Madame Curie and Thorpe. Until the discordance between Hönigschmid's low value and the higher is explained, it is undesirable to change the figure given in the table.

Tantalum.—The determinations of this atomic weight by Chapin and Smith were made by the hydrolysis of $TaBr_5$. The mean of eight determinations gave Ta = 181.80, a figure somewhat higher than that found by Balke from similar analyses of the pentachloride.

Iridium.—Hoyermann, by five reductions of $(NH_4)_2IrCl_6$ in hydrogen, finds Ir = 192.613.

Holmium.—Six determinations of the atomic weight of holmium by Holmberg gave Ho = 163.45. The well known sulphate method was employed.

There are also approximate determinations of the atomic weights of lead, zinc, and copper by Pecheux, and of calcium by Oechsner de Coninck. The figures obtained are not conclusive enough to justify their use in the table, for the methods employed were not of great accuracy. Only one change is recommended in the table for 1913; namely, the insertion of holmium, for which, hitherto, no good atomic weight determination has been available. Two or three other alterations of small importance might be made, but it seems undesirable to make changes too frequently.

	Symbol	Atomic weight
Aluminium	Al	27.1
Antimony	Sb	120.2
Argon	A	39.88
Arsenic	As	74.96
Barium	Ba	137.37
Bismuth	Bi	208.0
Boron	B	11.0
Bromine	Br	79.92
Cadmium	Cd	112.40
Caesium	Cs	132.81
Calcium	Ca	40.07
Carbon	C	12.00
Cerium	Ce	140.25
Chlorine	Cl	35.46
Chromium	Cr	52.0
Cobalt	Co	58.97
Columbium	Cb	93.5
Copper	Cu	63.57
Dysprosium	Dy	162.5
Erbium	Er	167.7
Europium	Eu	152.0
Fluorine	F	19.0
Gadolinium	Gd	157.3
Gallium	Ga	69.9
Germanium	Ge	72.5
Glucinum	Gl	9.1
Gold	Au	197.2
Helium	He	3.99
Holmium	Ho	163.5
Hydrogen	H	1.008
Indium	In	114.8
Iodine	I	126.92
Iridium	Ir	193.1
Iron	Fe	55.84
Krypton	Kr	82.92
Lanthanum	La	139.0
Lead	Pb	207.10
Lithium	Li	6.94
Lutecium	Lu	174.0
Magnesium	Mg	24.32
Manganese	Mn	54.93
Mercury	Hg	200.6
Molybdenum	Mo	96.0
Neodymium	Nd	144.3
Neon	Ne	20.2
Nickel	Ni	58.68
Niton (radium emanation)	Nt	222.4
Nitrogen	N	14.01
Osmium	Os	190.9
Oxygen	O	16.00
Palladium	Pd	106.7
Phosphorus	P	31.04
Platinum	Pt	195.2
Potassium	K	39.10
Praseodymium	Pr	140.6
Radium	Ra	226.4
Rhodium	Rh	102.9
Rubidium	Rb	85.45
Ruthenium	Ru	101.7
Samarium	Sa	150.4
Scandium	Sc	44.1
Selenium	Se	79.2
Silicon	Si	28.3
Silver	Ag	107.88
Sodium	Na	23.00
Strontium	Sr	87.63
Sulfur	S	32.07
Tantalum	Ta	181.5
Tellurium	Te	127.5
Terbium	Tb	159.2
Thallium	Tl	204.0
Thorium	Th	232.4
Thulium	Tm	168.5
Tin	Sn	119.0
Titanium	Ti	48.1
Tungsten	W	184.0
Uranium	U	238.5
Vanadium	V	51.0
Xenon	Xe	130.2
Ytterbium (Neoytterbium)	Yb	172.0
Yttrium	Yt	89.0
Zinc	Zn	65.37
Zirconium	Zr	90.6

*From the *Journal* of the American Chemical Society.

Constitution and By-Laws, American Institute of Mining Engineers

Constitution as proposed November 12, 1912, to be acted upon at the Annual Meeting, February 18, 1913, and prepared by a committee consisting of J. W. Richards, Charles Kirchhoff, and C. F. Rand, under a resolution adopted by the Institute at New York October 7.

Article I. Name and Object

Sec. 1. This Institute is incorporated under the membership corporation law of the State of New York; its corporate name is AMERICAN INSTITUTE OF MINING ENGINEERS; and its objects are such as are stated in its Certificate of Incorporation.

Article II. Members

Sec. 1. The membership of the Institute shall comprise four classes, namely: 1. Members; 2. Honorary Members; 3. Associates; 4. Junior Members. All members shall be equally entitled to the privileges of membership, excepting that Honorary Members, Junior Members, and Members and Associates whose residences shall be outside of the United States, Mexico, and Canada shall not be entitled to vote. Members and Associates residing within the United States of America, Mexico, and Canada, and not in arrears for dues, shall be entitled to vote in person at the meetings of the Institute, or as hereinafter provided for, by letter ballot.

Sec. 2. The following classes of persons shall be eligible for membership in the Institute, namely: as Members, all professional mining engineers, geologists, metallurgists, or chemists, and all persons actively engaged in mining and metallurgical engineering, geology or chemistry; as Associates, all persons desirous of being connected with the Institute who in the opinion of the Board of Directors are suitable. As Junior Members, (a) all students in good standing in engineering schools who have not taken their degrees and who are nominated by at least two of their instructors; (b) also persons under thirty years of age engaged in learning mining, metallurgy, or geology under the supervision of a member of the Institute. A Junior Member (a) may remain such not longer than three years after leaving the engineering school, or for not more than five years if in class (b), at the end of which period his qualifications to become a Member or Associate must be passed upon by the Membership Committee. If elected he shall pay at that time the entrance fee and dues of a Member or Associate. Every candidate for election as a Member, Associate or Junior Member must be proposed for election by at least three Members or Associates; must be approved by the Committee on Membership, or as prescribed in the By-Laws, and must be elected by the Board of Directors.

Sec. 3. Not less than three-fourths of the votes cast shall be necessary to an election; newly elected candidates shall be immediately notified of their election and also of their obligations, by the Secretary of the Institute. Every person so elected shall become a Member or Associate or Junior Member of the Institute in the class to which he is chosen, upon payment of his initiation fee, if required by this Constitution, and first year's dues, as hereinafter stated. Each candidate for Honorary Membership must be recommended by at least ten Members and must be elected by ballot at a meeting of the Board of Directors by the unanimous vote of the Directors present; provided, however, that the number of Honorary Members shall at no time exceed twenty.

Sec. 4. If any person elected a Member, Associate or Junior Member does not within four months after the mailing of notice of his election accept the same and pay his initiation fee, if required, and dues for the year in which he was elected, his election shall be null and void, and he shall be notified thereof by the Secretary of the Institute; providing, however, that if elected in the months of October, November or December the candidate may, at his option, pay dues only for the ensuing year, in which case he shall be entitled to receive the *Bulletin* of the Institute for the months of November and December, but not the annual volume of the year during which he was elected to membership.

Sec. 5. The Board may at any time, for good and sufficient reasons, change the classification of a member of any class except Honorary Members.

Article III. Dues

Sec. 1. The dues of Members and Associates shall be, until otherwise determined by the Institute, $10 per annum, and those of Junior Members shall be $5 per annum. All dues shall be payable in advance on the first day of each calendar year, and notice to this effect shall be published in the last number of the *Bulletin* of each calendar year, and a bill shall be mailed to each Member, Associate and Junior Member on the first day of the month of January in each year, stating the amount of dues and date when payable, and the penalty and conditions incident to default in payment within the limit of time set by the Constitution. Each newly elected Member or Associate shall pay, immediately on notification of his election, an initiation fee of $10; Junior Members shall not pay any initiation fee. Honorary Members shall not be liable for initiation fees or dues. Any Member, Associate or Junior Member in arrears for one year may, at the discretion of the Board of Directors, be deprived of the receipt of publications or stricken from the list of Members; provided, that he may be restored to membership by the Board on payment of all arrears or may be again proposed and elected after an interval of three years.

Sec. 2. The Board of Directors shall have the right to increase the dues of the membership for the next ensuing year or years by any sum not to exceed the amount of $5 per annum, such increase of dues to be applicable solely to the extinction of the principal of the land debt of the Institute. As soon as such indebtedness is paid the dues shall automatically return to those provided in Section 1 of this Article.

Sec. 3. Any Member or Associate not in arrears may become, by the payment of $150 at one time, a Life Member or Life Associate and shall not be liable thereafter to pay annual dues. The money thus received shall be invested and only the income thereof used for current expenses of the Institute.

Article IV. Business Meetings of the Institute

Sec. 1. The annual meeting of the Institute for the election of Directors and transaction of other business shall be held at the headquarters of the Institute in the City of New York on the third Tuesday in February in each year. A report of the financial condition of the Institute and an abstract of the accounts shall be furnished by the Directors and presented at each annual meeting.

Sec. 2. Special business meetings of the Institute may be held at such times and places as the Board of Directors may appoint, upon notice to all members and Associates entitled to vote, directed to each at his last known postoffice address, and mailed not less than twenty days before the date fixed for such meeting.

Sec. 3. At all business meetings of the Institute the presence of twenty-five Members and (or) Associates shall constitute a quorum.

Sec. 4. At all business meetings of the Institute, Members and Associates entitled to vote may vote only in person; proxy voting shall not be permitted. Any matter which is presented over the signatures of 25 Members or Associates, or which is advocated or opposed by 25 Members or Associates present at a business meeting of the Institute, or which the Board of Directors may wish to refer to the membership for decision, shall be sent out to the mem-

bership for a vote thereon by letter ballot, accompanied by a statement prepared by the Board of Directors giving the arguments for and against its adoption. Only Members and Associates entitled to vote may vote thereon.

Sec. 5. All meetings of the Institute other than business meetings shall be held at such times and places as the Board may appoint. Notice of all such meetings shall be given to all Members, Associates and Junior Members by mail.

Article V. Directors and Officers

Sec. 1. The business, financial, professional, technical, scientific, and social interests of the Institute shall be managed by and under a Board of Directors, elected annually by letter ballot as set forth in the Certificate of Incorporation and in the manner specified in this Constitution or in the By-Laws, to serve for the terms set forth in the Certificate of Incorporation.

Sec. 2. The Board of Directors shall consist of a President, two Past Presidents, six Vice-Presidents, and fifteen Directors. (The six Vice-Presidents of the Council, in office after the annual election, in February 1913, shall be the six Vice-Presidents of the Board of Directors.) Eight Directors shall be elected annually by letter ballot: One of said eight shall be designated as 'Director and President' and two shall be designated as 'Director and Vice-President.'

Sec. 3. The officers of the corporation, who shall also be termed the respective officers of the Institute, shall be a President, First Vice-President, Secretary and Treasurer. The President shall be that Director who is chosen at the annual election as 'President,' he shall serve as President for one year, and for the subsequent two years of his directorate be termed 'Past President of the Institute,' but the President for the year ending in February, 1914, shall be that person chosen to be President of the Council by the members at the annual meeting in February 1913. The President shall be ineligible for reëlection as such until two years after expiration of his term as President. At the first meeting of the Board of Directors after the annual business meeting of the Institute, the Board shall elect, from among the Vice-Presidents on the Board, a First Vice-President to hold office for one year; a Secretary, who may or may not be a member of the Board, to serve for one year, and a Treasurer from among the members of the Board to hold office for one year. The Secretary or the Treasurer may be removed from office at any time by a unanimous vote of the Directors present at a special or regular meeting of the Board, due notice having been given in advance that such action is to be considered at said meeting. The duties of all officers shall be such as usually pertain to their respective offices, together with such other duties as may from time to time be prescribed for them by the By-Laws or Board of Directors. The Treasurer shall give a bond for the faithful performance of his duties, in a sum to be fixed by the Board of Directors, but at the expense of the Institute.

Sec. 4. In the event of a vacancy occurring in the Board of Directors by death, resignation, promotion by election as President or Vice-President, or for any other reason than retirement at the end of three years' service, the remaining members of the Board shall elect a successor to fill the vacancy and to serve for the unexpired term. A member of the Board whose term has not expired and who is elected President or Vice-President at an annual election shall be considered to have vacated the former office held by him, and the Board shall fill the vacancy as above provided.

Sec. 5. The Board of Directors may, from time to time, in its discretion, appoint any Past Secretary of the Institute 'Secretary Emeritus,' to receive such compensation and to perform such duties as the Board may designate.

Sec. 6. The Board of Directors may authorize the formation of Local Sections, Topical Divisions, or arrange affiliations with other Societies in accordance with this constitution and the By-Laws.

Sec. 7. The Board of Directors may appoint standing and special committees charged with such duties as the Board may assign. Such committees shall be directly responsible to, and report to the Board, and take only such responsibilities as the Board shall authorize.

Sec. 8. At the first meeting of the Board of Directors after the annual meeting of the Institute, it shall appoint an Executive Committee of five of its members, three of whom shall constitute a quorum. This committee may act for the Board between meetings of the Board and at any regular or special meeting whenever a quorum of six Directors are not present. The Executive Committee is not authorized to perform the following acts, or any others the Board may see fit to interdict, viz: fill vacancies on the Board; elect the First Vice-President, Secretary or Treasurer; fix salaries of officers (it may fix those of employees); vote extra compensation to officers; vote extraordinary expenses or incur obligations of over five hundred dollars; take action affecting already invested funds or property rights of the Institute; elect Honorary Members; expel Members.

Sec. 9. The Chairmen of Local Sections or appointed representatives thereof, and the chairmen of the Technical Committees or Divisions of the Institute, if not members of the Board of Directors, shall be notified of and have the privilege of attending all meetings of the Board, but without the right to vote. They may participate in discussion, and shall receive the minutes of the Board's meetings.

Sec. 10. All salaries paid by the Institute shall be fixed in advance by the Board of Directors, but no salary shall be fixed in advance for a period longer than twelve months.

Sec. 11. The funds of the Institute shall be paid out only by check signed by the Treasurer and countersigned by the Secretary; in case of absence or disability, the President or First Vice-President may act for the Treasurer, or any Vice-President for the Secretary.

Sec. 12. The Directors may appoint an Assistant Secretary who shall, under the instructions of the Board, have charge of such of the business affairs of the Institute as may be assigned to him by the Board. His salary shall be fixed by the Board, and he shall hold office during its pleasure.

Article VI. Meetings of the Board of Directors

Sec. 1. A regular meeting of the Board of Directors for the election of officers and the transaction of other business shall be held in February in each year, at the headquarters of the Institute, in New York City, after the annual business meeting of the Institute has adjourned.

Sec. 2. The Board of Directors shall also meet once each month except in July and August, on a regular date to be fixed at its February meeting, for the transaction of such business as may come before it. A conference of the Board may be called at the request of three members of the Board, or by the President, to meet at any time or place, in connection with a meeting of the Institute for reading and discussion of papers or for the discussion of matters affecting the welfare of the Institute. All recommendations adopted by a majority of those present at such conference shall be transmitted to the Secretary of the Institute, accompanied by a record of the number favoring such recommendations, together with notes of the discussion thereon, and by him brought before the next meeting of the Board of Directors, for consideration and such action as it may deem expedient. Special meetings of the Board shall be called by the Secretary at the request of the President, First Vice-President, or any three members of the Board, to meet at any time and place, by notice mailed to the members of the Board at least ten days in advance, or by telegram sent at least five days in advance of the date of the meeting to members in North America (Alaska excepted).

Sec. 3. At all meetings of the Board of Directors the presence of six members shall constitute a quorum. In the absence of said quorum, at any meeting of the Board, a quorum of the Executive Committee, if present, shall transact such necessary business as is within the powers delegated to that Committee.

ARTICLE VII. NOMINATION AND ELECTION OF DIRECTORS AND OFFICERS

Sec. 1. A ticket of nomination for offices and places annually falling vacant in the Board of Directors shall be prepared by a Committee on Nominations, of which no member shall be, at the time, on the Board. This Committee shall consist of the Chairmen of three Local Sections, one Past President, and three other members of the Institute, and on recommendations made by the President of the Institute, shall be appointed by a vote of the Board of Directors, within ninety days after the annual meeting, and it shall then proceed to the selection of candidates and the naming of a ticket. In making such selections, the nominating committee shall, so far as practicable, distribute the representation on the Board geographically, so that seven members shall be residents of the district including New York City and the territory within a radius of fifty miles of the headquarters of the Institute, and one member a resident of each of the geographical districts enumerated in the By-Laws.

The official ticket thus formulated shall be transmitted to the Secretary of the Institute, not later than the last Friday in October, be submitted to the Board at its October meeting for its consideration, published in the November *Bulletin*, and, not later than January 1 be printed and sent to the membership. Any complete or partial ticket of nominees signed by any 25 Members, or Associates of the Institute and transmitted to the Secretary by December 15 shall also be printed and circulated with the official partial ticket of nominees signed by any 25 Members or ticket and over the names and with the recommendations of the nominators, together with an expression of opinion of the Board thereon if deemed expedient.

Sec. 2. The election ballots mailed with the nominations shall contain space for the naming of eight Directors, of which the first shall be designated: 'For Director and President', the second and third: 'For Director and Vice President', and the rest: 'For Director'. They shall be accompanied by small inside adhesive envelopes marked: 'Ballot. Do not sign,' and outer mailing envelopes addressed to the Secretary and marked 'Enclosing Ballots only.' Members voting shall not sign their names to the ballot, but seal it in the inner envelope, enclose it in the outer mailing envelope, and write their names on the outside, in the place provided. Cumulative voting shall not be permitted. Letter ballots must reach the Secretary on or before the second Tuesday in February. He shall give them unopened to tellers, to be appointed by the Board of Directors at its January meeting, at least three days before the annual business meeting, marking plainly those from Members not entitled to vote, because of geographical location or by being one year or more in arrears for dues. The tellers shall open and count the valid ballots received from Members entitled to vote, rejecting any unidentified by the name of the sender on the outer envelope; they shall prepare a report of the voting and hand it to the Chairman of the annual business meeting of the Institute. The latter shall declare elected to the respective offices the eligible persons receiving the highest number of votes. The ballots and unopened letters shall be returned to the Secretary at the annual business meeting; the latter shall preserve them one month, and then destroy the ballots which have been counted, and open and destroy the others.

ARTICLE VIII. PAPERS AND PUBLICATIONS

Sec. 1. The Board of Directors shall appoint a Committee on Papers and Publications, of which the Secretary shall be a member, whose duty shall be to pass upon the fitness of technical communications submitted for publication by the Institute. Stenographic or contributed discussions of papers may be passed upon by the Secretary, in consultation with members of the above Committee.

Sec. 2. The Institute shall not assume reponsibilities for any statements of fact or opinion advanced in the papers or discussions at its meetings. Neither the Board nor the Institute shall officially approve or disapprove any technical or scientific opinion or of any proposed enterprise, which is outside of the management of the meetings, discussions and publications of the Institute, and the conduct of its business affairs by the Board of Directors.

Sec. 3. Special committees may from time to time be appointed by the Board to make investigations and prepare reports for presentation to the Institute, but no action shall be taken binding the Institute for or against the conclusions embodied in any such reports.

ARTICLE IX. SUSPENSIONS AND EXPULSIONS

Sec. 1. Any Member of the Institute who shall be convicted of a crime involving, in the opinion of the Board of Directors, moral turpitude, shall, upon passage by the Board of Directors of a resolution declaring the crime for which he has been convicted to be of such character, be thereupon dropped from membership in this Institute.

Sec. 2. Any Member of the Institute may be suspended or expelled for misconduct by the Board of Directors, after charges setting forth such misconduct shall have been prepared and filed in writing with the Board. Upon the receipt of such charges in writing the Board may, in its discretion, suspend such Member pending a hearing and determination thereupon. As soon as may be after the receipt of such charges, the Board shall fix a date for a hearing thereupon and shall give to the accused Member notice thereof in writing, mailed to him at his last known post-office address not less than thirty days before said date, accompanied by a copy of the charges and a copy of the second, third and fourth sections of this article.

Sec. 3. Upon the day fixed for the hearing, the accused Member may appear before the Board, either in person or by an accredited representative; hear any witnesses who may be called in support of the charges and, at its option, cross-examine the same, and hear read any documentary evidence offered in support of the charges. The accused may, in his discretion, produce and examine witnesses in his defense, and submit documentary evidence, including a statement from himself in writing. After the conclusion of the hearing, the Board of Directors shall consider and vote to approve or disapprove the charges. If the Board shall, by a vote of two-thirds of its members, declare the charges sustained, it may suspend the Member for a stated period, or expel him.

Sec. 4. If the accused Member shall not appear at the hearing, and shall within three months thereafter file with the Board an affidavit stating that he had not received notice of the charges against him in time to enable him to present his defense, the Board shall fix a date for a re-hearing within three months from the receipt of such affidavit, and shall immediately notify the accused Member by mail of such date. Upon the re-hearing, shall have the same privilege of presenting his defense as he would have had upon the original hearing; and after the defense is presented, the Board shall take a new vote upon the charges, the result of which shall be conclusive.

ARTICLE X. AMENDMENTS

Sec. 1. Proposals to amend this Constitution shall be presented in writing to the Board of Directors, signed by at least ten Members; they shall reach the Secretary not later than October 15. The Board of Directors shall consider them and the proposers shall be notified of the opinion of the Board in regard to them, and they may then either withdraw their proposals, or accept any changes suggested, or insist on the original form. The original form, if insisted upon, togther with the changes proposed by the Board, if such there be, shall be mailed to all Members on or before January first, with the election ballots, and with a ballot in proper form for voting upon the amendment in its original or amended form. Ballots shall be received by the Secretary until the second Tuesday in February. The Tellers of the election shall count these ballots, and report the result to the Chairman of the annual meeting. Any Members present in person at the annual meeting who have not voted on the amendments by ballot, shall have the privilege of having their votes recorded before the result of the voting is announced.

PROPOSED BY-LAWS

I. Presiding Officer

At all business meetings of the Institute the President, or in his absence, the First Vice President, or in the absence of both of them, any other Vice President or Director, chosen by the meeting shall preside. At all other meetings of the Institute the President or, in his absence, one of the Vice Presidents shall preside. If none of these be present the meeting shall elect a Chairman.

II. Order of Business

At each business meeting of the Institute the order of business shall be as follows: (1) Reading of minutes of preceding meeting; (2) report of the President; (3) report of the Treasurer; (4) report of the Secretary; (5) report of Tellers of Election; (6) reports of standing committees; (7) reports of special committees; (8) special orders; (9) miscellaneous business. This order of business may be changed at any meeting, by a vote of a majority of the Members and Associates present. At all sessions of the Institute, other than business meetings, the order of proceedings and the time of adjournment shall rest in the discretion of the presiding officer.

III. Secretary of the Institute

The Secretary shall keep a record of the proceedings of all meetings of the Institute. He shall be custodian of the corporate seal, of the minute books and of all legal documents belonging to the Institute. He shall have charge, on behalf of the Institute, of all correspondence except such as pertains directly to the office of the Treasurer. He shall notify all Officers and Directors and all members of committees of their election and appointment; shall issue notices of all meetings of the Board, and of the annual and other business meetings of the Institute; and shall, in calling special meetings of the Directors, specify the objects of such meetings. He shall act as clerk at all the meetings of the Board of Directors and at all meetings of the Institute. The Secretary shall be custodian of all technical or scientific papers submitted to the Institute for its consideration, shall have general charge and supervision of the editing and proof-reading of all material published by the Institute, and of the distribution thereof, and be ex-officio Chairman of the Committee on Publications. On the first day of May following the year in which each volume of *Transactions* is printed, he shall turn over to the Library Committee all copies of the same not theretofore distributed by him. The Secretary may, with the approval of the Board of Directors, employ such persons as are necessary to constitute a clerical and office force, at such salaries as shall be approved by the Board of Directors or its Executive Committee. He shall be the immediate superior of all such employees.

IV. Assistant Secretary

The Board of Directors may, upon request of the Secretary, appoint an Assistant Secretary, to take charge of such portion of the Secretary's duties as may be assigned him by the Board or its Executive Committee, such as supervising the printing and distribution of advance papers, of the *Bulletin* and *Transactions*, soliciting advertising and conducting general business correspondence. He may be appointed also Assistant Treasurer, if the Board shall so determine, to collect annual dues and accounts due the Institute, subject to instructions from the Treasurer of the Institute. During the absence of the Secretary at meetings of the Institute, or for other reasons, he shall act as Secretary *pro tem.*

V. Treasurer

The Treasurer shall collect and, under the direction of the Board of Directors, shall disburse all funds of the Institute. He shall keep regular accounts in books belonging to the Institute, which shall be open to any member of the Board of Directors. He shall report in writing at each annual meeting of the Institute, and at every regular meeting of the Board of Directors, the balance of money on hand, and any existing appropriations which may affect the same. His accounts shall be audited anually by a committee of three Members or Associates to be appointed by the President at least thirty days prior to the annual meeting in each year, which committee shall report thereon at such annual meeting. The committee may employ a public accountant to assist it, at the expense of the Institute. The Treasurer may, at his discretion, place funds of the Institute, not at any time exceeding five hundred dollars, in the hands of the Secretary, Assistant Secretary, or Assistant Treasurer, and may delegate to either of them the duty of paying, therefrom, the smaller current expenses of the Institute. The Treasurer shall examine this 'Cash Box' account each month. The Treasurer shall be solely responsible to the Institute for all moneys received, whether the same are entrusted to others or not, and may require from any one to whom he entrusts funds, a bond, running to the Treasurer personally and taken at the expense of the Institute.

VI. Assistant Treasurer

The Board of Directors may appoint an Assistant Treasurer, to whom it may delegate the duties of conducting, under the supervision of the Treasurer, correspondence incidental to the office of Treasurer, of collecting, receiving, and depositing in bank, to the credit of the Institute, all moneys, and of paying, out of special account, if entrusted to him, the smaller current expenses of the Institute, subject to the instructions of the Treasurer.

VII. Standing Committees

The standing committees of the Institute shall be four: A Finance Committee, a Library Committee, a Committee on Publications, and Committee on Membership. The Finance Committee shall consist of three members of the Board of Directors, who shall be appointed by the Board at its first meeting after the annual meeting of the Institute in each year. The Library Committee shall consist of the Secretary of the Institute and four other Members or Associates of the Institute, one being appointed annually by the President, at the first meeting of the Board after the annual business meeting of the Institute, to serve for four years, in conformity with the By-Laws of the United Engineering Society, approved by the Board of Directors of the Institute. The Committee on Publications shall consist of the Secretary of the Institute, who shall be its chairman, and at least twelve specialists, Members of the Institute, to assist in passing on all papers offered for publication. They shall be appointed annually by the newly-elected President. The Committee on Membership shall consist of five Members of the Institute, the Chairman, and at least one other member being chosen from the Board of Directors, and shall be appointed by the President at the first meeting of the Board after the annual business meeting of the Institute.

VIII. Finance Committee

It shall be the duty of the Finance Committee to inquire into and examine the financial condition of the Institute and to consider proper means of increasing its revenues and of limiting its expenses. It shall report at each monthly meeting of the Board, and at other times whenever it shall desire or be directed so to do; and the Treasurer shall at all times furnish it with such statements and information as it may desire. It shall determine, with the approval of the Board, the investment of such surplus moneys as shall from time to time accrue to the Institute. It shall, at least once in each year, examine the securities belonging to the Institute, and report thereon to the Board. It may, at any time, examine the books and vouchers of the Treasurer and Assistant Treasurer. The Treasurer shall not be a member of the Finance Committee, but shall attend the meetings of the same if requested. The Finance Committee shall present a budget to the Directors at the meeting preceding the annual meeting of the Institute. This budget shall give an itemized estimate of the receipts and expenses of the Institute for the ensuing year. The Directors shall pass on this budget at their first meeting after the annual business meeting of the Institute, modifying it as they consider necessary, and make definite, detailed appropriations for the following year. All bills, accounts, salaries, pay-rolls, and claims of every kind against the Institute shall, before being paid, be examined by the Finance Committee and be ap-

proved by at least one member of the Committee. The Committee shall not authorize any payments in excess of appropriations. If at any time any of the appropriations seems in danger of being insufficient the Finance Committee shall report the same to the Directors.

IX. Library Committee

The Library Committee shall constitute the official representatives of the Institute upon the Library Board of the United Engineering Society, and be guided by the By-Laws of that Society, as approved by the Board of Directors of this Institute, with full powers to act for the Institute within the appropriations allowed by the Board of Directors. The Library Committee shall be the custodian of all books in the Institute library and of additions thereto; also of all back numbers of the *Transactions* of the Institute. It shall, on the first day of May of each year, receive from the Secretary and receipt for all the volumes of *Transactions* and *Bulletins* or other publications for the preceding year not previously distributed by said Secretary. It shall cause to be kept, under the directions of the Secretary, a catalogue of all books in the library and an account in ledger form of all volumes of *Transactions* in its custody, in which shall be charged all volumes delivered to it, and in which shall be credited all volumes taken from its custody for sale or for any other purposes. It shall make a written report annually to the Board of Directors, stating the stock of publications on hand, and a detailed statement of sales during the year, together with such observations and recommendations as it may wish, regarding said publications or the conduct of the library.

X. Committee on Publications

1. This Committee shall perform its functions as follows:

(a) On the receipt of a paper by the Secretary (Chairman), he shall send it to the member of this Committee who, in his judgment, is most competent and available to pass upon it, as 'Reader,' accompanying the paper with his own opinion of its suitableness for publication, and any other pertinent information.

(b) If the Reader and the Chairman agree upon the suitability or unsuitability of the paper; it shall be considered accepted for publication or rejected, as the case may be.

(c) If these two do not agree, the paper shall be submitted to a third member of the committee, and the opinion of two of these three members shall decide the matter.

(d) If a paper has been refused publication, the author shall have the right of appeal, in which case the persons previously passing on the paper, together with others selected from the Committee by the President—making five altogether—shall decide the question.

(e) If a paper has been accepted for publication, it shall be considered eligible to be placed on the program of a meeting.

2. The placing of a paper upon the program of a meeting shall not give it the right to be published in the *Bulletin* or *Transactions* of the Institute; its suitability for publication must in every case be passed upon by the Committee, as provided for in Section 1, of this Article.

3. In case the Secretary is unable to secure a decision as to the suitability or unsuitability of a paper for publication, as directed in Section 1, before the time of announcing the program of a meeting, he may at his own discretion place the paper upon the program of the meeting, or refuse it a place thereon.

XI. Committee on Membership

All nominations for Members, Associates, or Junior Members of the Institute shall be submitted to and passed upon by the Committee on Membership. This Committee shall meet at least once in each calendar month, with the exception of the months of July and August. It shall receive and consider all communications respecting candidates and shall make diligent inquiry as to the character and qualification of each. Its proceedings shall be reported to the Board, if required, but otherwise shall be secret and confidential. No member of the committee shall propose any candidate.

XII. Election of Members

After the Committee on Membership shall have reported to the Board its conclusions as to the acceptability of each candidate, the Board shall vote upon the same. No person shall be proposed for election to the Institute within one year after his name shall have been rejected by the Board.

XIII. Nominations

The geographical districts to be considered by the Committee on Nominations shall be as follows, until otherwise ordered by the Board.

District No. 1. New England, New York, and New Jersey, excepting New York City and district, which is provided for in the Constitution.

District No. 2. Pennsylvania.

District No. 3. Ohio, Indiana, Illinois, Iowa, and Missouri.

District No. 4. Minnesota, Wisconsin, and Michigan.

District No. 5. Montana, North and South Dakota, Wyoming, Nebraska, Kansas, Washington, Oregon, Idaho, and Alaska.

District No. 6. California and Nevada.

District No. 7. Utah, Colorado, Arizona, and New Mexico.

District No. 8. Louisiana and Texas.

District No. 9. Other Southern States and District of Columbia.

District No. 10. Mexico.

District No. 11. Canada.

XIV. United Engineering Society

This Institute shall be represented upon the Board of Trustees of the United Engineering Society by three Members or Associates, one retiring each year, as provided in the by-laws of the said United Engineering Society. At the December meeting of the Board of Directors the Board shall designate a Member or Associate of this Institute to be a representative of this Institute upon the Board of Trustees of the said United Engineering Society for a period of three years beginning at the next ensuing annual meeting of said Society. At any time when a vacancy shall occur in the representation of this Institute on the Board of Trustees of said Society, the Board of Directors of this Institute shall designate a Member or Associate to fill such unexpired term. These representatives shall report in writing to the Board of Directors at its regular meetings held in March, June, September, and December, and at other meetings, if called upon by the Board.

XV. Publication of a Bulletin

The publications of the Institute shall include, in addition to the *Transactions*, a periodical called the *Bulletin* of the American Institute of Mining Engineers, which shall contain reports of proceedings, professional papers, notices, and other matters of interest to Members. From the annual dues paid by each Member, Associate, and Junior Member, five dollars shall be deducted and applied as a subscription to the *Bulletin* for the year covered by such payment. Special volumes upon technical subjects may be issued, by vote of the Board.

XVI. Obligations to Members

Any Member of whatever class whose dues are paid within the limits set by the Constitution shall receive the *Bulletin*; and all Members and Associates who pay $10 annual dues, also all Life and Honorary Members, shall receive in addition the *Transactions*.

XVII. Local Sections

Sec. 1. A Local Section of the Institute may be authorized by the Council at the written request of ten Members residing within an appropriate distance of a central point.

Sec. 2. The Board shall define the territory of a Section.

Sec. 3. Only one Section shall be authorized in one locality or district.

Sec. 4. A Section must consist of at least twenty-five members; if its membership falls below twenty-five in number, the Board may annul the Section.

Sec. 5. Only Members of the Institute shall be members of its Local Sections.

Sec. 6. All Members and Associates of the Institute, residing within the territory of a Section shall be eligible for membership in such Section. But any such person failing within three months, after due invitation, to become a member of such Local Section shall thereafter be admitted to its membership and privileges only on such conditions as said Local Section shall determine.

Sec. 7. The officers of a Section shall be elected, after the formation of the Section has been duly authorized, at a meeting of the Members of the Institute within the territory of said Section, called by the sponsors of the Section, notice of said meeting and its objects being given to said Members at least thirty days in advance. Officers of Local Sections shall be elected for a term not longer than one year.

Sec. 8. The Officers of a Local Section shall be a Chairman, Vice Chairman, Secretary, Treasurer (or Secretary-Treasurer), and such others as the Section may desire.

Sec. 9. It shall be the policy of the Board of Directors of the Institute to contribute from its funds for the necessary running expenses of each Local Section, when and so far as practicable, an amount not exceeding, in each year, 25% of the dues received from the members of said Section in said year, but in no case exceeding the sum of $250. Requests for such appropriation shall be signed by the Chairman, Secretary, and Treasurer of the Section.

Sec. 10. If the expenses of a Section exceed the appropriation made by the Board, the difference may be made up by voluntary contributions from the members of said Section, if it shall so determine. The Institute shall not be responsible for the debts of any Section.

Sec. 11. The Board reserves the right to cancel a Section, or re-adjust its territory.

Sec. 12. Papers presented at Local Sections, and discussions thereon if reported, shall be the property of the Institute. They shall be submitted to the Publication Committee and published in the *Bulletin* or *Transactions* or both, if approved. Such papers shall not be published elsewhere *in extenso* without permission of the Board. The reading of a paper before a Local Section shall not carry with it the right of publication in the *Bulletin* or *Transactions* of the Institute.

Sec. 13. Neither the author of a paper presented to a Local Section nor the Local Section shall have the right to reprint a paper or publish it in advance of the meeting without obtaining the permission of the Publication Committee of the Institute, which may refuse, or determine the details of such permission. Nothing herein shall forbid the abstracting of a paper by the press after its presentation before a Local Section.

Sec. 14. The Institute shall print advance copies of papers offered to Local Sections, in order to facilitate discussion thereon, provided that such papers are approved for such advance publication by the Chairman or Secretary of the Local Section and by the Publication Committee of the Institute.

Sec. 15. Papers read before a Local Section may also be offered for reading or discussion at general meetings of the Institute, and shall be given equal standing with the other papers on the program of said meeting, when approved by the Publication Committee.

Sec. 16. Each Local Section shall transmit promptly to the Secretary of the Institute announcements of its proposed meetings and an abstract of its proceedings, including the names of authors and titles of all papers read before it, for the purpose of preparing a report thereon to be published in the *Bulletin* of the Institute and for the purpose of enabling the Board of Directors to comply with sections 17 and 19 of these regulations.

Sec. 17. The By-Laws and regulations of Local Sections shall be subject to the approval of the Board of Directors.

Sec. 18. No action shall be taken by a Section which shall contravene the Constitution and By-Laws of this Institute.

Sec. 19. The Board reserves the right to amend, annul, or add to this Article XVIII of the By-Laws.

XIX. Technical Committees

Sec. 1. A Committee on Iron and Steel, in charge of the interests of the Institute in this branch of its activities, is hereby established.

Sec. 2. Other technical committees may be authorized by the Board of Directors, charged with the consideration of such topic or topics as the Board may assign, and having the duty of providing papers and discussions upon such topics for the meetings of the Institute.

Sec. 3. The Board of Directors shall designate the officers thereof, who shall hold office for one year or until their successors are appointed.

Sec. 4. The officers of a Technical Committee shall be a Chairman, Vice Chairman, and a Secretary.

Sec. 5. The Committee may adopt such rules as are necessary for the convenient conduct of its affairs, subject to the approval of the Board of Directors, or its Executive Committee.

XX. Affiliation or Consolidation with Other Societies

The Board of Directors may arrange conditions for the affiliation or consolidation with the Institute of any regularly organized group of engineers or any engineering society, whether heretofore or hereafter incorporated or otherwise, which by Constitution, By-Laws, and practice is in accord with the aims of this Institute.

XXI. Affiliated Student Societies

Sec. 1. Any society of undergraduates at a technical school, comprising students in any branch of engineering, metallurgy, chemistry, geology, etc., may be recognized by the Board, in its discretion, as an Affiliated Student Society, and its name, together with the names of its president and its secretary, may be published in the *Bulletin* or the Year Book of the Institute. The individual members of such a society will not be catalogued as individual Members of the Institute, but may at any time be proposed for election as Junior Members of the Institute, in the usual way, and receive the *Bulletin* of the Institute, when elected, upon payment of $5 annual dues.

Sec. 2. Technical papers presented before any such society, and recommended by the officers thereof, will be received and considered by the Publication Committee as if offered by Members of the Institute, and, if accepted will be published, with the names of their authors, and with due acknowledgment to the said Affiliated Student Society. The members of such societies shall be welcome to use the facilities of the office and library of the Institute.

Sec. 3. Upon the request of the Secretary or other designated officer of any such society, accompanied with the necessary remittance, not more than three copies of the *Bulletin* for one year shall be sent postpaid to him at reduced price given to public libraries. One volume of *Transactions* may be similarly furnished at the price charged Members of the Institute for extra copies.

Sec. 4. The conditions and details of this relation between the Institute and Affiliated Student Societies may be changed at any time at the discretion of the Board of Directors of the Institute; and the relation itself may be terminated at any time by the action of either party.

XXII. Amendments

Sec. 1. Amendments to these By-Laws may be made by vote of a majority of the Directors, provided the amendments have been proposed by a member of the Board at a previous meeting of the Board and copies of the same sent to all members of the Board at least 20 days before the meeting at which they are to be voted on, and an expression of opinion invited thereon. At a later meeting they may be amended in form, but not in substance.

Sec. 2. Any Member or Associate of the Institute in good standing, may propose amendments or additions to

these By-Laws, by sending such in writing to the Secretary. The proposal shall be brought before the Board at its next meeting, and, if sponsored by any one member of the Board, shall pass through the course required in the previous section. If the proposal is not so sponsored, it shall be returned to the proposer.

Sec. 3. Amendments or additions to these By-Laws may be proposed by sending the same in writing to the Board of Directors so that they are received by them at least 60 days before a business meeting of the Institute, and providing they be endorsed by the signatures of at least 20 Members or Associates in good standing at the time. It shall be the duty of the Board of Directors to have such proposals printed in the next succeeding issue of the *Bulletin*, and to provide proper facilities for a vote of the membership thereon by letter ballot before the said business meeting. If favored by a majority of the ballots cast, the amendments shall be reported at the said business meeting as adopted, and shall thereupon become effective.

PROPOSED CLASS OF FELLOWS

The committee has been requested by a large number of members of the Institute to propose as a part of the new Constitution an article creating a class to be called 'Fellows,' and in response to that request the article appearing below has been prepared. At the meeting of the Institute in Cleveland, Ohio, October 30, this article was much discussed and at the request of the committee a vote was taken. Of those present who chose to express an opinion, 21 were in favor of it and 27 were against it. In order to give Members an opportunity to pass upon this question without affecting their votes on the new Constitution as a whole, the matter is now proposed separately. We hereby propose an amendment to the Constitution of the American Institute of Mining Engineers to read as follows:

ARTICLE XI

FELLOWS OF THE INSTITUTE

Sec. 1. The distinction of 'Fellow of the Institute' may be conferred upon a Member of the Institute who has been for at least ten years prominent in his profession, in responsible charge of mining, metallurgical, geological, or chemical work, or of educational work concerned therewith.

Sec. 2. The Board of Directors shall have the right to designate twenty-five members of the Institute as Fellows, and they shall be the nucleus of this body.

Sec. 3. Thereafter a candidate for the distinction of Fellow of the Institute must be nominated by at least five Fellows, and the nomination be sent by the secretary of the Fellows to the Secretary of the Institute, and after notice of said nomination has been published in the *Bulletin* three successive months, be elected by mail ballot of the Fellows. He shall be declared elected if 75% of the ballots cast are favorable to his election. Such elections to fellowship shall take place once yearly, at the time of the annual meeting of the Institute.

Sec. 4. The Fellows of the Institute shall hold at least one annual business meeting in each year, preferably on the date of the annual meeting of the Institute, at which those Fellows present shall elect a chairman, vice chairman, and secretary, to serve for one year, and adopt such rules and regulations for the activities of their body as may seem to them desirable and are in agreement with this Constitution and the By-Laws.

Sec. 5. Any Fellow who is guilty of unprofessional conduct may be deprived of his standing as Fellow of the Institute by a three-fourths vote of the Fellows, taken by mail after presentation of the matter in full by a committee of the Fellows.

Sec. 6. Fellowship in the Institute terminates with lapse of membership in the Institute.

Respectfully submitted,

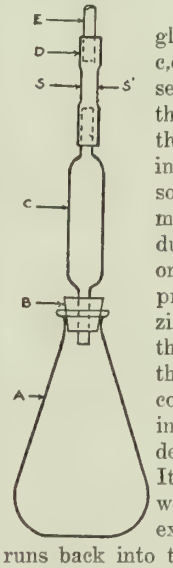
JOSEPH W. RICHARDS,
CHARLES KIRCHHOFF,
CHARLES F. RAND.

Modified Bunsen Valve

By LESLIE RUSSELL MILFORD

In making analyses of total iron, I have adopted the following scheme in working on the Saratoga mineral waters. When reducing the ferric compounds to ferrous, by means of nascent hydrogen, an Erlenmeyer flask with a Bunsen valve attachment has been used. The accompanying cut shows at a glance the modification which has been satisfactory.

A, Erlenmeyer flask; *B*, cork; *C*, bulb cut from 10-c.c. pipette; *D*, rubber tubing; *E*, glass plug; *SS'*, slits for valve.



Instead of an ordinary straight piece of glass tubing a bulb, *C*, from a discarded 10-c.c. pipette is used, one end of which is inserted into the cork *B*, projecting just below the surface into the Erlenmeyer flask *A;* to the other end is joined a piece of rubber tubing, *D*, carrying a glass plug, *E*. The ferric solution to be reduced is put into the Erlenmeyer flask, dilute sulphuric acid and zinc-dust are added, and the flask is then placed on the steam bath. The nascent hydrogen produced by the action of the acid on the zinc reduces the iron rapidly. When all of the zinc is in solution the flask is taken from the bath, placed on a wire gauze, and the contents are brought to boiling so as to eliminate any hydrogen in the flask, as this would decompose the $KMnO_4$ solution when added. It is at this point that the improved valve works to advantage. The steam in escaping expands in the 10-c.c. bulb, condenses and runs back into the flask. This eliminates the excess pressure and possible blowing out of the stopper. After thorough boiling, the flask is taken from the gauze, the stopper removed, the sides washed down, and a very little c.p. $NaHCO_3$ is dropped into the flask to generate an atmosphere of CO_2. The solution is then titrated with standard $KMnO_4$.—*Jour. Ind. and Eng. Chem.*

Hydraulicking on the Panama Canal

Hydraulic excavation in the Pacific division will be completed about December 1, 1912, according to the *Canal Record*, when the plant will be dismantled. For some time past, operations have been in the canal channel, south of Miraflores locks, and have about reached the point where the cost of excavating by this method would probably exceed the cost by steam-shovels. A good bottom has been obtained for shovel work on the east side of the channel below the dam, and from there the shovels will be in position to make favorable progress.

Excavation by the hydraulic method was begun in September 1910, and the equipment was first used in filling the core of the west dam at Miraflores, the monitors at that time working in the lower lock site at Miraflores. The hydraulic fill of the dam was completed on December 4, 1911, and amounted to 625,048 cu. yd. Prior to this time, the zone of operations had been moved farther south into the channel section, and, when the fill of the dam was completed, the material disintegrated by the monitors and pumped out by the dredge pumps was carried to the nearby tidal swamps. A total of about 110 acres of swamp land had been reclaimed to November 1, 1912. The total excavation accomplished by the hydraulic plant from the beginning of operations to November 1, 1912, aggregates 1,723,800 cu. yd. During the fiscal year ended June 30, 1912, the total cost of handling the material, earth and rock, by the hydraulic method, was $0.5564 per cubic yard.

NATURAL GAS amounting to 207,112,576,000 cu. ft., valued at $28,451,907 was produced in West Virginia in 1911 from about 4755 wells.

Decrease of Value in Ore-Shoots With Depth—II

By F. Lynwood Garrison

J. F. Kemp, of Columbia University, in his discussion of my paper on the 'Decrease of Value in Ore-Shoots with Depth,' at the Toronto meeting of the Canadian Mining Institute,[1] seemed to think my general conclusions on the subject did not sufficiently take into account the phenomena of secondary enrichment as a factor bearing on the apparent decrease of value with depth. Before discussing this aspect of the subject, if indeed it be a phase of the case, it is desirable to clearly understand what is meant by secondary enrichment. It is well known that in many ore deposits there evidently have been several successive periods of metallic deposition and the mineralizing waters or vapors may have come from lower, higher, or lateral sources. My understanding of the usual expression, 'secondary enrichment,' is solely that increase of metallic value which is derived from the leaching by surface waters of the upper part of an orebody above ground-water level; the leaching and accompanying oxidation of this portion of the lode taking place usually, but not necessarily, simultaneously. Of course, the ground-water level may have changed through the geologic history of the deposit, and the lode, enriched as we now find it below the present ground-water level, may have acquired this accretion when this water was much lower than now; or, conversely, the secondary enrichment of today may be far above the present ground-water level. Now evidently secondary enrichment strictly interpreted, may come from above, below, laterally, or from any and all directions. The difficulty in most cases is to determine what was primary ore. When we construe the term 'secondary enrichment' to mean only that which is derived from above, it is much less difficult to at least guess what was the primary mineral substance upon which the meteoric waters deposited their metallic burden. Accepting this as the common view, and applying it exclusively to the enrichment due to downward circulation, it is evident that secondary enrichment is substantially a superficial phenomena, depending upon the depth of the ground-water level or plane, which in most instances has been, and perhaps still is, a varying factor. As the ground-water level falls, the leaching action penetrates deeper. It may rise again and the depleted area be once more enriched by the mineralizing waters from higher horizons, the difficulty is to know where it begins, ends, or how far it has penetrated.

That brings us to another phase of this problem of ore deposition. It has long been assumed that chalcocite is a secondary mineral, in other words, a creature of secondary enrichment in the usually accepted sense. It is true it is usually found at no great depth, generally occurring intermediately between the oxidized portion of the copper lode and the deeper lying pyritic portions, which latter is usually assumed to be primary ore. Expressed in simple terms, the chalcocite is derived from the leached and oxidized part of the lode. its deposition and accumulation occurring at or about ground-water level. Our faith in this generally accepted view has been lately somewhat shaken by recent developments at Butte, Montana, where chalcocite has been found at depths of 2000 ft. vertical. According to Charles T. Kirk, it is a fact that the secondary concentration of chalcocite has not been reached at a depth of nearly 3000 ft.[2] The chalcocite at the Bonanza mine,[3] in the Chitina River district, Alaska, is probably the largest body of chalcocite ore yet discovered. It occurs in the Nikoli greenstone or diabase, as irregular lenticular and vein-like bodies replacing the rock or disseminated through it in small particles. In places the chalcocite is associated with epidote. Much larger masses of particularly pure chalcocite occur in the adjoining Chitistone limestone, by replacement of the original rock. F. H. Moffit leans toward the belief that in both the limestone and greenstone the chalcocite is of secondary origin, being probably derived from leaner sulphides.[4]

It seems likely as a general principle that similar metallic minerals in the same limited area, and even in the same rock, may have had a diverse genesis. Thus the minerals epidote and allanite, long assumed to be of characteristic secondary origin, are shown by a number of investigators to have been in many cases primary, and a constituent of unaltered igneous rock. Allanite and epidote are representatives of a large number of metalliferous and nonmetalliferous substances which enter into the constitution of igneous rocks. They indicate how widely metal-bearing components may occur, and how differently they may be found without being of extraneous origin. They occur as primary minerals under conditions far more extraordinary and seemingly impossible than those under which many metallic salts are found.

As affecting the general principle that richness in ore-shoots does decrease with depth below, say, 1000 or 1500 ft., some interesting observations have come to my notice since writing the paper under discussion.

At the Mysore mine, in the Kolar district, India, the latest reports show a decided impoverishment at the bottom levels, 2500 to 3000 ft., the value of the ore decreasing from $50 per ton in the upper reaches of the mine to $20 per ton at the 3000-ft. level.[5] At the annual meeting of the Mysore Gold Mining Co., held in London, March 20, 1912, the chairman stated:

"With regard to pursuing mining operations in greater depth, we have been questioned by more than one shareholder as to whether we anticipate any grave difficulty in following ore to largely increased depths. I say, in answer to this, that we have no sort of difficulty at the depth at which we are now working, and with the provision of the requisite machinery we see none in going to very greatly increased depths. My questioners appear to be under the impression that we have already reached exceptionally great depths in the Mysore mine, but I would like to remind them that after all the mine has only attained a vertical depth of about 3000 ft., although on its underlay it is over 4500 ft., whereas I could instance to you mines which are today being worked at a vertical depth of over 5000 ft., and a depth on the underlay of over 8000 feet."

At the North Butte mine in Montana it has been asserted on authority which may or not be reliable, that on the 2200-ft. level of the Snowball vein the orebodies average 3 ft. in width, 4% copper, and 10 oz. of silver. This vein was opened about January 1912; since then the same lode has been developed on the 2000 and 2200-ft. levels, the work on each succeeding level in depth showing not only increases in value but longer and more persistent ore-shoots.

In a comprehensive and comparatively recent review of the mining conditions in Western Australia,[6] A. Montgomery states: "It is undeniable that in Western Australia, as in all other parts of the world, the lower levels of the mines have not been so productive as those nearer the surface, but it does not seem to me that in this respect they have shown any more lack of permanency in depth than those of most other mining fields, nor is there any satisfactory reason yet apparent why valuable ore should not be found to persist in them to quite as great depths as in any other mining region, say to 4500 ft., as in Bendigo, or even to the immense depth of 6000 ft. at which mining in South Africa has been seriously contemplated. * * * As a mat-

[1] *Mining and Scientific Press*, April 20, 1912.
[2] *Economic Geology*, Vol VII, part No. 1, p. 82.
[3] Bull. 374, U. S. Geol. Surv., p. 46.
[4] Bull. 448, U. S. Geol. Surv., p. 78.
[5] Herbert A. Carter, *Mining and Scientific Press*, February 3, 1912, p. 201.
[6] *Economic Geology*, Vol. VI, No. 5, pp. 493-502.

ter of fact, good ore has been found in Western Australian mines at the greatest depths to which mining has been carried, namely the 2650-ft. level of the Great Boulder mine. So far as work has gone at that level, it is true that value has not been so satisfactory as at the 2500-ft. level, and there has been much fear expressed in consequence that this famous mine was at last failing. But some good ore has been obtained, and it must be remembered that at all the levels it has been often easy to miss the best ground until a great deal of exploration has been done. * * * In almost all the mines of Kalgoorlie it has been found essential to do a great deal of boring across the strike of the vein to find hidden ore. and the first drift along the lode has often been anything but a true test of its value. This local peculiarity must be recognized and allowed for, and time given to open the ground pretty thoroughly before jumping to the conclusions about extinction of values. * * * The whole history of the Boulder mines from below the oxidized zone has shown a succession of pessimistic forecasts of its early decease, and from time to time the prospects of first one and then another of them have appeared very doubtful. * * * Time and again, however, further exploration has brought about new developments, and the position has improved, and there is therefore always much hope that perseverance will be rewarded. * * * Another characteristic feature of the lodes of Western Australia is the unusual amount of secondary enrichment which appears to have gone on in most of them near the surface, especially in the zone of oxidation above the water-level. This has often led to much disappointment when the deeper parts of the lodes have been reached, but it is a feature which is now becoming much better understood than formerly, and for which allowance is to be made. There is, however, much doubt yet as to the depth below surface to which its effects are perceptible. * * * A great deal of the fear that is expressed as to permanency of ore deposits in depth is often founded on what is really an entirely unproved assumption, though it has a certain amount of *prima facie* probability—namely, that in a deposit formed by ascending hot waters the metals would be likely to be in solution in the deeper zones when at higher temperature and under high pressure, and would only be deposited in ascending through the crust of the earth as the temperature and pressure are reduced and the solutions come in contact with more superficial waters carrying precipitants. It is somewhat inconsistent that this view should be put forward as a reason for expecting falling off in value in veins like those of northern New Zealand, which seem plainly to be of hydrothermal origin and outcrop probably at no great depth below the original outlets of the hot springs which formed them, and also for the pneumato-genetic lodes of Kalgoorlie, the portions of which now accessible to us have most probably been formed at great depths under pneumatolytic rather than hydrothermal conditions."

In contradiction to these optimistic views of Mr. Montgomery, we note that recent reports from the Ivanhoe at Kalgoorlie indicate a decrease of value in the ore reserves of the lowest levels of 2s. 10d. (67c.) per ton.[7] A more detailed later report from the Ivanhoe seems to cast doubt upon this conclusion, for it states that the main shaft is over 2600 ft. deep and is being slowly but steadily deepened. A bore-hole put in from the Great Boulder at 2800 ft. pierced a lode, at 57 ft. from the south and 12 ft. from the east boundary, assaying 89s. 6d. ($21.48) per ton. This proves that good ore persists and that the present workings are in a poor zone. Development in the adjoining Horse-Shoe mine confirms this inference.[8]

The following interesting instance is given by George J. Hough[9] of the occurrence of oxidized ore at comparatively great depths. Near the little town of Ramos in the northwestern corner of the state of San Luis Potosi, about 35 miles east of the city of Zacatecas, Mexico, there is the Cocinera mine, which attained about the year 1901 a depth of 1200 ft. At 1100 ft. a large body of oxidized ore was found, containing its copper almost entirely as red oxide associated with native silver and some small amount of an apparently new variety of stromeyerite, having a composition about A_8Cu_4S with a massive perfectly homogeneous structure. As to deep-lying oxidation, a similar condition occurs at Bisbee, Arizona, where the level of oxidation is very erratic, extending to at least the 1400-ft. level, while at other places sulphide ores are found within 200 ft. of the surface.

If the metallic minerals of a lode result from the concentration of traces of metals disseminated throughout accompanying and associated rocks, it is to be expected that such mineralization will not extend much beyond or remote from the areas or spots where these attendant rocks have been decomposed and more or less leached; consequently when there is a good and copious flow of water in deep workings there must be as deep or deeper channels for its circulation and where there has been a sufficient fracturing of the accompanying rocks to provide such fissures, it is fair to assume some of them have been filled or choked with depositions of mineral matter perhaps sufficiently rich to constitute ore. During the past summer I had the opportunity of going through the lower levels of the Mexican mine on the Comstock Lode and the deeper workings in the North Star mine at Grass Valley, California. At both of these places there is good ore, not as rich as has been found higher up, but on the whole excellent in value and grade, with promise of continuance, or perhaps it would be better to say, at present no indications of discontinuance with depth. The levels to which I refer are below 2000 ft. and are accompanied by a copious flow of water. The discovery of the orebodies at these deep levels was not the result in either case of wholly fortuitous circumstances, but the reward of intelligent and courageous development. When we consider the intense heat and other discouraging difficulties presented by both nature and man which at present surround and hamper all enterprise and progress on the Comstock, Whitman Symmes deserves a meed of praise no money can ever compensate or anyone fully appreciate who has not been through those deep, hot, and suffocating stopes.

As is well known, the underground flow of water in the Comstock is enormous. It is believed by F. Becker to have its source in the high Sierra some 15 or 20 miles west.[10] His hypothesis that some of the drainage of these mountains reaches a great depth below the Washoe district and is heated by contact with deep seated and still hot eruptives is plausible, and, if accepted, assumes very deep fissuring in the plane of the lode. Admitting such is the case, it is not unreasonable to assume that some portions of these fissures may be filled with mineral substances rich enough to be denominated ore, and at levels considerably deeper than 3000 ft. Our knowledge of the physical and chemical processes going on in deep-seated rocks is certainly shadowy. We do not know how deep fissuring and faulting has progressed; without voids and fine cracks for the circulation of mineral-bearing solutions, veins cannot form even by replacement. It must not be assumed that deep underground circulation implies a large flowage of water. It seems probable much of this movement may be credited to water in closely confined spaces and moving with inconceivable slowness.[11]

The time honored conception of ground-water held that there existed a standing aqueous body universally present at a fairly definite distance below the surface. The upper limits of an orebody were assumed to be sharply defined and indicated by the line or zone of demarcation between the oxidized and enriched ones and the unaltered sulphides. The supply of water was maintained by that part of the rainfall which sinks into the ground.[12] The fact that a great body of standing water is usually found at no great

[7] *The Mining Magazine*, May 1912, p. 319.

[8] *The Mining Magazine*, July 1912, p. 40.

[9] *Mining and Scientific Press*, December 30, 1911, p. 836.

[10] 'Geology of the Comstock Lode,' p. 242.

[11] M. Maclaren, 'Gold,' p. 8.

[12] J. F. Kemp, 'Rôle of Igneous Rocks in the Formation of Veins,' *Trans.* Amer. Inst. Min. Eng., Vol. 31, p. 184.

depth below the surface in regions of considerable rainfall makes it necessary, according to this theory, to believe that rocks are pretty thoroughly saturated with water down to depths where the return journey begins, in fact, as C. R. Van Hise expresses it, "there is a sea of ground-water." Van Hise in particular rejects specifically the igneous rocks as significant contributers of either material or energy in the hypothesis he seeks to establish.[13] He contends that the waters which fill the veins with mineral are meteoric and that gravity is their motive power. There are grave objections to this conception when examined in the light of experience gained with deep wells and shafts, for as previously intimated, they show in most cases a decided disposition of the rocks to become progressively drier with depth. A further review of this subject is not contemplated save to observe that the views of Van Hise, although admirably worked out and presented, do not harmonize with the experience of mining engineers who have had occasion to study conditions in very deep mines. It would seem that these conceptions of Van Hise as well as those of C. S. Slichter[14] must be revised if they are to fit in with the practical facts ascertained in recent years, at least so far as concerns conditions existing in crystalline rocks.

Instances close at home are not wanting wherein good ore has been found at increasing depths; thus at the famous old Dolcoath mine in Cornwall a substantial improvement in the tin lode was found at the 490-fathom (2940-ft.) level where the ground yielded 60 lb. of 'black tin' for the full width of the drift.[15] At Guanajuato, Mexico, we have a great lode (Veta Madre) resembling in many respects the Comstock. Mining operations were begun here about the year 1554 and the principal shaft, the Valenciana, had reached a depth of 1800 ft. when operations were finally suspended in 1897, chiefly owing, it is asserted, to inability to handle the large influx of water. The orebody in the Valenciana was worked to a depth of 1640 ft. vertical, then by winzes about 200 ft. deeper. It is asserted the bottom was in bonanza ore; there may have been ore at the bottom, but whether sufficiently rich to yield a profit in the face of the increasing pumping and hoisting costs with the old equipment is doubtful. The impression I have obtained from a careful perusal of the most reliable statements to be had, is that Valenciana is bottomed in ore, but not bonanza ore in the sense of being abnormally rich.

Ponciano Aguilar, of the Mexican Geological Survey, is credited with the statement through H. E. Miller[16] that the lower levels of the Valenciana mine were comparatively dry, that the flow of water which caused the cessation of work in the shaft, came from the higher levels, from the hanging wall crossing through the faults and cross-veins. It has been observed in this case that the richest ore was along the hanging-wall side of the vein, where also there was most water, the inference being that the water naturally followed the lines of maximum fissuring, bearing out the hypothesis that the water circulation and ore deposition are often, if not usually, concomitant phenomena. The exact depth of the Valenciana shaft is another matter of doubt. Probert[17] gives it as 1807 ft.; Halse,[18] 1968 ft.; Ramirez,[19] 2042 ft.; Dahlgren,[20] 2100 ft.; and Tilman,[21] 1968 ft. The Nueva Luz (a new shaft), which is to be cross-cut into the underlay of the Valenciana orebody, is 2030 ft. vertical, the deepest shaft in Mexico. According to Halse, from the 300-ft. to the 1200-ft. levels in the Valenciana rich ore was abundant; below this, impoverishment began to appear.[22] Halse, in the paper mentioned, cites eighteen or twenty instances of Mexican mines having shafts of over 1000 ft. vertical depth. In nine of these cases there was a distinct impoverishment in the lowest levels, but in most of the other instances given the value of the ore held up pretty well at the bottom. This paper was published seventeen years ago (1895): doubtless many of these shafts have been, in that interval, sunk much deeper; it is to be regretted we have no later data regarding them. Mexico is an excellent illustration of a country containing a large number of relatively deep mines ranging from 1000 to 1800 ft. vertical. Such probably is to be expected in a country where the mining industry is comparatively ancient. It is, however, presumable we have here a terrain which has been subjected to relatively little erosion, hence with few or no stumps of lodes. But such conclusions must be accepted with great caution, or at least until more is known about the geology of the country than is now the case; doubtless at some places in Mexico the degradation has been considerable, yet on the whole the erosion cannot be anything like as great as that suffered by those parts of North America once covered by the great ice sheet of the Glacial period. In the discussion of the Halse paper, H. F. Collins stated he was not prepared to believe "in any continuous or general impoverishment of fissure veins in depth * * * they were just as likely to find one vein rich at the surface, yet poorer in depth, as they were to find another poor at the surface yet rich in depth." Of course, those poor at the surface would not

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be likely to be worked, and therefore it might happen that in the majority of cases veins rich at the surface would appear to become poorer in depth; it was, however, merely because the veins evidently poor at surface did not get worked as much.[23] Mr. Collins further stated it was perfectly true that most veins showed a zone of enrichment near the surface, but he thought it essential to clearly distinguish between the evidences of surface enrichment and of steady or gradual impoverishment with depth. These views were expressed seventeen years ago. It is but fair to suppose the speaker's ideas may have changed somewhat in that long period; moreover, as previously intimated, none of the mines in Mexico at that date exceeded 1000 to 1800 ft. vertical depth.

It has been objected that this discussion as a whole is 'academic,'[24] the inference being it has or eventually would have no practical value; that it is, in other words, learned rather than utilitarian. No better refutation of this view could be asked than the valuable observations from the Newhouse tunnel made by Mr. Collins, wherein we have a practical illustration of the non-persistence of some veins and the persistence of others at a depth of 1500 ft. as exposed in this working; the latter showing little or no change of general character or extent of mineralization, while the former wholly fail to penetrate to that depth. It is only in the collation of such data as this by competent observers that we can hope to make these dissertations of essential value to the student and public. Doubtless much which creeps in is mere talk, but so far as we have gone in this instance there remains, I believe, not a little of practical value.

[13]'Some Principles Controlling the Deposition of Ores,' *Trans.* Amer. Inst. Min. Eng., Vol. 30, p. 103.

[14]Water Supply and Irrigation Paper No. 87, U. S. Geol. Survey.

[15]*The Mining Magazine*, July 1912, p. 39.

[16]Unpublished Notes. March 3, 1911.

[17]*Eng. & Min. Jour.*, Dec. 31, 1910, p. 1310.

[18 19 20]*Trans.* Inst. M. & M., Vol. III, p. 429.

[21]'Der Bergbau von Guanajuato en Mexico,' 1866, p. 22.

[22]'Deep Mining in Mexico,' *Trans.* Inst. M. & M., Vol. III.

[23]*Loc. cit.*, p. 442.

[24]G. E. Collins, *Mining and Sci. Press*, Sept. 28, 1912.

The Ophir Cyanidation Plant

The new plant of the Ophir Silver Mining Co., operating on the Comstock Lode, has now been in operation a little over a month, and was briefly described in the *Virginia City Chronicle*, by Walter Techow, who, after designing and erecting the mill, is now in charge of its operation. In building the plant an excellent record for speed was made. It was ordered by the directors June 22. The first work of grading began on July 15, and while the lumber did not arrive on the ground until the end of the month, the actual construction began early in August. The frame was put up during that month, and the building inclosed early in September. The machinery was also installed in September, the finishing touches made early in October, the plant started October 14, and has been running continuously ever since. The plant is complete with the exception of the clean-up room, now being added, and soon to be placed in commission. With the melting facilities available, the first clean-up will be made.

According to Mr. Techow, the plant was designed for a capacity of 100 tons per day. During the first two weeks after starting, it treated 1065 tons. During the third week 625 tons was handled, and during the past week the plant has been running at a rate of more than 100 tons per day. The process adopted consists of re-grinding the coarse part of the tailing from the old Kinkead mill, agitating the re-ground tailing with cyanide solution, and separation of the gold and silver-bearing cyanide solution from the now barren tailing. The tailing is re-ground in a 5 by 22-ft. tube-mill furnished by the Union Iron Works. One problem in connection with the erection of this mill was how to get the wet and sticky material to the tube-mill, and the method adopted was to sluice it from the pond to the tube-mill. This method has proved successful and economical, as the cost of getting the tailing into the mill is only about 9c. per ton. The tailing is sluiced into the tube-mill with dilute cyanide solution and is continually in contact with cyanide solution from the moment it leaves the pond until the treatment is completed.

From the tube-mill the re-ground tailing passes to a Dorr thickener 28 ft. in diameter by 8 ft. high, where it is settled and the excess of the cyanide solution is removed. This solution is pumped back to the tailing pond and is kept continually in circulation. The settled slime is elevated from the bottom of the Dorr thickener into one of a series of three agitating-tanks, 16 ft. high and 22 ft. in diameter. These agitating-tanks are equipped with Trent agitators. They require little power and do excellent work if properly erected and looked after. After about 24 to 36 hours agitation with an additional amount of cyanide, the slime is transferred to a storage tank and passes from this tank to the Butters filter. The gold and silver-bearing cyanide solution leaves the filter clear, and passes on to the precipitating-boxes, while the tailing is discharged from the Butters filter and allowed to run to waste.

The original estimate of the cost of operation of this plant was $1.25 per ton. It appears now, however, after one month's operation, that the estimate was too high. The cost of treatment will probably not exceed $1.20 per ton, and possibly may be lower. The consumption of cyanide is at present less than three-quarters of a pound per ton or an equivalent of $0.19 per ton. The total cost of labor will come to about $0.40 per ton. The power consumed during the first two weeks was at the rate of 100 hp. It will probably be less in the future, as all the machinery was new and in the process of being limbered up.

Up to the present time, by the records at the plant, the tailing treated has averaged about $5 per ton before treatment and $1 per ton after, thus indicating an extraction of approximately 80%. It is believed, however, that further experiments and improvements will raise the extraction to 85%, or possibly higher. It will be of interest to again recall that the tailing is the product of the Kinkead mill, which by the process of concentration, extracts 84 to 87% of the original value of the ore as shown by the smelter bullion returns. It can thus be concluded that a final loss of $1 per ton represents only 2 to 3% of the first head sample at the Kinkead mill. The total extraction at the mill and cyanide plant will, therefore, undoubtedly average 97% or better of the gross value of the ore. This extraction, according to figures furnished at the Ophir office, is being obtained at a total cost of $3.75 per ton for both milling and cyaniding.

A Souvenir Medal

We present below a picture of the beautiful medal struck in commemoration of the visit of the American mining engineers to Japan in 1911, and sent by them to their Japanese friends. The medal was designed and manufactured by Tiffany & Co., and is made of gold bronze framed in ebony. Replicas have been sent to each of the members of the general committee and to others prominent in entertaining the visitors. In addition, life memberships in the American Institute of Mining Engineers have been purchased and presented to Reija Kanda, M. Otagawa, and W. Watanabe, to whom the visitors were indebted for many especial courtesies. The selection and presentation of the souvenirs was made by a committee consisting of D. W. Brunton, F. C. Smink, and F. H. Daniels.

THE MEMBERS AND GUESTS
OF THE AMERICAN INSTI
TUTE OF MINING ENGI
NEERS WHO VISITED THE
EMPIRE OF JAPAN IN
NOVEMBER NINETEEN HUNDRED
AND ELEVEN BEG YOU TO ACCEPT
THIS TOKEN OF THEIR GRATEFUL
RECOGNITION OF THE COURTESY
AND HOSPITALITY RECEIVED BY THEM

Of the industries of the Union of South Africa, mining is by far the most important. The total value of the principal minerals produced in South Africa up to the end of last year was approximately as follows: gold, $1,579,715,000; diamonds, $777,600,000; coal, $113,210,000; copper, $43,740,000; and tin, $7,260,000. During December 1911 the mining industry of the Union gave direct employment to 31,700 white and 259,600 colored persons. The amount of gold ore crushed during the past year was 25,000,000 tons, yielding 8,250,000 oz. of gold, valued at $170,000,000. The profits amounted to $57,348,000, and the dividends $38,991,780. The increase in the production over 1910 was $14,895,900, principally due to new producers. The value of the output of the other principal minerals during the past year was as follows: diamonds, $38,510,420; coal, $9,438,120; copper, $2,702,160; and tin, $2,016,900.

THE oil industry in the Taranaki division of New Zealand has excited a good deal of comment from time to time. The first attempts to prove the oil-bearing country were from 1865 to 1868, and the second period of activity was from 1889 to the present. There are now four oil companies holding property in or near the area examined, but the combined output is little over 100 bbl. per week.

Special Correspondence

LONDON

CAMP BIRD REPORT.—FURTHER INVESTMENTS BY THE COMPANY.—MESSINA DEVELOPMENT.

The annual meetings of the Camp Bird, Ltd., The Santa Gertrudis Co., Ltd., and the Messina Development Co., Ltd., have just been held in London. The Camp Bird company carried forward a surplus of £51,000, against £39,000 brought forward last year. The profit and loss account, as made up from quarterly reports, covering fourteen months, from May 1, 1911, to June 30, 1912, showed £245,000, less £11,000 charged off for taxes, £8000 for depreciation and other sundry expenses, amounting to a total of £22,000, leaving a balance to the profit and loss account of £223,000, Camp Bird's proportion of Santa Gertrudis profits during a like period amounting to $202,000 net, being 81%—a total of £250,000 to the credit of the Santa Gertrudis profit and loss account. One of the chief items of interest in the Camp Bird balance sheet is an expenditure of £79,225 invested in the purchase of the Aviado-Recuperadora shares. These shares have since been transferred to the Santa Gertrudis company.

The principal item of interest discussed at the meeting was the outlook for further production from the old Camp Bird mine, and in this regard A. M. Grenfell, chairman of the board, said in part:

"I think we may look forward with every confidence to another prosperous period; but as the Camp Bird becomes exhausted we begin to depend more on dividends from Santa Gertrudis. The developments at Camp Bird seem to justify Mr. Cox's estimate that we may still expect a profit in Camp Bird of £60,000. The orebody being developed is quite promising, but inasmuch as the finding of ore at this horizon is contrary to the expectations of the experts, I do not care to attempt to prophesy, though there does seem a sporting chance of our finding a fair orebody here. There is always a possibility—a small one, perhaps, but still a possibility—that we may be on the top of an entirely new body. Mr. Cox has thought well enough of the prospects to sink the shaft down 200 ft. below the present drifts, and, as I have said, should we find that the values are maintained at this depth, we may begin to speculate on the probability of considerable future profit from the Camp Bird mine." In reference to the Santa Gertrudis, Mr. Grenfell said: "I will say here that if the estimates of the engineers of the Santa Gertrudis are borne out, that mine should give a profit this year of £360,000, taking silver at 35c. per ounce, or if you take silver at the price of today, the profit should come up to £412,000, of which the Camp Bird proportion would be £304,000. Adding this to the £60,000 we should receive as profit from the Camp Bird, we may look forward fairly safely, I think, to an income this year of £364,000, so that we have every reason to congratulate ourselves, not only on the past, but on the immediate future. Furthermore, from the reports of the Santa Gertrudis, it appears that that mine has sufficient ore in sight to yield very large dividends during the next four or five years, so that not only are we in an exceptionally good position today, but I think we may look forward to very satisfactory profits during the next few years; in fact, our position appears to me to be so strong and so satisfactory that the board are of opinion that we should take advantage of our prosperity to establish ourselves on a really sound and lasting basis."

One of the important items of discussion at this meeting was in regard to the policy of the Camp Bird company as to the making of further investments similar to that made in the Santa Gertrudis property. As to this Mr. Grenfell said: "During the next four or five years it should be our policy to build up a reserve fund of £600,000 or £700,000, if we can do so without in any way impairing the real benefits of the shareholders. As it is, today we are dividing our profits up to the hilt. We are making little provision for the maintenance of dividends or for accidents or shut-downs which might happen to Santa Gertrudis, just as it happened in Camp Bird, the idea being that shareholders in mines arrange for their own sinking fund, but in all properly managed industrial companies the board of the company incurred this responsibility, and I think that all shareholders who really think out the position of the company will come to the conclusion that I have come to, namely, that undoubtedly the soundest policy is for us to make hay while the sun shines, and to so shape our policy now, when everything looks prosperous, to assure our future beyond all possible question. At the present moment we are considering—together with probably one of the strongest groups of mining people in America, and with one of the strongest groups in France—purchasing a very well known mine in Mexico. It is a mine that has been reported on by nearly all the best known engineers; but the owners' idea of its value was too extravagant, and we have acquired an option on it on terms which, with small modifications, may be considered satisfactory. As the negotiations are still going on, and as our preliminary corps of engineers has only just reached the mine, you will not expect me to make any definite statement as to which the mine is or what is the purchase price; but suffice it to say that even the third share which has been reserved for Camp Bird will require a considerable sum of money, and provided that the results of the examination satisfy our engineers, there is no doubt, in my opinion, that it is an opportunity that should not be missed. Had we been in the fortunate position of having a lot of spare cash, I would like to have had a bigger interest for the Camp Bird. As it is, our participation is such that we can see our way to financing it, and the profits which should accrue to the company would be considerable."

With reference to the Messina development, the situation is covered by Mr. Grenfell's statement to the effect that the option which the Camp Bird holds on the 125,000 shares of Messina Development now shows a paper profit of between £30,000 and £40,000. It is very interesting to note the work which the Camp Bird is doing in Mexico, and it is not out of the way to say that there is hardly a precious-metal mining company in America that has as well satisfied a list of shareholders as is possessed by the English companies, including Camp Bird, Esperanaza, and El Oro. The full reports made by these companies are a source of satisfaction to the investors, and while there has been some strong criticism leveled at the Camp Bird management as to the manner in which the Santa Gertrudis purchase was made, similar deals made by American companies are hardly noted as a matter for adverse comment.

BLACK HILLS, SOUTH DAKOTA

HOMESTAKE CHRISTMAS PRESENT.—DEVELOPMENT OF THE REPUBLIC.—WORK AT THE GOLDEN REWARD

Appreciating the loyalty and efficiency of its employees, the Homestake Mining Co. announces that on December 31 it will pay to each employee a sum equivalent to 7% of the pay drawn during the past year. In connection with this announcement, the statement is made that the company is enjoying the most prosperous year in its history. The output of the mines is larger than ever before, and everything is running smoothly. The royalty contracts with C. W. Merrill, under which the cyanide plants of the Homestake were operated, have all expired, the last to be canceled being the contract for the big slime plant. The two cyanide plants and the slime plant will be operated, as in the past few years, under the direction of A. J. Clark, the company's metallurgist, ably assisted by W. J. Sharwood.

The Republic Mining Co., a reorganization of the old Golden Gate Mining & Milling Co., has started work on its property at the head of Blacktail gulch. The Golden Gate company was one of the first in the Black Hills to successfully adopt the cyanide process. After a shut-down of 14 years, the owners decided that a little more work might put their property on a paying basis, and the stockholders, who are wealthy men of Chicago and Oregon, Ill.,

raised funds among themselves to carry on development, with the understanding that if the mine warrants they will furnish money to build a mill. An old shaft has been cleaned out, equipped with a 30-hp. electric hoist and other machinery, and from its 100-ft. level a cross-cut is being driven to the Maggie shaft, to drain the old workings and give ventilation, as well as to develop the intervening territory. The old workings contain considerable quantities of ore, which, although formerly too low grade to work, is now suitable for milling. E. J. Hoover is general manager and C. C. Todhunter superintendent.

The roasting plant of the Golden Reward, at that company's Astoria mine, is rapidly nearing completion, and it will probably be in operation by the first of the new year. The ore from the Astoria shoot is soft and wet, so that it must be dried before going to the rolls; this will be accomplished, after a preliminary crushing to ¾ in., in cylindrical driers. From the rolls the ore will go direct to the Wedge 7-hearth mechanical furnace, fired by crude oil. After passing through coolers, the roasted ore will be elevated to a cylindrical steel bin for loading into cars for delivery to the company's cyanide plant at Deadwood. The roasting plant will have an initial capacity of 75 tons per day, but provision is made throughout the plant for duplication of all machinery, so that the capacity can be doubled when necessary. The Astoria ore-shoot has been explored for a length of 2200 ft., with the limit not yet found. The shoot is 8 to 12 ft. thick, and 100 to 150 ft. wide. After roasting, the ore is easily and cheaply cyanided. The Astoria shaft has been equipped with a new head-frame, a Leyner double-drum 82-hp. electric hoist, and a 100-hp. air-compressor. Among other surface improvements are a complete machine-shop, assay office, sawmill, and ore-bins for reception of ore from other mines of the company. It is the present intention to make tests on roasting the so-called blue ores from other openings. The entire plant has so far cost approximately $75,000. It was designed by Frank Cazin, of Denver, and Henry Schnitzel, general manager for the Golden Reward company.

At the Wasp No. 2 the old zinc-boxes have been replaced with three new steel boxes, of heavy construction. The compartments are 3 by 4 by 2 ft., each box having five compartments. The change has already effected a material saving in zinc, and it is hoped to reduce the zinc consumption one-half. This is quite an item when zinc, as at present, costs $10.10 per cwt. delivered at the Wasp spur. The Wasp No. 2 company is enjoying a prosperous year, having already paid $85,000 in dividends this year, and another $10,000 disbursement is expected next month. This makes the most prosperous year in the history of the company.

The Trojan company is getting in good shape for winter, having made a number of improvements, including housing the ore-bins and switch tracks, repairing and enlarging the heating plant, and completing other protection against cold weather. A fully equipped machine-shop is rapidly nearing completion. This shop will be one of the most complete in the Black Hills, containing lathes, punches, shears, drill-presses, bolt-machine, and drill-sharpener. The equipment is such that practically all ordinary repairs will be made on the ground. After a year's test of a gasoline locomotive for ore haulage, a second has recently been ordered and delivered. It is practically identical with the first, having a capacity of 11 to 12 cars of one ton each over the 4% maximum grade. In addition to the big producer of the company, the Decorah, the Portland and Empire are rapidly being gotten into shape for ore production. At the former property an electric hoist is at work, and at the latter a hoist and air-compressor, both electric driven, are being installed. With the new improvements completed, and the mill capacity raised to 400 tons per day, early next year, the Trojan will be the largest producer in the Bald Mountain district.

SUTTER CREEK, CALIFORNIA

LINCOLN CONSOLIDATED DISCOVERY. — SHAFT-SINKING AT KENNEDY.—NEWS OF NEVADA COUNTY.

The new vein intersected in the Wildman ground by the drift from the 1900-ft. level of the Lincoln Consolidated is reported to range from 6 to 7 ft. wide. Free gold and sulphides are evident. The company is arranging for development. The find was made beneath the point where the big vein was cut in the Wildman mine several years ago. The east cross-cut on the 2540-ft. level of the Central Eureka has cut a vein in the virgin ground recently acquired by the company. A winze is being sunk from the 2825-ft. level on ore of milling grade. It is reported the shaft may be sunk deeper to assist in the extraction of this quartz. Operations have been resumed at the East Eureka. The mill is in commission and considerable development work is under way. E. Gualard has been chosen superintendent. Sinking is progressing rapidly at the Kennedy with the shaft now down about 3700 ft. With the consummation of this work extensive lateral driving will start. In the meantime production continues along normal lines. It is rumored that the last clean-up at the Argonaut was the largest in years. A good surplus is in the treasury, but no dividends are being disbursed pending settlement of the litigation with the Kennedy Extension company. Hugo and Martha Loss have petitioned the courts for a temporary injunction preventing the Kennedy, South Eureka, Zeile, Bunker Hill, Fremont Consolidated, Lincoln Consolidated, and other prominent mining companies from dumping débris into Dry, Jackson, and Sutter creeks. The defendants are also desired to appear and show cause why the injunction should not be made permanent. It is charged that deposition of tailing in these creeks has damaged the agricultural lands of the plaintiffs. Deep quartz mining is probably more active in this county at the present time than at any period in local history. This is largely due to the success attending deep exploration at the Kennedy, Argonaut, and South Eureka mines.

The Delhi Mining Co., in Nevada county, has made ar-

AMADOR CITY AND THE KEYSTONE MINE. FROM AN OLD PHOTOGRAPH.

rangements for the completion of the five-mile flume line from Bloody Run to the Delhi mine, on Columbia hill. One mile is already in place, and the company will complete the remainder on its own account. It is expected to have the work finished by the end of next summer. Good finds were reported last week from the American Hills area in Nevada county. Cadman Bros. have found a shoot of sulphide ore in their Ophir mine. The vein is said to be 10 ft. wide, with the ore fair grade. It is thought to be the south extension of the Sierra del Oro vein. The find was made 700 ft. from the adit portal. The level is being continued to intersect the Clover Patch deposit of red gravel. A shoot ranging from 2 to 12 ft. wide is reported at the Mt. Moriah. It is stated to assay $5 to $10 per ton. H. Norman, J. W. Meehan, and T. Peterson, of Kennett, are the owners. Promising ore has been found near the Middle Yuba river by W. J. Nixon. The claims are owned by C. E. Harvey, of Astoria, Oregon. Six stamps of the Prudential mill are operating on ore from the 900-ft. level. Lessees are working at this point and some good ore is reported showing.

NEW YORK

STRONGER COPPER MARKET.—SHATTUCK-ARIZONA.—DEVELOPMENT AT ELY.

The clearing of the Balkan war cloud and the apparent averting of the danger of a general European conflict served this week to put fresh spirit into the market, which had very nearly come to a dead standstill. The buying of copper for foreign account is said to be in very large volume and that without any concession in price on the part of the sellers. Undoubtedly this is in part due to the publication of the fortnightly figures covering the visible supply in England and on the Continent, which show a decrease of nearly 4,000,000 lb. Taking also into consideration the calculated decrease in the amount of copper afloat in transit from South America and from Australia, the world's visible supply showed a decrease of 6,250,000 lb. This is attributable to the unsettlement created by war conditions and the fact that during the past month buyers preferred to draw upon home supplies rather than make commitments, with the result that such supplies must now be replenished. Custom House clearings show a comparatively small volume of copper moving from this side to Europe during the past six or eight weeks, but the aggregate for the ten months of the current year has broken all previous records, and it may be regarded as certain that 1912 will be the largest export year the copper industry has ever had. Shipments for the ten months total 625,786,800 lb., as compared with 610,346,240 lb. for a similar period during 1911, and 537,304,320 lb. for the first ten months of 1910. The added strength shown in the foreign situation is due to the fact that, in spite of these record-breaking exports, there has, nevertheless, been no inconsiderable shrinkage in foreign supplies. If peace overtures are successful and confidence is restored abroad, an increased demand might result. If at the same time domestic consumers should abandon the hand-to-mouth policy which has been pursued during the past eighteen months, the demand for copper would be such as to undoubtedly create a further increase in price. At the moment 17¾c. is the prevailing figure, with sellers resolutely refusing to make the least concession.

The record-breaking consumption of copper is a matter worthy of a great deal of study. That an enormous copper surplus should pile up with the metal at a figure that can be said only in a few instances to have equaled the cost of production, as was the case two and a half years since, only to be followed by a cleaning up of copper stocks with prices 50% higher, is one of the incomprehensible contradictory movements in business. If there could be some adequate statistical information compiled covering the actual consumption of copper—that is to say, its manufacture into the articles in which it ceases to be an article of merchandise—such figures would shed a world of light on the copper situation and would assist greatly in determining the point at which production is to overtake or pass consumption. While the mining of copper has changed radically in its character as an industry, and has become so exclusively a field of large capital in which public participation is gained only through the stock market, yet the rejuvenation and rehabilitation of the many copper properties that could not be operated profitably during the months when the metal was selling at 12 and 13c. is a most encouraging feature. Granby, heretofore commented upon as a striking example of ability to come back, has just issued a supplementary report showing net profits for four months ending October 31. Granby is earning at the rate of $1,680,000 per year, and has on hand a net balance of $1,100,000 in cash and copper in excess of its liabilities. C. O. Mailloux, assistant to the president, has just completed a trip of inspection covering the properties at Grand Forks, Phoenix, and Hidden Creek, and in his report embodies the statement that the outlook at all of the properties is even better than indicated by previous estimates and figures. The Granby management is still looking for some plan that will permit the expenditure of the $2,000,000 necessary to equip the Hidden Creek property without deferring the payment of dividends for too long a time.

The movements in Shattuck-Arizona on the Boston Stock Exchange have created a good deal of comment. The market in the shares has been an inactive one for months, and sales have recently been made as high as $35 per share. The movement is supposed to be based upon the resumption of shipments to the Calumet & Arizona smelter. It is highly probable, however, that the market price is affected somewhat by two or three deals now in hand looking to the absorption of the Shattuck-Arizona by some of the larger interests, the deal to take over both the original Shattuck-Arizona and the Denn Arizona ground.

The foreclosure of the mortgage held by the Lincoln Trust Co. of New York, securing the bonds of the La France Copper Co., is presumed to mark the termination of the connection of F. Augustus Heinze with that property. It is said that as soon as legal requirements can be complied with, the Old Lexington mine of the La France company will be reopened. At the moment Heinze is devoting some of his energy to the Stewart property at Coeur d'Alene. Stewart is now said to be earning some $60,000 per month, and there is talk of a dividend. The suit brought by E. J. Carter has recently been dismissed, but it is said that some serious litigation has been started by the Bunker Hill & Sullivan alleging that Heinze has been pursuing the tactics that made him famous in Butte—disregarding boundary lines underground. Market experts are much inclined to the belief that this move is one of distribution.

Nevada Consolidated, since its share control passed into the Utah Copper Co.'s treasury, has ceased to be a live issue marketwise, and news concerning that property is without any effect upon quotations. It is reported, however, by engineers recently returned from Ely, that the company has recently made an important discovery on the Veteran ground, where a large body of high-grade ore has been found in a contact vein. Details are not forthcoming, but the importance of the discovery is said to be considerable. There is a rumor that a large merger is a possible development at Ely. A deal is being put together to include in a new company the Giroux, the Gunn-Thompson holdings, and some other ground, the interests concerned being those in the Inspiration Consolidated Copper Co., consisting of Wm. B. Thompson, of Thompson, Towle & Co., Thos. F. Cole, John D. Ryan, and other leading figures in the copper world.

A possible copper merger that has been considerably talked about includes the Wolverine, the Mayflower, and the Old Colony, which lie near and in part adjoin the Calumet & Hecla in the upper peninsula of Michigan. Recent diamond-drilling on the Mayflower and Old Colony has brought most encouraging results. From assays made from drill-cores results of 25 lb. of copper per ton have been obtained. The drilling has been most thorough, some 26,000 ft. of core having been raised, and the results very carefully tabulated. Mayflower development is now considered the most important that has been made in the Lake Copper country during recent years. Followers of the Mayflower

are saying that the Ahmeek, now the spectacular producer of the Lake country, did not have so good a showing at the same period in its development. The New England faith in copper is to be renewed by an increased disbursement by the Calumet & Hecla, as it is expected that a $15 disbursement will be made by the directors at the coming quarterly meeting. Up to the present time the Lake copper companies have distributed nearly $3,000,000 more than was distributed last year.

TORONTO, CANADA

STRIKE AT PORCUPINE.—DEMANDS OF THE MINERS.—NEW SHIPPER AT COBALT

A general strike of the union men belonging to the Porcupine branch of the Western Federation of Miners was called on November 15 as the result of a referendum vote on the question, taken on the previous day, which was stated to be practically unanimous in favor of the strike. The cause of the trouble dates back for some weeks, when five mines in the Pearl Lake area which had been paying somewhat higher wages than were given at the other mines, announced a new wage schedule making some reductions. The men thereupon appealed to the Canadian Department of Labor, which appointed a Board of Conciliation, under the Lemieux Act, to make an investigation. The Board brought in a majority report to the effect that, with one minor exception, the wages offered in the new schedule were fair and adequate, and recommended its acceptance. The men rejected the terms and submitted the question of going on strike to a vote. As a result, about 1000 men, including a number not belonging to the union, are out, and most of the mines have been closed down. The numbers on strike at the principal mines are given approximately as follows: Dome, 300; Hollinger, 300; McEneany, 80; McIntyre, 60; Dome Lake, 60; Porcupine Lake, 50; Hollinger Reserve, 50; Plenaurum, 30; Hughes, 40; Jupiter, 25; Dome Extension, 25; Vipond, 50; Pearl Lake, 20; Three Nations, 20. Three mines, the Pearl Lake, Three Nations, and Shumacher, have yielded to the demands of the union and work has been resumed. The Dome and Hollinger mills are running, and each has a few men at work underground. With these exceptions the entire district is tied up and a large number of the strikers have left. The Dome has succeeded in bringing in a trainload of strike-breakers, and has a force of special police closely watching the property. The roads are picketed by the strikers, who have stopped assessment work on many of the outlying prospects. Order has been generally well maintained, though one affray took place in which revolvers were drawn. Just before the outbreak of the strike A. A. Cole, mining engineer for the Timiskaming & Northern Ontario railway, after a visit to Porcupine, estimated that the gold output for 1912 would closely approximate $2,000,000. In view of the strike, this forecast cannot be expected to be realized.

Large additions had been made to the ore reserves of the McEneany up to the time when work was suspended, and the ore blocked out is valued at over $800,000. On the 300-ft. level there is an ore-shoot 150 ft. long, averaging 5 ft. in width, carrying ore which averages $50 per ton. Assessment work on the Bewick-Moreing claims adjoining the Foley-O'Brien property has opened up a large orebody with high gold content. The company's plans as regards the development of this property have not been announced. The Vipond mill closed down before the strike for alterations in connection with the construction of the 100-ton cyanide annex. The roof is being raised 5 ft., and other outside changes made, so that the cyanide machinery can be put in as soon as it arrives. Surface exploration on the Calvert has resulted in the discovery of four new veins in the schist formation, running from 6 to 8 ft. in width, and yielding good assays. The Dome Lake has cut its vein at the 180-ft. level, where it is 2 ft. wide and carries about $40 in gold per ton. At the claim owned by W. S. Edwards, north of the Imperial an orebody 30 ft. wide has been found.

The principal feature at Cobalt lately has been the appearance of the Seneca Superior, which holds a Peterson Lake lease, on the shipping list with an initial consignment of 34 tons, to be followed up shortly by other shipments. The success of this company has resulted in an upward movement in Peterson Lake stock. The Beaver has cut a new vein of 2 in. of high-grade ore on the 460-ft. level. This mine is now drawing ore from eight levels and is working at a depth of 700 ft., which is the deepest level in Cobalt. The General Mines Co., recently organized, has taken over the Green-Meehan power plant to furnish air to drills operating at the Red Rock. Ten of the 40 stamps of the Nipissing's new low-grade mill have been put in operation. The aerial tramway connecting the Meyer shaft with the mill is working regularly. The McKinley-Darragh has declared an extra dividend of 10%, to be paid January 1. The Casey Cobalt new mill is treating an average of 25 tons per day, the ore averaging 40 oz. per ton. There is enough low-grade ore on the dump to keep the mill running for two years. A pocket of rich ore has been found at the Lumsden on the 220-ft. level which shows a good

NATIVE SILVER FROM NIPISSING MINE.

width. On several levels pockets have been found, but hitherto have proved too short to show profits from working.

SPOKANE, WASHINGTON

SESSION OF AMERICAN MINING CONGRESS.

Over three hundred delegates are in attendance at the fifteenth session of the American Mining Congress, now being held in this city, and much interest is shown. The session was called to order on Monday afternoon by Graham B. Dennis, chairman of the Spokane committee, and the remainder of the day was taken up by the addresses of welcome and the responses from the different state delegations. In the evening the president's annual address was delivered, followed by a reception on a magnificent scale to the president and officers of the Congress by the Spokane Chamber of Commerce. Tuesday, Wednesday, and Thursday are to be devoted to morning and afternoon sessions for discussion as already announced in the printed program, but arrangements have been somewhat upset by the failure of many of the speakers to arrive, and general discussion has been substituted for the papers announced in some cases. Tuesday was devoted to discussion of the protection of investors, which had been set for Friday; on Wednesday papers on Alaska and its needs were presented, followed by an open discussion. On Thursday workmen's compensation was the topic for discussion. The entertainment afforded the visiting delegates by the local members was as elaborate as it was enjoyable.

General Mining News

ALASKA

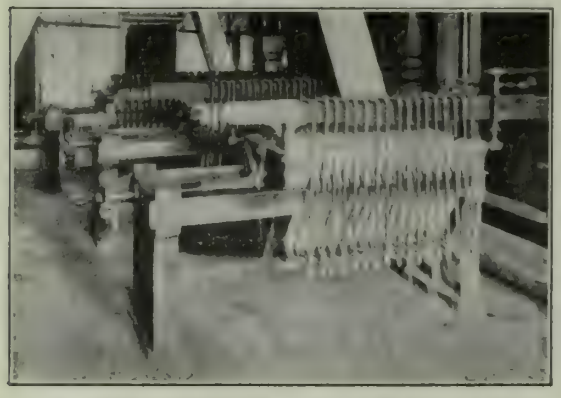
A Government report recently issued states that the trade of Alaska for 1912 amounted to $45,000,000, as against $20,000,000 in 1903, an increase of 125% in less than ten years. To this total must be added production of gold for the eight months ended August 31, amounting to about $8,000,000. The bulk of the value of Alaska's trade at this time is represented by copper and canned salmon shipments. For a sparsely populated country which has labored under many difficulties, these figures are remarkable.

Fairbanks

The 5-stamp Joshua Hendy mill has been started at the Pioneer mine, and there is plenty of ore and water for milling purposes. At the Bluebell lode claim, a shaft is being sunk on a vein two feet wide. The shaft at the Cotton Blossom is down 80 ft., and at 60 ft. a lode was found to be 28 ft. wide. Water has given trouble, and a hoist will be installed. The mill on Ester creek is almost finished. It consists of a 40-ton ore-bin, crusher, automatic feeders, two Nissen stamps, with room for others if necessary. At 85-ft. depth the vein in the claim is 7 ft. wide. The Newsboy mill crushed 225 tons of ore valued at $3750. Two stopes are being opened at the 215-ft. level. At Iditarod the Mohawk syndicate on Flat creek has arranged to sell its property to the Yukon Gold Co. for $106,000.

Juneau

The Alaska Mexican, Alaska Treadwell, and Alaska United companies have declared dividends of 30c., $1, and 50c. per share, respectively, payable on November 29 at San Francisco. During October the Treadwell mills worked 30.45



MERRILL PRECIPITATION PRESSES AT TREADWELL CONCENTRATE PLANT.

days, and crushed 77,924 tons of ore, producing $193,489 from amalgamation, and cyanide treatment of 1680 tons of concentrate. The net profit was $101,051. Development covered 725 ft., and the stock of broken ore decreased 5605 tons.

ARIZONA

Cochise County

(Special Correspondence.)—Foundations are being laid for a new mill at the Commonwealth mine, at Pearce, which is being developed by a subsidiary company of the Montana Tonopah Mines Co. E. A. Collins is superintendent. The mine has been opened to below 450-ft. depth, and reserves are estimated at 289,543 tons worth $1,783,100. Two mills have worked at the property, one being destroyed by fire in 1900, and the second shut down in 1904 on account of a cave-in at the mine. The new mill, to crush an andesite ore carrying gold and silver, will consist of the following: Thirty 1500-lb. stamps crushing through a coarse screen, three Hardinge 8-ft. mills, Dorr classifiers, two 5 by 22-ft. tube-mills, eight Pachuca vats 15 by 38 ft., four Oliver filters, and probably zinc-dust precipitation. The mine makes about 900,000 gal. of water daily.

Pearce, November 20.

According to recent statements, the Guggenheim interests have come into Arizona by the purchase of the interest of the Development Company of America, including the Christmas, Imperial, Congress, and other properties. It is also stated that the Tombstone Consolidated properties are included, and probably the Poland mine. Large bodies of silicious ores are regarded as of great importance to the smelting interests of Arizona.

Gila County

There is nothing fresh to report from the Miami Copper Co., work at the mine and mill being on the usual lines. At the Inspiration large gangs of men are cutting grades and tunnels for the railroad. The Sulphide tunnel of the Live Oak portion of the Inspiration is being enlarged for installation of electric haulage. A No. 24 Star drill rig has been erected at the Southwestern Miami. The Prospector drill-hole is over 140 ft. deep. At the Sho Me property men are completing assessment work, a 50,000-gal. tank is being constructed, and it is probable that churn-drilling will be started soon.

Mohave County

The Tom Reed Gold Mines Co. has paid dividends equal to 7% for November, amounting to $65,000. The monthly output has averaged $120,000 of late. A new orebody has been opened about 500 ft. from the old ore-shoot. Improvements are being made to the cyanide plant. R. N. Dickman is at the Frisco mines, at Union Pass, examining the property and planning the new mill.

Santa Cruz County

The Phelps-Dodge company has acquired the Humboldt group of copper-silver claims for $10,000, and they will be opened at once. Ore will be sent from Patagonia to the Copper Queen smelter at Douglas.

Yavapai County

The adit being driven by the Arizona-Portland Mines Co. is now in 160 ft. Over 5000 tons of ore has been shipped from the Commercial mines at Copper Basin. Ten tons of silver ore, averaging $300 per ton, was sold by the owner of the Bill Arp mine in the Turkey Creek district. Copper ore has been opened in the Sink to Rise claim at a depth of 25 ft., which is something new, as this is a gold mine.

Yuma County

The lower Eagle adit of the Arizona-Empire mine, 10 miles above Parker, continues to open high-grade copper ore, which has averaged 52% of copper. Ten tons of ore daily is to be shipped for a month, after which the tonnage will be 20 per day. Shipments are also being sent to the Swansea smelter from the American Eagle mine. The main shaft is down 300 ft., and with the reserves of ore it is probable that a concentrating plant will be erected.

CALIFORNIA

Eldorado County

A large deposit of gravel has been uncovered at the Maynard claim of the Landecker mine, 1½ miles from Placerville, and averages $3 per ton. Part of the property has been worked since 1852, but the present find is in unprospected ground, covering 200 acres. At the China Hill mine, 6 miles from Placerville, ore worth $40 per ton has been cut in a vein 6 ft. wide, in an adit 130 ft. below the outcrop. The ore carries sulphides, and there is a stamp-mill on the property.

Inyo County

Work is again under way in the Chidago district after a long period of idleness. The St. Ives is being developed by the Lone Star company of Goldfield, Nevada. The main shaft is being straightened and repaired. Lessees have shipped ore worth over $30 per ton and left a dump of 400 tons averaging $15 per ton. Ore reserves are estimated at $40,000. On the whole, prospects are fairly good at this mine.

Nevada County

At the Morning Star mine, at Badger Hill, rich ore has been opened in a cross-cut. It is highly mineralized, and J. Curnow, superintendent, considers the discovery the best ever made at the mine. Salmon Brothers are also mining good ore in their claim at Badger Hill. The Supreme Court has upheld the Nevada county court's finding for the Champion Mine Co., which was sued by the Champion Gold Mining Co. to enforce a contract for the purchase of the former's mining claims in this district.

Sacramento County

The Natomas Consolidated company has commenced to build its No. 7 dredge, which, when completed, will work in Blue ravine, about four miles east of Folsom. The dredge will be of steel, 134.7 ft. long, 46.5 ft. wide, and 9.5 ft. deep. There will be 98 buckets of 9-cu. ft. capacity each, and allowing for usual stoppages, the monthly capacity should be about 155,000 cu. yd. A revolving screen 7 by 35 ft. will separate the fine gravel from the large stones. The bucket ladder will be able to dig from a depth of 58 ft. Blue ravine has produced a good deal of gold in the past. The drift-mining operations which were being conducted there had to be abandoned because there were no proper means of handling water. The new dredge may be finished by April of next year. The company is to reclaim and develop 90,000 acres of land near Sacramento and has arranged with the Oro Electric Co. for a water right sufficient to irrigate this large holding.

San Benito County

It is reported that a large deposit of cinnabar has been discovered near Hernandez in this county. Samples of ore have yielded a high percentage of mercury.

San Bernardino County

The United Greenwater Copper Co., in which C. W. Schwab is interested, has taken a 49-year lease on the mining properties of A. Landwehr, at Dale, for $2,000,000, with the agreement to purchase at any time during that period. There are 38 claims in all, carrying ores averaging $20 per ton. Royalties to A. Landwehr will be from 3 to 50% of the gross value of the ore mined and treated on the property, and when treated elsewhere he will receive 50% of the net receipts.

Sierra County

The Alaska company, at Pike City, is employing 80 men. Rich ore is being mined just now. The October output was between $40,000 and $50,000 from the 40-stamp mill. At the Wisconsin drift gravel property, underground surveys are being made for a new scheme of development. Several nuggets were recently obtained from the True Blue Extension quartz claim. The Omega gravel mine has been acquired by new people, and the adit will be driven 1000 ft. farther. During the past three weeks there have been excellent falls of rain and snow in the Sierras, making a revival of mining generally.

Siskiyou County

The coal mine near Snowden which has lain idle for the past five years will be reopened soon, pumping having been in progress for two months. E. C. Gamble is manager.

COLORADO

Clear Creek County

Work has been started at Silver Plume for the Edison works, which will employ large rolls and concentration, probably as a custom mill for the district. At the drill-hole on Griffith mountain efforts are being made to recover the lost tools which have been interfered with by caving of the hole. Lessees at the Capital mine are busy and making regular shipments of ore.

Gilpin County

Settlements for ore from the Pittsburg mine have returned $200, $168, and $81 per ton, respectively. This ore was from the 900-ft. stopes. The Topeka mine is producing 7 cars of ore per day. An electric hoist has been installed by the Bezant Mining Co. A shipment from the War Dance averaged 2.1 oz. of gold and 3.26 oz. of silver per ton. At the Wild Cat, on the 100-ft. level, good lead and zinc ore has been opened.

The Buckley property, recently taken over by R. P. Morris, E. F. Colbon, J. R. Letcher, J. A. McAlister, Newton Farr, and others, is developing in a satisfactory way. B. T. Lloyd, the general manager, reports that a large amount of gold-silver ore is being developed, some of which assays as high as $400 per ton.

Lake County (Leadville)

Car shortage continues to hamper shipments from the district and seems to be getting worse. The opinion is that until farmers are supplied with cars the miners will not be relieved. During October the D. & R. G. railroad handled 300 less cars than in September.

The 'interior' shaft in the Yak tunnel, being sunk to develop the Diamond and Vega properties, is down 150 ft. below the tunnel level, and will be sunk another 100 ft. At present there is a heavy flow of water hampering work.

San Miguel County

The United States Government has charged the Telluride Power Co. with taking 122,434 ft., board measure, of lumber from land in Idaho, between January 1910 and December 1911. The company made 300 poles out of the lumber. Damages are assessed at $3575.75. On November 18 the deputy sheriff sold all the property and rights of the power company in Colorado, Utah, and Idaho, at Telluride, for $6,460,000. By this transaction the Telluride Power Co. is dissolved, and a new corporation will have control.

CAMP BIRD MILL.

Teller County (Cripple Creek)

Another meeting of the directors of the Roosevelt tunnel is to be held soon, while data are being secured as to the usefulness of another drainage tunnel 500 ft. below the Roosevelt tunnel. On November 6 water in the Mary McKinney shaft stood at 126.7 ft. below No. 8 level, or at an elevation of 8625.6 ft., showing an approximate total decline of water at that point of 217 ft. Water is entering the 1000-ft. level of El Paso at about 500 gal. per minute at an elevation of 8450 feet.

The Cresson shaft on Raven hill is to be sunk another 100 ft. Sub-lessees have started work at the Requa-Savage mine. As soon as the Nichols shaft of El Paso is in working order the main shaft will be cleaned to the level of the Roosevelt tunnel. This shaft was put through from the tunnel when work was going on in the heading of the drainage bore. On the 1275-ft. level of the Isabella, 700 ft. south of the shaft, a large orebody has been opened. Since April 1908 about 320,000 tons of ore has been treated from the dumps at Stratton's Independence.

IDAHO

Shoshone County

The suit of E. J. Carter, of Spokane, against F. A. Heinze

and others of the Stewart company has been compromised and settled out of court, whereat there is rejoicing among shareholders. The company has about $400,000 in reserve, and dividends are now expected.

The Hecla Mining Co. has paid a 2c. dividend amounting to $20,000, making $250,000 for the current year, and a grand total of $2,600,000.

The introduction of electric power into the Carter district, in the east Coeur d'Alene district of western Montana, is resulting in more active work. A transmission line 50 miles long is being constructed from Thompson Falls by the Iron Mountain Co., and other companies are arranging for a supply. The line is expected to be ready early in December. The Iron Mountain company is employing 70 men; it has a 150-ton mill to treat its ores carrying zinc, silver, and lead. The main adit is in 6400 feet.

MONTANA

Lincoln County

(Special Correspondence.)—The Big Eight mine, south of Troy, is shipping another car of ore this week, and expects to ship another within the next two weeks. The auto-truck intended for use in hauling ore to town has been found incapable of climbing the big hill, and will be shipped back to Spokane.

Libby, November 21.

NEVADA

Esmeralda County

Some good samples of silver-lead ore have been on view in Tonopah during the past week, coming from the Thorndyke district, 15 miles south of Tonopah, and near the railroad to Goldfield. Quite a small rush has taken place, and prospects are decidedly encouraging. J. Golden recently secured control of the Original Klondyke property, and in addition to development has let several leases on it. About 150 tons monthly are being shipped from the property. Lee and Watson have opened good silver-lead ore about a mile from the Golden property. One vein is 8 ft. wide returning from $20 to $70 per ton, and another is 5 ft. wide worth from $30 to $60 per ton. Leases have been granted on the property. This district is near the railroad, water, and electric-power line.

At the Florence Goldfield mine high-grade ore is being shipped from the vein which was first opened at the 250-ft. level, and which has been also developed between No. 5 and 7 levels. The 1200-ft. station is being excavated, and the shaft is down to 1270-ft. depth. The Bonnie Clare mill, which is treating ore from the Jumbo Extension, has started again, after improvements to the crusher, and the installation of five more concentrating tables. The daily capacity of the mill is now 100 tons. A shipment of ore worth $40 per ton is being sent out from the Vernal property near Diamondfield. Development at the Silver Pick is encouraging. Near the Mohawk a seam of quartz and talc, from 6 to 36 in. wide, was cut on a prospecting level at 85-ft. depth. A cross-cut on the 130-ft. level also passed through it, but here it was low grade. At 260-ft. depth the vein is large, though much disturbed, and a raise is now up 40 ft. in poor ore, yet similar in appearance to the Mohawk. There is nothing fresh from the Consolidated property. At the mill all is in good order, and high extractions are being made at the concentrate plant.

The Nevada Coal & Fuel Co., which owns a coal mine near Coaldale, on the Tonopah & Goldfield railroad, has started regular shipments from its property, which contains the only coal mine in Nevada. A shipment of five cars will be sent to Goldfield, and in time the mine may supply the needs of the mining centres.

Eureka County

(Special Correspondence.)—Foundations for the new mill of the Buckhorn Mines Co. are now being laid. The ore being soft, there will be no stamps in this mill, which was designed by J. W. Hutchinson of the Goldfield Consolidated company.

Goldfield, November 20.

The Aurora, one of the most famous old mines of the desert, is being reopened by a syndicate headed by Charles E. Knox, of Tonopah, and Jesse Knight of Salt Lake City. The property was examined recently by J. E. Spurr and assistants for the Tonopah Mining Co., but that concern decided not to undertake to reopen the mine. Mr. Spurr's report, by contract, was given to the mine-owners, and it was upon it that the new syndicate was organized.

Lyon County

For the seven days ended November 14 the Thompson smelter received 6080 tons of ore, 3148 tons coming from the Nevada-Douglas, and 2288 from Mason Valley. Ten carloads of matte was shipped during the same week. During October the smelter dealt with 27,319 tons of ore producing 1,646,000 lb. of copper, making a total of over 13,000,000 lb. since January of this year.

During October, Hamilton & Pollard's mill at Silver City crushed 800 tons of ore, and the three cyanide plants worked full time. While there is no mining operation of unusual note at this centre, lessees and claim owners are mining a considerable amount of ore of fair grade.

Nye County

(Special Correspondence.)—Electric power is a great boon to Tonopah, and it is hard to imagine very profitable work without it, and any interruption of supply shuts

MAIN STREET, TONOPAH.

everything down. On October 29 a short-circuit in the sub-station here started a fire which damaged the plant to a value of $17,000. Since then the Nevada-California Power Co. has worked hard to get the building and plant in order; but on November 23, at 10:30 a.m., a 'short' was caused by something being dropped on the high-tension wires, and a big fire started again. It may now cost $30,000 to fit the station properly. All the mines were closed down for 5 hours, but in 24 hours connections were made again for full power and light.

At the pumping station of the Tonopah Water Co. a man was electrocuted on November 22 through a pipe coming in contact with wires carrying 6600 volts. He lived about ten minutes after receiving the shock.

The new mill at the Belmont is working well and shows a general high extraction. Generally the mine is opening well, especially on the 1166-ft. and No. 12 levels. The West End mill was overhauled on November 22, one tube-mill being relined and other repairs made. The company shipped during the week 21½ tons of concentrate and 23 bars of bullion. October profits amounted to $33,864. The North Star has shipped a carload of ore from between the 800 and 950-ft. levels, where the ore is from 16 to 30 in. wide. From the Extension, 40,144 oz. of bullion, worth $31,715, was shipped during the week. Two cars of ore have been sent to the Belmont mill at Millers, from the Merger mine. This ore will average $40 per ton, and it is expected that 300 tons per week will be sent to the mill.

Production from all the mines during the week ended November 23 was 10,554 tons, valued at $263,850. The *Tonopah Miner* has issued a pamphlet dealing with the district, which states that to September 30 the bullion pro-

duction of the district was $55,143,248, and dividends totaled $14,703,314.

Tonopah, November 25.

At Manhattan the Big Four company is pushing development on the 200, 300, and 400-ft. levels, and material for the new mill is arriving from Tonopah, a distance of 45 miles across the desert. A flow of water amounting to about 144,000 gal. has been tapped in the northeast drift on the 250-ft. level of the Earl. From the Pittman-Finlayson lease at the Litigation Hill Merger, 300 tons of ore is being treated at the Associated and War Eagle mills. The White Caps is sending a regular tonnage to the former mill. About 100 tons of ore is to be milled from the Muskett-Wittenberg lease on the Manhattan Consolidated.

The Tonopah Mines Corporation has completed the purchase of 21 claims owned by the Little Tonopah Mining Co., adjoining the Merger mine, for $250,000. A large shaft will be sunk to 1000 ft. in the Sagebrush claim. The Tonopah Mines Corporation is capitalized at $300,000, with J. G. Kirchen as president; Seeley W. Mudd, vice-president; Key Pittman, secretary and treasurer.

Surveyors are at work for the Southern Pacific Co. near Manhattan, and it is thought that the line will pass within a few miles, if it does not enter the town.

UTAH

Salt Lake County

At the Alta Consolidated, at the Brooklyn shaft, connection will soon be made between the bottom level and a raise from the lower adit level. The raise has been in two to four feet of high-grade ore. In a drift started west several mine-cars of ore assaying 28.4 oz. of silver, 42.6% lead. and 0.03 oz. of gold were broken out. This orebody is 1500 ft. from the famous deposit in the Emma property, from which $7,000,000 was mined years ago.

Summit County

Until the two additional roasting furnaces for the Mines Operating company's plant at the Ontario mine are finished, work at the mine and mill is almost at a standstill. The furnaces will have a capacity of 40 tons each, and should be ready in a few days. The Augustin process being tried in this mill is a revival of an old method by which silver in the ore, when roasted with common salt, is converted into a chloride, and a strong solution of salt will dissolve the chloride, which will be precipitated as metallic silver on copper. In 1874 the first mill built in Park City was the Marsac, and in 1875 three mills were treating the Ontario ore. In 1877 the Ontario mill was remodeled, as was also the Marsac, in 1880 and 1882, to the Russell process. In 1890 concentration was tried and remained the process until recently.

Ore shipments during the week ended November 23 were 687 tons from the Daly West, 539 from the Silver King, 339 from Daly-Judge, and 42 tons from King Consolidated. The Daly West recently received as an express 'package' a 12,000-lb. air-compressor which was needed in a hurry.

Tooele County

Regular ore shipments are being made from the old Stockton district. From the Bullion Coalition mine about 1000 tons per month are sent out by the company and lessees, while the Ben Harrison, Cyclone, Galena King, Honorine, and others are also shipping ore.

WASHINGTON

Ferry County

(Special Correspondence.)—In the Superior Court in and for Ferry county, in the case instituted by the Quilp Gold Mining Co. *v.* the Republic Mines Corporation and J. L. Harper, wherein the plaintiff, alleging that the defendants were and had been extracting and removing ore from the Quilp lode claim, owned by the plaintiff, applied for an injunction to restrain the defendants from trespassing and taking ore therefrom, as mentioned in these columns on October 26. The trial lasted eight days, the plaintiff testifying that, although the defendants had followed their own vein from its apex in the Surprise quartz lode claim, they had crossed their east side-line and entered the Quilp ground and extracted and removed ore from another and separate vein within the vertical lines of the Quilp lode claim. The defendants testified that they had followed the Surprise vein from its outcrop, on its pitch downward, through and across the westerly vertical side-line of the Quilp ground, to the 700-ft. level; that the 'separate' vein alleged in the plaintiff's testimony is one and the same as that which had been followed by the defendants from the surface, but that it had been partly dislocated and separated within the vertical side-lines of the Quilp claim by

REPUBLIC, WASHINGTON.

a fault, which had been disclosed on the 400-ft. level and afterward on No. 2, 3, and 5 levels of the Surprise workings. The court, after five days' deliberation, decided that, upon an order to show cause why an injunction should not be issued, it was ordered that the defendants and others are enjoined and restrained from entering upon any part of the vein within the vertical lines of the Quilp lode mining claim or taking any ores or minerals therefrom or trespassing thereon. The plaintiff was required to file a bond with the clerk of the court, signed by a responsible surety company, to be approved by the clerk of the court, in the sum of $15,000. The case so decided is preliminary to one for damages, on account of ore claimed by the plaintiff to have been extracted and removed from the Quilp ground, the property of the plaintiff, the date for the trial of which has not yet been set.

Republic, November 22.

H. J. Lefevre and Jasper King, of the Walla Walla M. Co., have bought the land of the Keller & India Con. Smelting Co., sold at public sale by J. C. Cody, the receiver. Mr. Lefevre bought the smelter and water-rights of this company at a tax sale last year.

Snohomish County

Rich copper ore has been found in the mine of the Glacier Peak M. Co., 27 miles from Lucerne. Underground development amounts to about 800 ft. of work. Henry Noll is vice-president of the company.

Spokane County

The American Mining Congress opened at Spokane on November 25. There is a large attendance of delegates from Alaska, British Columbia, and nearly every state where mining is engaged in. Discussions will cover control of natural resources, Alaskan coalfields, more liberal application of mineral land laws, and a new law for states to provide compensation to injured workmen, the cost to be taxed on the commodity produced.

Stevens County

Machinery is being installed in the Chewelah Copper King mine, and the property will be on a shipping basis soon. S. P. Domer is manager. Mark Mitchell, who is leasing the Blue Star, has installed a pump in the main shaft of the property.

Personal

Professional men are invited to send news of their engagements and travels. Such news is interesting to friends.

GEORGE E. FARISH was in Denver recently.

LOUIS DECOTO has returned from Colombia.

W. C. RALSTON has returned from Los Angeles.

L. D. GODSHALL was at Kingman, Arizona, recently.

A. CHESTER BEATTY was in San Francisco on Friday of last week.

CHARLES BUTTERS was in Virginia City during the week and has gone to Tonopah.

EUGENE P. KENNEDY was married to Miss Keenan in San Francisco on November 26.

E. RAMMELMEYER has gone to Oberwalten, Saarnen, Switzerland, for several months.

MORTON WEBBER has gone to Tennessee and will proceed to Mexico by way of New Orleans.

A. B STEPHENS has returned to El Tigre, Sonora, after a six months stay at Mineral Hill, Nevada.

SAMUEL PRICE, Mining Commissioner for Ontario, has resigned, and has been succeeded by T. E. GODSON.

NORMAN C. STINES returned from Siberia on Monday and will make a short stay in San Francisco before proceeding to London.

A. HULSHOFF-POL is visiting metallurgical plants at Goldfield and Tonopah and expects to reach San Francisco by December 5.

H. FOSTER BAIN, D. W. BRUNTON, C. W. GOODALE, and J. W. MALCOLMSON are at Spokane attending the American Mining Congress.

CURTIS H. LINDLEY has returned from Kellogg. He was elected an honorary member of the International Law Association at its recent meeting at St. Paul.

T. J. GRIER, superintendent of the Homestake Mining Co., has returned to his duties after a six months' absence in eastern Canada, recuperating from an illness.

R. H. FLAHERTY, head of the exploratory staff of the Mackenzie & Mann interests, has returned from an extensive trip along the eastern side of James and Hudson bays.

OLD STUDENTS of the Freiberg Bergakademie will meet on December 20 at 7 p.m. at the Hofbräu Haus, Broadway and 30th street, New York City. All Freiberg students are urged to be present.

C. H. MACNUTT was in San Francisco during the week in the course of an extensive tour of inspection of the principal mining districts of this country, and has gone to Los Angeles on his way to Arizona and Mexico.

Obituary

ISAAC COPELAND, of Sierra county, died at Berkeley, California, November 15.

C. KAUFMAN died in London, early in September, following a serious operation. Early in life he went from California to London and thence to Coolgardie, where for many years he was a prominent figure in the promotion and management of mining enterprises, the Golden Horse-Shoe among others.

DAVID D. DEMAREST died of pneumonia at his home in Berkeley, California, on November 21, aged 88 years. Born in New Jersey, he came to California with the earliest pioneers and settled at Angels Camp, where he engaged in the manufacture of machinery. For over a half-century he lived there, conducting at the same time the D. D. Demarest Co. in San Francisco, until eight years ago, he retired from practice and removed to Berkeley. A pioneer and well known in the manufacture of mining machinery on the Pacific coast, many of the largest mills along the Mother Lode were built at his works.

Market Reports

LOCAL METAL PRICES

San Francisco November 27.

Antimony	11—11½c	Quicksilver (flask)	41.50
Electrolytic Copper	18—18½c	Tin	52—53½c
Pig Lead	4.75—5.70c	Spelter	8½—8¾c

Zinc dust, 1400 lb. casks, per 100 lb., small lots $9.50—9.75; large $7.50—8.50

LONDON QUOTATIONS

(By cable, through the courtesy of C. S. Burton & Co., New York.)

	November 27.
Camp Bird Ltd	$ 5⅞
El Oro	4
Esperanza	9⅛
Oroville Dredging	1⅛
Santa Gertrudis	7
Tomboy	7

COPPER SHARES—BOSTON

(By courtesy of J. C. Wilson, Mills Building.)

	Closing prices, November 27.		Closing Prices November 27.
Adventure	$ 5⅛	Mohawk	$ 63½
Allouez	42	North Butte	36¼
Calumet & Arizona	78½	Old Dominion	57½
Calumet & Hecla	560	Osceola	108
Centennial	19	Quincy	83⅜
Copper Range	56¼	Shannon	14¼
Daly West	3⅜	Superior & Boston	2⅜
Franklin	9¼	Tamarack	42
Granby	72½	Trinity	4⅜
Greene Cananea, ctf.	9⅜	Utah Con	11½
Isle-Royale	35	Victoria	2⅜
La Salle	5⅜	Winona	4
Mass Copper	5⅜	Wolverine	74

NEVADA STOCKS

(By courtesy of San Francisco Stock Exchange.)

San Francisco, November 27.

Atlanta	$ .12	Montana-Tonopah	$2.05
Belcher	.24	Nevada Hills	1.25
Belmont	8.45	North Star	.29
Big Four	.60	Ophir	.40
Con. Virginia	.36	Pittsburg Silver Peak	.75
Crown Point	.40	Round Mountain	.35
Florence	.68	Sierra Nevada	.22
Goldfield Con.	2.05	Tonopah Extension	2.40
Halifax	1.45	Tonopah Merger	.80
Jim Butler	.62	Tonopah of Nevada	6.37
Jumbo Extension	.26	Union	.26
MacNamara	.18	Vernal	.10
Mexican	1.70	West End	1.37
Midway	.32	Yellow Jacket	.30

MINING STOCK QUOTATIONS—NEW YORK

(By wire from C. S. Burton & Co., New York.)

	Closing Prices. November 27.		Closing Prices. November 27.
Alaska Mexican	$ 13½	McKinley-Darragh	$ 2⅜
Alaska Treadwell	50	Miami Copper	27
Alaska United	23	Mines Co. of America	2⅛
Amalgamated Copper	84⅞	Nevada Con	23½
A. S. & R. Co.	78⅛	Nipissing	8½
Braden Copper	9	Ohio Copper	1½
B. C. Copper Co.	4½	Ray Con	22
Chino	46½	Tenn. Copper	41
First National	2	Tonopah Belmont	8⅛
Giroux	4½	Tonopah Ex.	2⅜
Goldfield Con.	1⅞	Tonopah Mining	6⅜
Greene-Cananea	9⅜	Trinity	6
Hollinger	15	Tuolumne Copper	2⅜
Inspiration	19⅞	Utah Copper	63
Kerr Lake	3	West End	1⅛
La Rose	2½	Yukon Gold	3½
Mason Valley	12½		

OIL SHARES

San Francisco, November 27.

Claremont	.59	Paraffine	.25
Coalinga Central	.20	Palmer	.18
De Luxe	.70	Republic	.15
Empire	.35	Silver Tip	.50
Maricopa 36	.30	S W & B	.18
Midway Premier	.25	Turner	.80
Monte Cristo	.80	West Coast pfd	85.00
New Penn	.53	W K Oil	2.00

Quarterly Report, Ray Consolidated Copper Company

The quarterly report of the Ray Consolidated Copper Co. shows a gross production of 9,295,818 lb. of copper contained in concentrate for the quarter, or an average monthly production of 3,098,606 lb., as compared with 2,374,314 lb. for the first and 2,984,024 lb. for the second quarter. The total production for the first nine months of the year was 25,370,835 lb. During the quarter the total net tonnage of ore treated at the mill was 429,411 tons, as compared with 374,609 tons. Of the tonnage treated during the quarter, 68% came from the territory tributary to No. 1 shaft and 32% from the No. 2 shaft. Of the total, 24% was produced from development work. The average daily tonnage for the quarter was 4667 tons. An average rate of 5000 tons per day was reached during the quarter and maintained during the month of September.

The average assay of the ore treated during the quarter was 1.6147%, as compared with 1.72% for the preceding quarter. The lower grade of the ore, amounting to about 0.10%, taken together with the fact that the tonnage was still derived in large part from the upper levels of the mines and therefore contained considerable quantities of oxidized material, is reflected in a somewhat lower percentage of extraction applying to the third quarter than to either of the previous quarters of the year. The average extraction for the quarter was 67.026%, as compared to 69.37% for the previous quarter. The average extraction for the first nine months of the year has been 68.35%. The total production of concentrate for the quarter was 25,926 tons, containing an average of 17.93% copper. The ratio of concentration was 16.56 tons of ore into one ton of concentrate. The average cost per pound of net copper produced during the quarter, after allowing for smelter deductions, and after crediting the earnings of the Ray & Gila Valley railroad against operating costs, was 10.027c., as compared to 9.954c. for the preceding quarter. The average cost per pound so derived for the first three quarters is 10.047c. This cost includes all operating and general charges, as well as 12½c. per ton for the second and third quarters, or approximately 0.6c. per pound on the third quarter's production, for the extinguishment of mine development expenses.

The constant improvement in the operating costs and conditions is shown by the fact that on a recovery of 21.65 lb. copper per ton of ore treated for the quarter under discussion, as compared to 23.9 lb. for the previous quarter, the per pound cost of production increased only very slightly. The deficiency of over 2 lb. per ton in recovery is, of course, because the ore contained approximately 2 lb. less copper per ton than it did for the previous quarter, and was at the same time somewhat more difficult to concentrate on account of its oxidized content, as previously explained.

The financial results of operations for the quarter were as follows, the disbursed earnings of the Ray & Gila Valley railroad being included under the heading of operating profits: Direct operating profits for quarter, $640,748; miscellaneous income, rents, etc., $9965; total net profit for the quarter, $650,713. These earnings are computed on the basis of 17.13c. per pound for copper, or approximately ½c. per pound less than was actually received for copper sold during the period. The total net earnings for the first three quarters of the year were $1,497,703.83. During the entire nine months the copper production has been carried at less than the market price in order that the inventory price of copper in transit might be brought down to 12½c. per pound. The entire stock of copper due for delivery from the refineries remained unsold.

During the period the sixth section of the Hayden plant was put in operation, and the seventh section is now well along toward completion, leaving only one to finish, and this last one is also partly completed, all the material and apparatus required being on the ground. The power-plant and all other accessories are completed, with the exception of unimportant details, and on the whole the additional expenditures necessary to finish the entire plant will be comparatively small. At the mines the installation of the new compressor at No. 1 shaft has been completed and the plant at that shaft is now finished. The plant at No. 2 shaft is complete, with the exception of the installing of an additional crusher and set of rolls in the coarse-crushing plant at that point. The surface improvements, including hoist, ore-bins, crushing plant, etc., at the No. 3 shaft on original Ray Central territory, are about 50% completed, and all the material necessary to finish them is on the ground ready for assembling. The work of sinking this shaft has progressed more slowly than was expected. This has been due largely to the fact that this shaft is deeper than any workings in the vicinity and is therefore draining the entire surrounding territory, and as a consequence experienced more difficulty with handling water than was anticipated. At the end of the quarter there remained 60 ft. of sinking to complete this shaft. It should be finished in November and production of ore from the relatively high-grade orebody in Ray Central territory will be started in December, or in any event not later than January 1.

Development work in all parts of the mining territory progressed satisfactorily during the quarter, and a total of 37,715 ft. was driven in driving, raising, and sinking. This brings the total workings in the mines at the end of September up to 264,000 ft., or about 50 miles. The rate of tonnage production has been somewhat disappointing, although approximately in accord with the prediction in the last quarterly report, where it was stated that it was expected that a rate of 5000 tons per day would be reached in August. This rate was reached toward the end of August and, as previously stated, maintained during the month of September. As additional stoping ground is now becoming available, it is expected that the rate of tonnage increase will be somewhat more rapid during the fourth quarter than it has been in the immediate past. The grade of ore produced during the quarter was not as high as expected, but the reasons for this were operating rather than physical ones. Certain stoping areas expected to produce considerable tonnages of good-grade ore did not become available for actual work as rapidly as anticipated, and it was necessary, as a consequence, to produce the major part of the tonnage from areas previously worked near the upper zones of the ore deposits, and in orebodies known to be low grade. All conditions pertaining to the operations of the properties as a whole, including the labor situation, continue to be generally satisfactory, except as to the grade of the ore, and this is now improving, and the outlook is that it will increase to an average of nearly 2% by January 1.

Company Reports

CONSOLIDATED MERCUR GOLD MINES CO.

This company is capitalized for $1,000,000, in shares of $1 each. It operates an old mine in the Camp Floyd mining district, Mercur, Utah, which is now about exhausted. Prospecting for new ore was continued throughout the year. A total of 3657 ft. of dead work was done, at a cost of $17,498. Some new ore was found, which served to prolong the life of the mines a number of months, but no really important discoveries were made, and at this time the ore reserve is seriously depleted. Unless something new is found, the duration of operations is now a matter of only a few months. A number of properties have been examined during the year, in the effort to find a new mine at which the company's present equipment might be utilized, but none of them came up to requirements. During the year ended June 30, 1912, 67,816 tons of base ore, 119,776 tons of oxidized ore, and 14,060 tons of tailing was milled, a total of 201,652, or an average daily tonnage of 560. This had an average gold content worth $3.27 and the tailing averaged $0.82 for the year. The average operating cost for the year was $2.42 per ton, corresponding to an op-

erating profit of 3c. per ton treated, or 31c. per ounce of gold produced. This, with receipts from other sources, corresponds to total net earnings of $11,047 for the year. During the year a dividend of $30,000 was paid. The last previous dividend was paid December 19, 1906, including which the disbursements were $1,205,000, hence the total dividends to date are $1,235,000. Adding to the above the amounts paid by the old Mercur and De La Mar companies prior to their consolidation, the grand total of the dividends paid out of the property of the Consolidated Mercur Gold Mines Co., is $3,415,313.

The segregated milling cost was as follows:

	Per ton.
Crushing (201,652 tons)	$0.114
Roasting (67,816 tons)	0.857
Classifying and settling (159,403 tons)	0.051
Filtering (49,377 tons)	0.180
Leaching (152,275 tons)	0.545
Precipitating	0.072
Refining	0.046
Assaying	0.015
General expense	0.065
Total	$1.097

The number of tons of sand and dry ore leached during the year was 152,275. The consumption of chemicals was 0.73 lb. cyanide per ton and 15.27 lb. lime per ton. The lime is burned on the premises, and is low grade, so that the consumption was less than 15.27 lb. of pure lime per ton. The leaching cost was as follows:

	Per ton.
Labor	$0.188
Cyanide	0.184
Lime	0.029
Other supplies	0.031
Power	0.017
Water	0.025
Total	$0.474

The financial statement for the year ended June 30, 1912, is as follows:

Gross value of gold produced		$494,133.65
Receipts from other sources:		
Gold Belt Water Co., dividends	$3,300.00	
Ground rent	570.30	
Unclaimed pay checks	75.68	
Sale of Manning assay office	25.00	3,970.98
Total revenue		$498,104.63
Less operating expenses:		
Mine	$263,658.87	
Tailing dumps	2,414.44	
Mill	221,193.11	
Manning taxes	26.01	
Farm loss	15.13	
Total cost		487,307.56
Net earnings for the year		$10,797.07
Plus proceeds sale Fairfield lot		250.00
		$11,047.07
Balance from last annual report		84,951.97
		$95,999.04
Less depreciation written off:		
Stores account	$6,619.17	
Manning Leasing Co. stock	1,620.23	8,239.40
		$87,759.64
Less dividend No. 27		30,000.00
Balance of assets, June 30, 1912		$57,759.64

COPPER EXPORTS from Chile for the first 7 months of 1912 show an increase of 3400 tons over the corresponding period in 1911.

Concentrates

Most of these are in reply to questions received by mail. Our readers are invited to ask questions and give information dealing with the practice of mining, milling, and smelting.

THE first commercial arc-lighting central station was installed in 1879.

TO the simple alloys of copper and tin which are free from zinc, a considerable amount of phosphorus may be added without causing any harm; but when zinc is present, great care must be taken in the amount that is added.

WIRE is said to have been 'killed' when it is given sufficient tension to produce a permanent set. In other words, when the elastic limit of the material has been exceeded.

IN the copper-rolling mill it is customary to coat the sheets of copper with an emulsion of guano before they are annealed. This causes the oxide to leave the surface when it is plunged into water, and, accordingly, a clean surface is produced.

AIR-LIFTS under ideal conditions of design and operation may be regarded as perfect expansion engines, the air escaping at a pressure equal to that of the surrounding atmosphere. For this reason the efficiency of the air-lift does not decrease with increase of altitude.

GOLD and silver are always found together. At Kalgoorlie alluvial gold has been found which assayed 999.0 parts of gold and 0.9 part of silver per 1000. At the Rio Plata mine in Mexico the cyanide bullion assayed 982.0 parts of silver and 0.2 part of gold per 1000.

AN excellent cement for leather belting is composed of 2 parts pitch, 4 parts (by weight) of India rubber, 1 part shellac, 2 parts linseed soil, and 16 parts gutta percha. The several ingredients are cut into small pieces and afterward melted and mixed over a slow fire. The cement should be used while hot.

A ROUGH blue-print frame that will give satisfaction consists of a sheet of heavy plateglass and a blanket; the blanket is laid in two or three folds upon a table top or other plane surface; the blueprint paper is placed on top, face up, and then the tracing to be printed. The weight of the plate glass is sufficient to hold the three in contact.

ADSORPTION has been defined as "the adhesion of the molecules of gases or dissolved substances to the surfaces of solid bodies, resulting in a relatively high concentration of the gas or solution at the place of contact." Losses of metal from adsorption in treatment plants where milling is carried out in cyanide solution are by no means insignificant. To minimize such losses cement floorng is essential; and arrangements should be provided for washing down the floors and for the return of the solution of water used to the mill-circuit.

SAMPLING gold bullion has led to many discussions, and in a paper on this subject, recently read at the Eighth International Congress of Applied Chemistry, F. P. Dewey, assayer at the Mint, summarizes the following conclusions in sampling deposits of miscellaneous gold bullion weighing over 300 oz.: There are various cases where either a chip or drill-sample may be satisfactory; there are cases where a drill-sample is better than a chip-sample; where an assayer is acquainted with the metal, he may accept a chip or drill-sample; on unknown bullion, it is unsafe to accept any sample except a properly prepared dip-sample; and, in many cases, particularly of cyanide-bullion, the composition of the metal interferes with the actual assaying, and the bullion must be refined before the gold can be accurately determined.

Book Reviews

Any of the books noticed in this column are for sale by, or can be procured from, the MINING AND SCIENTIFIC PRESS.

ELEMENTS OF DRAWING. By George F. Blessing and Lewis A. Darling. 174 pp., index. John Wiley & Sons, New York. For sale by the *Mining and Scientific Press.* Price $1.50.

This book has been especially prepared for beginners who intend to take a course in engineering or commercial draughting. So many books of similar nature are already available that it would seem to be a difficult task to add anything to the existing literature on the subject. The use and care of the usual instruments, how to sharpen pencils, lettering, draughting room practice, conventional hatchings, free-hand sketching, and isometric projections are all treated at length. The book is copiously illustrated, even to the extent of showing how to make holders for ink bottles.

MACHINE DESIGN: HOISTS, DERRICKS, CRANES. By H. D. Hess. 364 pp., index. J. B. Lippincott Co., Philadelphia. For sale by the *Mining and Scientific Press.* Price $5.

Though principally intended to aid the work of machine design in technical schools and colleges, this book should also prove decidedly useful in drawing rooms as a book of reference. The work is admirably illustrated with good line drawings and graphic tables, which are of great service for quick calculations. Chapter on hoisting machinery refers to that type of hoist required for crane and derrick service, rather than for larger hoisting engines, such as are used for mining. In the chapter on electric hoists no attempt has been made to go into details of design of the electrical apparatus itself, outside of a general discussion of the types of motors developed by manufacturers for this purpose and their application to various requirements for cranes and derrick hoists. As a whole, this work is excellent and will form a valuable addition to any technical library.

COAL: ITS COMPOSITION, ANALYSIS, UTILIZATION, AND VALUATION. By E. E. Somermeier. 175 pp., ill., index. McGraw-Hill Book Co., New York, 1912. For sale by the *Mining and Scientific Press.* Price $2.

This little book has been written by the professor of metallurgy at the Ohio State University, in order to bring to mechanical and power plant engineers, chemical engineers and chemists, and laymen interested in purchase or sale of coal, the newer results on its sampling, analysis, and valuation. The subjects covered include the composition and heating value; chemical analysis; sampling; methods of analysis; determination of calorific value; summary of chemical determinations and records; coal washing; purchase of coal under specifications; fuel gas analysis; and analytical tables. Because of Mr. Somermeier's intimate connection with the testing work begun at St. Louis by the United States Geological Survey and continued by the Bureau of Mines, and his contact with teaching and commercial work, he is especially qualified to write such a book as this. He has succeeded admirably in condensing and clarifying the large amount of material available and has produced a readable book of wide usefulness.

THE DESIGN OF STEEL MILL BUILDING. By Milo S. Ketchum. 478 pp., index. McGraw-Hill Book Co., New York. For sale by the *Mining and Scientific Press.* Price $4.

Mr. Ketchum's works covering the applications of steel structures have been recognized as standard for many years. The first edition was issued in 1903, and was so well received that a second edition was published in 1906. This is the third edition, which has been amplified and enlarged in order to bring the text up to improvements in practice that have taken place during the past six years. The chapters on 'Stresses in Framed Structures' and 'Stresses in Bridge Trusses' have been rewritten and enlarged. Specifications for steel-frame buildings have been revised and rewritten. Many additions have been made, including two in graphic statics, and appendix III, covering structural drawings, estimates, and designs. The latter contains 78 pages, 30 tables, and 24 illustrations, which furnish much data not readily available. While the title would indicate that steel buildings monopolized the text, the greater part of the data given really applies to steel building design in general.

A TEXT-BOOK OF PHYSICS. By Wilmer Duff and others. 686 pp., index. P. Blakiston's Son & Co., Philadelphia. For sale by the *Mining and Scientific Press.* Price $2.75.

The third edition of a well known book, the section devoted to 'Mechanics' has been prepared by A. Wilmer Duff; 'Wave Motion,' by E. Percival Lewis; 'Heat,' by Charles E. Mendenhall; 'Electricity and Magnetism,' by Albert P. Carman; 'Conductivity of Electricity through Gases and Radio-Activity,' by A. K. McClung; and 'Sound,' by William Hallock. The primary object in the preparation of this work was to provide a textbook for students that would present the laws of physics and the various phenomena pertaining thereto, clearly and concisely, in order that a thorough understanding of the fundamentals would be assured before proceeding with a study of their application. The various co-authors are all teachers of note, who have brought their experience to bear by the preparation of the text to suit the needs of students. While no essential feature has been overlooked in any of the sections into which the book is subdivided, there is an absence of the padding and verbosity that often characterize a work of this kind. It is a publication well worth while, not only for students in schools and colleges, but for older men engaged in engineering practice, who will appreciate the thoroughness and systematic grouping of the subject matter whenever there is occasion to indulge in a little 'brushing up.'

AMERICAN CIVIL ENGINEERS' POCKETBOOK. Second Edition. Edited by Mansfield Merriman. 1400 pp., index. John Wiley & Sons, New York. For sale by the *Mining and Scientific Press.* Price $5.

This work needs no introduction to the engineering fraternity, as the first edition has won for itself a position in the reference libraries of civil engineers that has made it indispensable for the practice of this branch of the engineering profession. The first edition was issued in December 1910, and was so favorably received that a reprint was necessitated three months later. The second edition of 15,000 copies contained two new sections, namely, section 14, giving the elementary principles of steam and electric engineering, which are of special value to civil engineers; and section 15, setting forth the most recent practice regarding the construction and maintenance of highways and streets. Eight new pages are added in section 2 on earthwork computations. Section 3 has been given over entirely to steam and electric railroads and seven pages of additional matter. Many other changes have been made throughout the text, bringing the subject matter up to the minute as far as developments in practice are concerned. Nothing of importance contained in the first edition has been eliminated, and there is no doubt that the second edition of this work will maintain the prestige of its predecessor.

HANDBUCH DER REGIONAL GEOLOGIE: UNITED STATES OF NORTH AMERICA. By Eliot Blackwelder. 258 pp., ill., paper covers. Heidelberg, 1912. For sale by the *Mining and Scientific Press.* Price $4.50.

This forms the second part of the eighth volume of the series of handbooks now being issued under the editorship of Messrs G. Steinmann and O. Wilckens. The books follow a general plan, and collectively will constitute an up-to-date encyclopedia of geology. Mr. Blackwelder's volume is an admirable discussion of the stratigraphy of the United States under the general headings: morphological summary; stratigraphy and formations; outline of geological history;

orographic elements; and economic geology. The value of the book lies in its freshness and the amount of new data included. The chapter on the orographic elements is especially good. On the other hand, that part which relates to economic geology is not as well done as is the rest of the book. In discussing copper, Bisbee, Butte, Lake Superior, and Ducktown are taken as the type deposits, and the account of Butte is based upon the U. S. Geological Survey Folio, later material being ignored. Condensed as the material relating to any one metal must be in such a work, a listing of typical deposits which omits the porphyry copper at Bingham, is glaringly incomplete. So, too, in discussion of gold. The rich deposit at Goldfield, Nevada, is exceptional rather than typical, and the statement that "the term 'orebodies' can hardly be applied fittingly to the Homestake deposits" is permissible only as rhetorical exaggeration. The book closes with a brief summary of the literature of the subject in which the principal sources of data are indicated.

Recent Publications

The following advance chapters from the 'Mineral Resources of the United States, Calendar Year 1911,' U. S. Geol. Surv., Government Printing Office, Washington, D. C., 1912, have been received:

THE STONE INDUSTRY IN 1911. By E. F. Burchard. 96 pp., 7 plates.

THE PRODUCTION OF COAL IN 1911. By E. W. Parker. 207 pp., 2 text figures.

THE PRODUCTION OF LIME IN 1911. By E. F. Burchard. 76 pages.

THE PRODUCTION OF TUNGSTEN, VANADIUM, URANIUM, TITANIUM, MOLYBDENUM, NICKEL, COBALT, AND TANTALUM IN 1911. By F. L. Hess. 24 pages.

THE PRODUCTION OF NATURAL GAS IN 1911. Text by D. T. Day, statistics by B. Hill. 57 pp., 2 text figures.

THE PRODUCTION OF GLASS SAND, OTHER SAND, AND GRAVEL IN 1911. By E. F. Burchard. 56 pages.

THE PRODUCTION OF COPPER IN 1911. By B. S. Butler. 63 pages.

ZINC AND CADMIUM IN 1911 (SMELTER PRODUCTION). By C. E. Siebenthal. 54 pp., 4 text figures.

LEAD IN 1911 (SMELTER PRODUCTION). By C. E. Siebenthal. 41 pp., 4 text figures.

AN INVESTIGATION OF EXPLOSION-PROOF MOTORS. By H. H. Clark. Bulletin 46. 44 pp., 6 pl. Bureau of Mines, 1912.

IGNITION OF GAS BY STANDARD INCANDESCENT LAMPS. By H. H. Clark. Technical Paper 28. 4 pp. Bureau of Mines, 1912.

COMMISSION OF CONSERVATION, CANADA. REPORT OF THE THIRD ANNUAL MEETING. James White, secretary. 154 pp. John Lovell & Son, Ltd., Montreal, 1912.

RESULTS OF SPIRIT LEVELING IN OHIO, 1911. By R. B. Marshall. U. S. Geol. Surv. Bull. 518. 108 pp., 1 pl. Government Printing Office, Washington, D. C., 1912.

QUALITY OF THE WATER SUPPLY OF KANSAS. By E. H. S. Bailey. U. S. Geol. Surv. Water-Supply Paper 273. 375 pp. Government Printing Office, Washington, D. C., 1912.

METHODS FOR THE DETERMINATION OF WATER IN PETROLEUM AND ITS PRODUCTS. By I. C. Allen and W. A. Jacobs. Technical Paper 25. 13 pp. Bureau of Mines, 1912.

OIL AND GAS DEVELOPMENT IN NORTH-CENTRAL OKLAHOMA. By R. H. Wood. U. S. Geol. Surv. Bull 531-B. 31 pp., 1 pl. Government Printing Office, Washington, D. C., 1912.

LIGNITE IN MONTANA. By W. R. Calvert, C. F. Brown, F. A. Herald, J. H. Hance, E. Stebinger, and A. L. Beekly. Advance chapter from Bulletin 471, 'Contributions to Economic Geology, 1910, Part II,. U. S. Geol, Surv. Bull. 471-D. 176 pp., ill, maps. Washington, 1912.

Lunkenheimer 'Puddled' Semi-Steel Valves

The increasing use of high pressures and superheated steam has created a demand for something better than the ordinary cast iron brass mounted valves. To meet this demand, The Lunkenheimer Co., Cincinnati, Ohio, offer their line of 'puddled' semi-steel valves. 'Puddled' semi-steel is an extremely high-grade iron and steel alloy, of very close grain and strength. It must not be confused with the mixtures made in cupolas where the admixture of steel with the iron is beyond control, and the resulting metals sadly lacking in uniformity. Lunkenheimer 'puddled' semi-steel valves have been extensively used in high-pressure plants carrying superheated steam, and in other places where the physical demands on a valve are great, and in every case they have given complete satisfaction. These valves are made in two combinations as regards the material used for the trimmings, and are designated as combinations C and D. The object of these combinations is to suit various conditions of superheat and to meet the specifications of engineers who differ as to the metal that should be used in the trimmings. Combination C is guaranteed for 600° F. temperature, and combination D for 550°. Both combinations are suitable for 250 lb. pressure per square inch. The line includes globe, angle, cross, check, gate, non-return safety boiler stop-valves, etc. For extreme conditions of pressure, superheat, and strain, The Lunkenheimer Co. manufacture the above line made of cast steel, the tensile strength of which is about 80,000 lb. per square inch. For lower pressures and temperatures, the line is made of a high-grade cast iron.

A full description of these valves, together with that of the complete line of high-grade engineering specialties made by The Lunkenheimer Co. can be obtained by referring to their 654-page catalogue, 1912 edition, a copy of which the company will send upon request.

Catalogues Received

DENVER QUARTZ MILL & CRUSHER CO., Denver, Colorado. Catalogue No. 10. 26 pages. Illustrated. 9 by 6 inches.

GEO. W. MYERS, Kohl building, San Francisco. Pamphlet on 'Ideal' Battery Stamp Stem Guide. Illustrated. 3½ by 6 inches.

WESTERN GAS ENGINE CO., Los Angeles, California. Catalogue F, 'Western Gas Engines.' 64 pages. Illustrated. 9 by 6 inches.

DELAVAL STEAM TURBINE CO., Trenton, New Jersey. Catalogue on Class 'C' Turbines. 47 pages. Illustrated. 3½ by 6 inches.

E. J. LONGYEAR CO., Minneapolis, Minnesota. Catalogue and price list of diamond-drills and supplies. 64 pages. Illustrated. 3½ by 6½ inches.

EDGAR ALLEN AMERICAN MANGANESE STEEL CO., Chicago. Bulletin No. 52, 'The Komata Liner for Tube Mills.' 20 pages. Illustrated. 6 by 9 inches.

UNITED STATES ENGINEERING CO., 80 Wall street, New York. Brochure B. M. 1, 'Briquetting Machinery.' 16 pages. Illustrated. 7 by 10 inches.

THE parts that get the greatest wear in a rock-drill are the cylinder, chest, and air-head. In the common run of drills, in which these parts are made of gray iron castings, a constant source of trouble and expense is found. This weakness has been entirely overcome in the WOOD ROCK-DRILLS by the substitution of vanadium tungsten iron for gray iron in the castings for these parts. Broadly, the vanadium iron in Wood drills gives about 200% more wear than the cast iron commonly used, besides being almost unbreakable. The superior economic value of this construction makes the Wood drill worthy of investigation by all interested in rock-drilling.

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EDITORIAL

CONGRESS is in session again, but matters held over from the spring term are likely to engross the attention of both Houses.

ANNOUNCEMENT that the Wall rolls have been discarded at the mill of the Ohio Copper Company presumably presages the appearance of interesting reading concerning the personnel and activities of the company.

NICARAGUA is chiefly associated in the popular mind with revolutions, but it is productive of much more of benefit. The description of the Chontales district, which we present this week, is of interest and value, both because the western part of Nicaragua is less well known than the eastern, and also because it is written by a well informed engineer who has devoted much study to the district.

SUGGESTIONS as to the exhibit which the mining industry may properly be expected to make at the exposition in San Francisco in 1915 are elsewhere advanced by Mr. Harold French. There is need for urging coöperation, for the work of preparation of a creditable exhibit will be great, but it is only just to add in this connection that apparently the exposition officials stand in need of urging quite as much as the mining men. Though official announcements of the advanced state of preparations are frequently made, it is nevertheless true that the name of the director of the mining exhibit has not been announced, and outside organizations receive little of definite information in response to inquiries as to what should be done in preparing for 1915. More activity is needed inside as well as outside the exposition organization.

SUPPLEMENTING the review of the Eastern metal market, given elsewhere, it is interesting to note that while the copper market has been more or less directly affected by the Balkan war, as has that of tin, though to a lesser extent, other minerals which are important but not so conspicuous in American manufacturing have also been affected, and in some cases seriously. Aside from heavy consumption, high ocean freights imposed because of the war are in part responsible for the advances in the price of ferromanganese, the higher rates even applying to the poorer grades of ore which are exported from Brazil. Ferromanganese is now strong at $75 for spot delivery, $65 and upward for first half, and $61 for last half. Chromite, essential to the steel industry, and of which Turkey and Greece are the principal sources of supply, is higher in price, not alone from the increased demand due to the greater activity everywhere in the making of steel, but because of the desertion of the mines by laborers who have gone to join their national armies. Quotations for Greek and Turkish chromite, which averages 40 to 45 per cent in chromic oxide, vary from $13 to $15 per ton of 2000 pounds at the seaboard, according to the size of the lots. Magnesite, of which Austria is the chief source of supply, though California is an important producer, is also affected, but not so seriously, by the troubles in the southeast of Europe.

The Mining Congress at Spokane

Spokane members of the American Mining Congress may well feel satisfied as they recall the sessions held in their city last week. While the number attending was not so large, nor were the names of the speakers so well known as at the Chicago convention of a few years ago, the meeting was not less interesting and will perhaps prove equally influential. In two particulars the Congress achieved the unusual—the sessions were devoted to real and informing debate, and the local committee must dispose of a surplus before disbanding. The first was in part the fortunate result of chance; the second followed careful planning and brilliant executive work. The preliminary program carried the usual list of distinguished names. Governors, senators, judges, and lawyers, with an occasional mining man, were to have delivered addresses on various phases of the relations of mining to public policy. Practically all these distinguished gentlemen found it inconvenient to attend, and most of them failed even to send papers to be read in their absence. One of the exceptions among the latter was Mr. Henry S. Graves, the United States Forester, who contributed a paper that provoked one of the liveliest discussions of the week, one that at times verged upon acrimony. It is to be regretted greatly that this debate was closed, though without any such plan on the part of the officers of the Congress, without allowing the representative of the Forest Service an opportunity to reply to the various charges and criticisms made on the floor. Most of these were trivial and could doubtless have been easily explained, while such a reply would have necessarily brought into sharper relief the real causes of friction. Those present at the Goldfield meeting of the Congress will recall the fairness with which criticisms of the Forest Service were met by its representative, and substantial good in several particulars followed. Unfortunately, the Spokane meeting, in this particular, seems likely to lead to increased friction rather than to agreement. In the main, however, the discussions were good-tempered and will prove helpful. If occasionally a speaker shot beyond the mark it was doubtless only the unthinking result of active discussion of what to the speaker appeared to be great wrongs. Remembering the point of view of the speakers, the general repression was admirable.

Discussion crystallized mainly around three topics: (1) protection of the mine investor; (2) Alaskan problems and conservation; (3) workingmen's compensation. Remembering the days when the Mining Congress consisted almost wholly of promoters and peddlers of worthless stock, something of the progress of the organization became apparent to one listening to the debate on the first topic. It was generally agreed that the mining industry suffered from the sale of worthless stock. The old slogan, 'outside money keeps the camp alive,' was not once sounded, and the need of real protection was urged from all sides. To the proposal that each state practically censor all stock sold within its borders and pass on the value of the property, the objection was urged merely that it was impractical. The consensus of opinion seemed to be that the state should provide the fullest measure of publicity, with suitable penalties for misstatements, rather than approve or disapprove each proposed issue. This plan will give every investor the means of protecting himself. This, we think, is a sensible conclusion. As a first means of attaining this end, the Congress provided a committee to compile and publish existing laws and compare their efficiency.

Alaskan problems, with which were entangled the leading phases of conservation, and the need of revision of the mining laws, formed easily the main topic of interest for the Congress. The delegates were fortunate in having on the platform Mr. Falcon Joslin, and on the resolutions committee Messrs. John M. Steele and M. D. Leehey, whose knowledge of Alaska is at once comprehensive and obtained at first hand. Others contributed to the discussion, but Mr. Joslin, by his clear and forceful presentation of conditions met at Washington by the Alaskan committee of the Congress, made possible practical agreement upon an effective program. Briefly, the Congress approved unanimously of the work already done by its committee, and instructed it to work for the building of railway lines, either through government aid or at government expense, and the opening of the coalfields upon the most favorable leasing system to which consent of Eastern senators and congressmen can be secured. In the matter of proposed changes in the general mining law, the Congress endorsed fully the position taken by Mr. E. B. Kirby and his associates, published in full in the *Mining and Scientific Press* last week, and urged the appointment of a congressional commission to hold hearings preparatory to a general revision of the mining statutes.

The third topic actively discussed on the floor was workingmen's compensation. When account is taken of the fact that the Congress is mainly made up and supported by operators, our labor friends may well take pleasure in the fact that the principle of workingmen's compensation was unequivocally endorsed. Defects in existing compensation acts were cited and injustices on both sides were illustrated, but to the fundamental doctrine that each industry should bear its own burdens and that it is better to pay the workman than the claim agent and the lawyer, there was no dissent. In this, as in other matters, the American Mining Congress is reflecting the best sentiment among mining men and keeping a little ahead rather than behind; which is exactly where such an organization should stand.

The entertainments offered to the visiting members and delegates were numerous and excellent. At clubs, theatres, mines, and mills, all doors were open. The excursion to the Coeur d'Alene was well arranged and excellently conducted, and allowed the visitors to get at least a general notion of the scale of the work and the methods employed in that great district. The most enjoyed entertainment was the 'Spokane Diggins,' an old-time mining camp extemporized in a large skating rink. Here 'Brunton's livery stable' fronted the general store, where one could, according to the signs, buy "suits, sardines, shoes, suspenders, and notarie public," while just around the corner 'Big Bertha's' dance hall did a flourishing business, and at 'Dutch Jake's Club' one might bet recklessly on faro or roulette with the 'phony' money liberally supplied to delegates. Amateur boxing matches and vaudeville entertained the street crowds. 'Galena Alley,' a realistic picture of one phase of early mining conditions, had been "closed by the sheriff," and through the whole camp there was excellent order. In the closing hours of the last night one of the dancers, unfortunately, performed as in a modern city slum, and so smirched an excellent and appropriate entertainment. It is but fair to say that this feature was not on the program, and that the chairman of the local committee promptly started a policeman to stop the performance. On the whole, 'Spokane Diggins' was a harmless, instructive exhibition that emphasized progress rather than stimulated retrogression. This session of the Congress must be adjudged to have proved distinctly helpful. Doubtless its influence will be felt widely in the framing of the new legislation that the times demand. Election of Mr. D. W. Brunton as president for the next year, and selection of Mr. Hennen Jennings as vice-president, emphasizes the position the Congress is acquiring among men of rank in mining. The membership is changing and the work of the organization must change also. The new board of directors

will face grave problems of organization and finance, but with the prestige of genuine success and with the cheerful optimism that goes with mining, they should be able to direct the American Mining Congress into fields of even greater usefulness.

Local Sections of the Institute

Not the least among the important provisions of the revised constitution of the American Institute of Mining Engineers, which we published in full last week, is the by-law providing for the organization of local sections of the Institute, and it may eventually prove one of the most vital. The discussion of Institute affairs during the past year has unimpeachably demonstrated that one of the critical problems of the society is the awakening and maintaining of the interest of the membership at large.

Of the desirability of the organization of local sections there can be little question. To doubt whether the Institute will benefit from their activities is equivalent to urging that a large business firm derives no benefit from the work of branch agencies. In this case the probable benefit is even less in doubt. The securing of desirable new members can be done much more effectively by local groups of members than through the secretary's office, as well as the stimulation of contributions of original papers and discussion, now that the organization has grown to a membership too great for even a committee to know all those who might contribute valuable papers to the *Transactions*. Effective service may be done in many other ways, and the aim should be to encourage organization in such a way as to most effectively secure the maximum of this. The problem may be approached from the viewpoint of securing the maximum of benefit to local members, regardless of its effect on the Institute as a whole, of limiting the sections so rigidly to prevent any possible local action inimical to the interests of the whole society, or of securing the greatest good to the greatest number. It will scarcely be urged that local sections should be allowed *carte blanche* in their activities, since embarrassing complications might thus arise. But to our mind, this fear is an exaggerated one, resembling the gloomy prophesies of speedy disaster when the referendum and recall were enacted in some Western states. Experience has gone to show that the general public exhibits a level of intelligence comparable, at least, to that of its representatives, and in this case it is probably not rash to assume that local members will comport themselves as becomes intelligent men. On the other hand, it must not be overlooked that the organization of a section in any mining centre is an individual problem. In one place, for example, there may be in existence a flourishing social organization of engineers, so that the section must be restricted to technical matters, while in another technical matters can best be coordinated with social activities, to the benefit of both. The work of any given section will, therefore, be largely shaped by the local conditions. Too strict control of branches by the head office leads to a good deal of friction in the business world, and in this case is likely to operate to hinder the organization and maintenance of sections.

Passing from the general to the specific, we believe that two provisions of By-law XVIII need revision before adoption. For the Institute to contribute from its funds for the support of local sections, leaving the latter without means to secure funds except through appeal to the Board of Directors, is at once an artificial and presumably unworkable arrangement. An organization without the power to raise funds is a helpless one, and it is at least doubtful if success is possible under any such arrangement. The permission to solicit voluntary contributions for the purpose is undesirable, and would transform the local secretary into a professional mendicant, making his ordinarily arduous and vicarious labors still more unacceptable. The success of any section will largely depend upon its secretary, and his work should be aided, not hindered. If the local section at Douglas, Arizona, for example, should find it feasible to organize as an ordinary club and wish to assess the club members at the rate of $2 per month, it should be possible for them to do so, and both the Institute and the local members will be the gainer thereby. Common sense and business experience indicate that all members of the Institute resident in the territory of a section should be free to join it when first formed, or at the time of their election, and if they fail to avail themselves of the privilege may only do so later under such restrictions as the section may impose. The funds required by a section should be raised by the members of a section, who will automatically regulate their needs by what they are willing to subscribe. Adjustment of the territory of a section by the Board of Directors is unobjectionable if exercised with discretion. But in the case of the Mining and Metallurgical Society the members in western Nevada are grouped with those of Utah, though for geographical and business reasons they rarely visit Salt Lake City, and are constantly in San Francisco. The needs and convenience of the local members should at least influence the actions of the central governing body.

The provisions in regard to papers presented before local sections are of even greater importance. In this regard also the sections should be largely autonomous, and the provisions of the by-law seem to us based upon a misconception of the proper field of the Institute as a publishing medium. To the transactions of a learned society there should attach a prestige which no other medium of publication possesses. Papers there printed are published simply because they are of permanent value. The technical journals print articles which are primarily interesting and often only of temporary value. If they are also of permanent value, so much the better. A journal must be interesting, otherwise it will fail; the *Bulletin* need not be interesting, for if it contains papers of permanent value the members will preserve it and read it, even though unable to stifle yawns in the process. In other words, the factor of value is the primal one in the publications of a learned society, the factor of interest is fundamental in a journal. On the other hand, interest is essential in a local section. For that reason many of the papers there presented will be unsuitable for publication in the *Transactions*, and the requirement of submission of manuscript may often tend to prevent the presentation of interesting informal accounts of matters which members are willing to talk about, but unwilling to put in print in unalterable form. Engineers when urged to write accounts of work which has been carried on under their direction frequently reply that the experiments were discontinued when the immediate results required were obtained, the investigation was never completed, and the experimenter is unwilling to publish uncompleted work. Large companies frequently discourage publication of articles by their employees, and a local section at Butte, for example, would find the greatest difficulty in securing papers for publication in the *Transactions*, while matter for oral presentation only might be freely offered. In this respect as well the sections should be autonomous. Matter which is sufficiently valuable for publication in the *Transactions* will be held for that purpose by the author (previous publication, of course, invalidating any claim to that privilege), and papers of less interest should be left to the discretion of the local secretary. The work of creating and maintaining interest in a local section will devolve upon its members, and it is not unreasonable to suppose that they may properly serve as the best judges of what is possible and desirable under the conditions which must govern them.

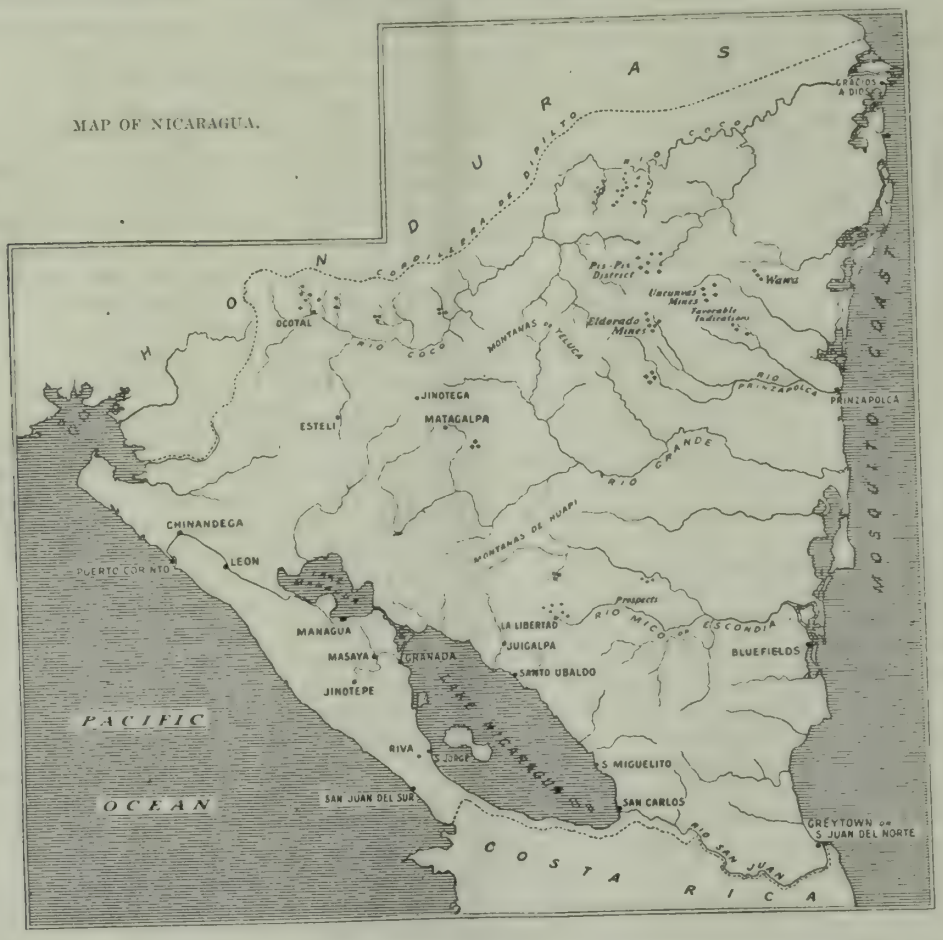
The Chontales Mining District, Nicaragua

By Arthur Feust

The Chontales district lies on the western side of the Republic of Nicaragua, about 42 miles by road slightly north of east from the port of San Ubaldo, which lies on the northeast shore of Lake Nicaragua. This distance is from San Ubaldo to La Libertad, which is the focus of the western end of the district. The eastern end centres in Santo Domingo, 10 miles east of La Libertad.

Early History

The district was discovered in the early sixties, the San Juan mine, close to La Libertad, being the first located.



It was closely followed by discoveries at Santo Domingo, where Thomas Belt, the famous English naturalist, was manager of the Chontales Mining Co. from 1864 to 1868. After meeting with varied success, most of the companies that depended entirely on amalgamation abandoned their properties, and the district was practically deserted until some six years ago, when the cyanide (leaching only) process was first introduced. This, together with the purchase of the Babilonia mine by Bewick, Moreing & Co., started the present revival.

Present Status

At the present time there are eleven producing properties in the district, of which the Babilonia mine, of the Babilonia Gold Mines, Ltd. (Bewick, Moreing & Co.), with its pneumatic stamp of some 35 tons capacity and leaching plant probably holds first place, closely followed, if not surpassed, by the production of the 5-stamp mill of the Cedro mine, without a leaching plant, now being installed.

Following comes the Javali with 19 stamps (10 single cam) and leaching plant; Esmeralda, 15 stamps and leaching plant; Pavon, 1 Husband pneumatic stamp; Costa Rica, 8 stamps; San Juan, 9 stamps; Carmen, 6 stamps; Chamarro, 3 stamps; Los Angeles, 4 stamps; Santa Fe, 3 stamps; and Virginia, 3 stamps. The production of the district is between $15,000 and $20,000 per month (mostly from the first five named), which, considering the light stamps (750 lb.), that few are cyaniding even the sand, and none treating slime, and all depending on the available water-power at or close to the mine, is rather a fair showing. This production will be somewhat augmented during 1913 with the erection of four more leaching plants and the first slime plant in the district, at the Babilonia mine.

General Geological Features

The geological formation of the Chontales district is everywhere eruptive. Andesites, probably augite andesite (?) predominate, with intrusions of greenstone roughly paralleling the general trend of the veins. The mineralized area consists of a series of roughly parallel fissure veins with a strike varying from N.45°E. at the La Libertad end to N.70°E. at the Santo Domingo termination, dipping in places to the north and in others to the south, but with very slight variation from the vertical plane. There seem to be two principal vein systems; one on the northern and the other on the southern boundary, some two miles apart and 15 miles in length, the area between being occupied by smaller veins which in some cases are approximately parallel to the strike of the larger ones, but which may later prove to be ramifications or branches of these.

The larger veins are generally looked upon as continuous, consisting of lenses of quartz (varying in width from a few inches to 32 ft.) which peter out into stringers or *hilos* of varying size for a distance and then unite again, forming other lenses. These lenses vary from 50 to 500

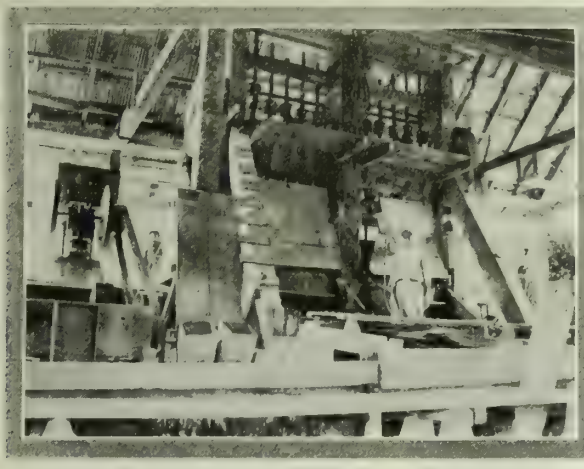
ft. or more in length, some consisting entirely of vein matter, while others carry horses of country rock of varying width and length which in some cases are sufficiently wide so as to form three or more distinct orebodies.

The veins at the western end of the district are oxidized to a greater depth than at the eastern end, with one exception, the San Juan mine. The vein matter generally is softer in the mines on the western end and carries less silver than at the eastern end. These facts, coupled with surface observations on the depth of overburden, incline me to the idea advanced by Oscar Hershey[1] concerning the Pis Pis district, that the zone of oxidation, which is irregular and indistinct, depends to a great extent on the thickness of *manta* or overburden, which is practically impervious to atmospheric agencies, and also on the texture of the vein matter at any particular place, as in some instances sulphides have been observed in compact quartz in the outcroppings.

Besides these, other characteristics are crossings at various angles to the plane of the strike in the orebodies proper, which vary from the width of a knife-blade to 1 in. thick, and which seem to bear some intimate relation to the mineralization of the veins, as there is a considerable rise or fall in the gold content after passing through one of these, besides a distinct change in the character of the mineralization, one side being stained with oxides of iron and the other with manganese. These crossings contain principally manganese in the form of pyrolusite, with some quartz, and occur at intervals of 10 ft. or more. They resemble the crossings described by R. Gilman Brown at the Standard Consolidated, Bodie, California, some years ago. See the accompanying sketch showing a horizontal section in the Esmeralda mine.

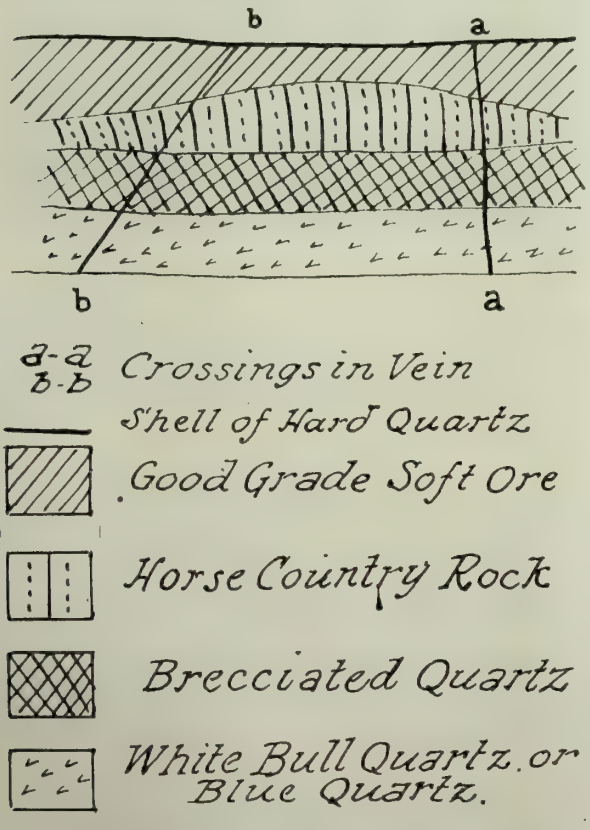
The vein matter consists of quartz of three distinct types; white 'bull' quartz, at times jasper, nearly always barren or practically so, giving way at times to a dense hard blue quartz which is well mineralized, usually containing the original sulphides; brecciated quartz carrying some valuable mineral; and the more friable, sugary, and ribbon-like quartz which forms the bulk of the ore. Vugs of drusy quartz are found in all except the brecciated quartz, but more frequently in the white bull quartz.

From my observations and assays I am of the opinion that the amount of gold and silver found in the present sulphide areas above the water-level, which is somewhat lower than that in the oxidized areas, indicates to a certain extent the content one may expect to find in depth. These sulphides consist of pyrite with smaller quantities

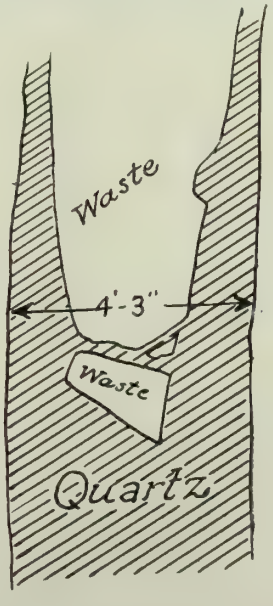


INTERIOR OF JAVALI MILL.

JAVALI CYANIDE PLANT.



HORIZONTAL SECTION, ESMERALDA MINE.



VERTICAL VEIN SECTION, COSTA RICA.

[1] *Mining and Scientific Press*, February 17, 1912.

of argentite, galena, and sphalerite, and occasionally chalcopyrite and arsenopyrite. The difference in content I expect to be small, as the walls close to the surface are badly decomposed, diluting the ore, but in depth become harder, allowing a cleaner product to be mined.

Method of Development and Mining

All the mines in the district are developed by adits at intervals of 20 to 90 ft. vertically. These are connected by raises at intervals of 20 to 100 ft. or more. With the exception of the Babilonia, Javali, and Costa Rica, no systematic development has been attempted. The smaller owners 'gopher' out the ore as fast as they find it, without any attempt at systematic stoping, usually by driving wide levels with a 10-ft. pillar between, and still they politely inform you they are developing, not stoping.

Where stoping is done, the stopes are filled with waste run in from the surface, as walls in the superficial workings crumble and slab off on short exposure. A notable feature in the entire district is the absence of waste dumps of any size, such as are seen being very small in proportion to the work done. The only sinking so far attempted in the district is at the Babilonia mine, where the shaft is now down over 100 feet.

Treatment of Ore

On account of the sticky condition of the superficial ores (in the rainy season) nearly all the mines use the slope of a hill as an ore-bin, from which the biggest pieces are sorted and broken by hand or passed through one of various types of jaw crushers, then fed by hand to either gravity or pneumatic stamps, no automatic feeders being used in the entire district. Some mines follow this with arrastres, as these in regrinding save some of the finer gold.

The sand from the plate is collected either in a box from which it is shoveled out, or else run to a pond in which it collects, together with considerable slime. The Javali mine is the only one using a classifier at present. But I found no difficulty in treating sand from well oxidized ore containing 15% −150 mesh (the finest screen available) as long as it was uniformly distributed, but in several cases of poor extraction the slime which caused the trouble was in lumps, producing layers. This trouble was overcome by stationing a boy in the tank while charging same to break these up with a shovel. In treating some 6000 tons of old tailing I obtained an extraction of 88.6% gold, excluding the first month's run on a product which was very irregular. The supplies and quantities consumed per ton were as follows. Cyanide in terms of KCN, 0.639 lb., using both sodium and potassium cyanide; lime, 4.765 lb. (various grades of lime); zinc, 0.277 lb. per ton. The cost per ton, including labor, superintendence, and supplies, was $0.98. The bullion was 750 to 800 fine. The treatment consisted of a 5-day leach with solutions containing 2 lb. and 5 lb. of KCN in terms of free cyanide. The solution contained not over 0.15 lb. protective alkali in terms of NaOH.

Slime

The slime, which forms 40 to 60% of the product (on the superficial ores), is run to waste except at the Babilonia mine, where it is impounded. But the slime presents no serious difficulties and could be readily treated by any of the various types of agitators and vacuum-filters. When the sulphide problem is approached, which in some cases is close at hand, I believe that concentration and sliming, possibly only sliming, will be the treatment adopted.

Labor

As a laborer the Nicaraguan is inferior to the Mexican, both as a miner and surface worker. There is likewise a vast difference between the Atlantic and Pacific sides of Nicaragua with regard to the question of labor. To begin with, on the Atlantic side the labor consists of Jamaican negroes, Nicaraguans, and Indians, with a large proportion of the former, while on the Pacific side labor is scarcer and operators are dependent on Nicaraguans and Indians, chiefly the former. Secondly, on the Atlantic side the currency is silver, which does not fluctuate so violently as the paper currency on the Pacific side.

Labor is the critical issue that the mine-owners and operators at Chontales have to face at the present day, for with a poor crop the past year and the unstable monetary and political conditions there are violent fluctuations in the cost of foodstuffs, and in consequence the miners at times barely earn enough to live on. Wages are at present 5 to 8 *pesos* per day, with board at 5 *pesos* per day. At the average exchange, 16 *pesos* equal $1. To raise the wage scale is suicidal, as the exchange may fall at any time (once the pending loans are arranged), so there is but one alternative, now adopted by the largest operators: to sell foodstuffs at a loss in order to have a plentiful supply of labor until the financial conditions become settled. It is one thing to raise the wage scale, but a rather serious one to reduce it, as the average laborer has no conception of the value of the *billette* and none whatever of exchange rates.

The laborer or the native miner is the keenest 'high-grader' or *güiris* that I have seen. Samples of stolen ore showed as low as $50 per ton in one instance, and the assayer at one mine informs me that he has assayed the so-called rich streak where they noted 'high-grading' and found it to run only $25 per ton. The low wage scale necessarily permits their working such a grade of ore at a profit to themselves.

Transportation

All the freight consigned to the district enters the ports of Corinto or San Juan del Sur; from the former it goes by rail to Granada, and from the latter by carts to San Jorge, both ports on Lake Nicaragua. From Granada and San Juan del Sur by tri-monthly lake steamer service or schooners to San Ubaldo. In the dry season most of the mines get in their heavy freight, or what they can, as the season is short. Freighting from San Ubaldo to the mines is done by contractors using bull-carts and pack-mules.

However, once the rains set in, the roads (if such one may call them) become quagmires, and carting becomes difficult; so heavy machinery has to be left until the dry season sets in again. In the rainy season oxen work to better advantage as pack-animals across the plains than mules, for although slower they plow through the mud much better.

Freight rates are at present 30 *pesos* to La Libertad per *carga* of 200 lb.; from there to Santo Domingo, 25 *pesos*, and, per additional league, 5 *pesos* added. This big difference in freight rates from La Libertad on reflects the condition of the road and trails, as from San Ubaldo to Santo Domingo is 42 miles and from the former to La Libertad 10 miles.

Timber and Fuel

Although not in superabundance, there is a fair supply of timber for mining and structural purposes. For mine timbers the following are the principal ones used: *nispero* (medlar-tree), *palo de piedra, nauzite,* and *barazón;* for structural work, *cedro marcho* and *cedro real* (cedar), *bimbajan, areno armarillo,* and *caoba* (mahogany); the first three being superior, as they are not attacked by wood ants; for fuel, *roble* (scrub-oak), *canelo* (cinnamon tree), *guavo,* and *manga larga blanca;* whereas for making charcoal, *nispero* (medlar), *cortez,* and *barazón* are superior.

Power

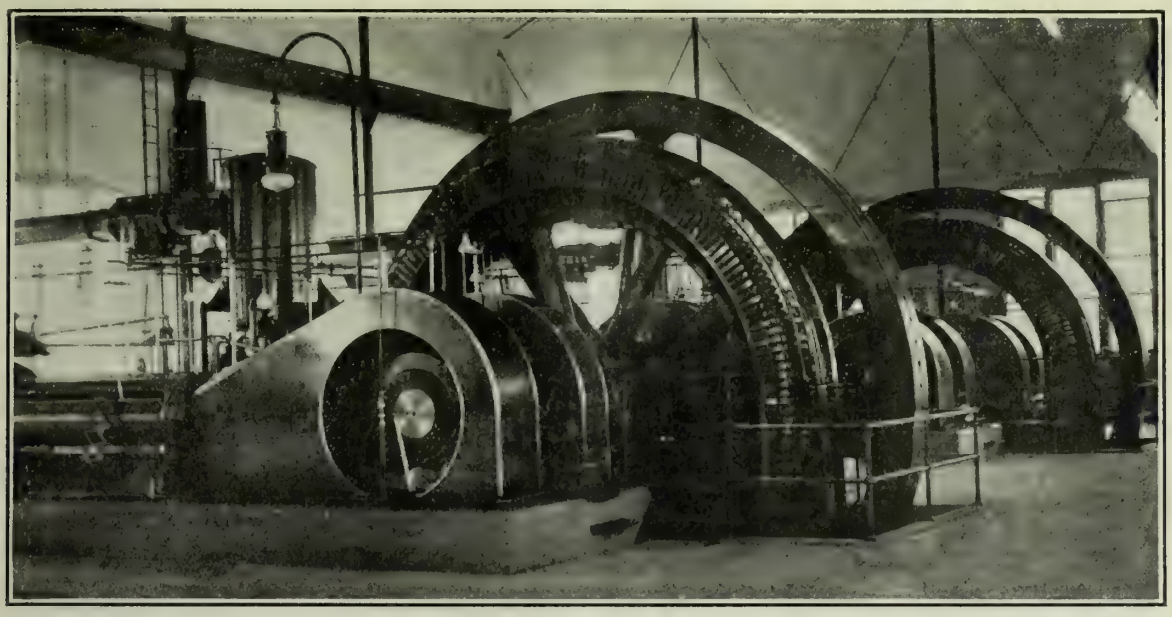
With the heavy rainfall one would think there was an abundance of water-power available, but such is not the case, and good power sites close to the mines, except at Javali and Pavon, are scarce and hard to develop, and even these are liable to run short in the dry season. Wood as fuel soon becomes costly and is not used, so that in the near future hydro-electric power from the Atlantic side, or its tributaries, or some of the various types of gas or oil engines will have to be used, depending on the scale of operations and capital available. At present Pelton wheels are used everywhere.

Large Synchronous Motors for Compressor Service

By Girard B. Rosenblatt

The use of compressed air for certain classes of mining operations has been standard practice for a long time. The application of electric power for driving the compressors which furnish the air is also by no means new. It is, however, only within recent years that the advantage of building central air-compressor stations has received any great amount of attention from mine operators.

For large individual or separately owned neighboring properties, there are many advantages to be obtained from a centralized air-compressor station, some of the most obvious of which are the use of large units with consequent increased efficiency, reduced cost per horse-power installed, minimized cost of attendance and installation, and decreased cost of spare units. Other advantages not so pat-



1200-HP. WESTINGHOUSE SYNCHRONOUS MOTORS, DIRECT CONNECTED TO AIR-COMPRESSORS, ANACONDA C. M. CO.

ent are the possible improvement in the load-factor and the use of a special form of electric drive, both of which tend to reduce the first cost of the installation and the cost of power operation. There are, however, many cases where the installation of a central compressor plant is not justifiable. Electricity usually can be transmitted to better advantage than can compressed air, which is markedly affected by temperature. The problem as to whether a centralized air-compressor plant will prove economical is one that must be decided for each particular case, but it will be found that the economy of centralized air-compressing machinery can often be proved for cases where the advantages are not so apparent on casual inspection. As the policy of centralizing air-compressor stations in mining is one worthy of considerable attention, a few words regarding the selection of electrical apparatus for such stations and a description of one of the largest stations in this country may be of interest.

Air-compressors for the pressure used in mining work (varying from 60 to 100 lb.) are usually reciprocating in type, and compound. They may be driven either by direct-current, induction, or synchronous motors. The motors may be connected to the compressors either by gear, belt, or rope drive, or mounted directly on the compressor-shaft. The use of a gear drive for large units is at present not recommended, except for exceptional cases. Probably for units requiring up to 500 hp., belt driving is at present the most popular, and for larger units rope driving has many adherents. The use of direct-connected engine-type motors has, for some unexplained reason, not received the attention from mine operators that it deserves. While direct connection necessitates a large slow-speed motor with very definite starting characteristics, it will usually be found, when viewing the matter impartially, that for units requiring motors of 350 hp. or larger, direct connection of the motor to the compressor-shaft will prove most economical. The economy may not be apparent in the first cost of the apparatus, but when the cost of foundations and buildings is estimated, when the increased efficiency due to the elimination of the belt or rope is ascertained, and when attendance is considered, it will usually be found that direct connection is best for units of moderate and large size.

The next point to consider is the type of motor to be used. Except in coal-mining and similar plants, where much direct current is used, the source of available power is almost entirely three-phase alternating current at either 25 or 60 cycles; more generally at 60 cycles. Either induction motors or synchronous motors may be selected to drive the compressors. Both types offer advantages, but the advantages of the synchronous motor are not generally realized. In fact, until recently, the synchronous motor for mining installations has been regarded as something to be avoided. The fact that synchronous motors can be designed with reasonable self-starting characteristics is not generally known, and the fact that a synchronous motor can be designed which will have great stability and will not easily fall out of step is not realized by the many engineers engaged in the mining industry.

The direct-connected induction motor in the sizes under consideration is almost invariably of the wound rotor type with slip-rings to permit insertion of resistance in the secondary circuit during starting. The direct-connected synchronous motor for the same conditions is usually of the revolving field type, provided with a cage winding of the fields, at least to prevent 'hunting', if not to give self-starting characteristics. For either type of motor the speed to meet efficient commercial designs of compressors will vary from approximately 200 to 75 r.p.m. The starting torque required will range from 25 to 40% of full-load torque. Constant speed over wide ranges of load, or rather the maintenance of normal speed under heavy load, is to be desired.

For such service the two types of motors compare as

follows. The induction motor has the distinct advantage that no direct current is required for excitation. It will also exhibit somewhat better starting characteristics in that it will develop the required starting torque with a less draft of current from the supply-lines and develop sufficient starting torque even under conditions of low voltage. On the other hand, the synchronous motor can be designed to develop sufficient starting torque for any ordinary compressor, and will have a better efficiency than the corresponding induction motor. The induction motor will probably have a power-factor between 85 and 90% lagging at full load, while the power-factor of the synchronous machine will be unity, or the current may be leading and thus help to improve the power-factor on the system to which it is connected. While power is charged for on a kilovolt-ampere instead of a kilowatt or horse-power basis, this will mean a marked saving in the cost of power for the synchronous motor.

The induction motor will not be simpler than the synchronous motor. The stator windings on both machines will be of the same approximate type. The phase-wound rotor of the induction motor will be not quite as simple and rugged as the revolving field of the synchronous motor. Both machines will have collector-rings; the induction motor three, the synchronous motor only two. The starting device for the synchronous motor will be no more elaborate or complicated than that of the induction motor, and the air gap on the synchronous motor will be decidedly larger than that of the induction motor, a marked point in its favor. The synchronous motor will maintain a constant speed under all conditions of load. The induction motor on the other hand, will show a falling off in speed practically proportional to the increase in load up to full load, and a somewhat greater falling off in speed above full load. Both motors can be built for a maximum torque which will be well beyond the greatest requirements for the service, and the synchronous motor may be given characteristics that will insure its stability or power to 'hang on to the line' under abnormal conditions. These two facts are not generally realized by operators. Figures confirming this are given below.

In a plant having several units, the disadvantages of having an exciter for the synchronous motors is not so marked as where a single unit is installed, as one exciter may be employed to furnish direct current for a considerable number of synchronous motors. The starting of either type of machine is equally simple. In either case the compressor is 'unloaded' before starting. A self-starting synchronous motor synchronizes itself. If, as is the case in some plants, the synchronous motor is not self-starting, but is brought up to speed by the compressor, with its valves reversed, acting as an air engine, or by an auxiliary starting motor, special attention to synchronizing may still be avoided by the use of an automatic synchronizer.

The selection of a proper synchronous motor is not as easy as that of an induction motor. Any induction motor of the proper real capacity, voltage, frequency, and speed, with a reasonable pull-out torque, to carry it through periods of low voltage, and ordinary starting characteristics, will operate a compressor successfully, though possibly not as satisfactorily as might be the case with a more carefully designed machine. In selecting a synchronous motor for the same service, a number of features must be borne in mind which do not enter into the selection of an induction motor.

The first is the fact that development of the 30% full-load torque usually required at starting necessitates a power supply of from one and one-half to three times normal full-load kilovolt-amperes. A self-starting synchronous motor starts as an induction motor, and at that speed where it changes in action from an induction motor to a synchronous motor the torque suddenly falls to one-half or less of the starting value. The value of torque at this point is called the pull-in torque. The greatest torque is required at starting to bring the parts of the compressor from rest to motion. Thereafter less torque is required to speed them up, but this torque must not be greater than what is termed the pull-in torque. Many synchronous motor applications have been unsatisfactory through overlooking this fact. The starting torque of a self-starting induction motor may be increased by increasing the resistance of the cage winding, but as this increase in resistance increases the slip of the motor operating as an induction motor, it increases the gap between the maximum speed the motor will attain under load when operating as an induction motor and its synchronous speed, which is its normal speed when operating as a synchronous motor, and the pull-in torque decreases as a result. In a well designed motor the resistance is so proportioned that a good balance between starting and pull-in torque is obtained.

The second feature is the fact that a certain amount of care must be employed in the selection of a proper fly-wheel for use on a compressor to which a synchronous motor is to be direct-connected. The compressor, being a piece of reciprocating machinery driven from a rotating machine, must have a fly-wheel to equalize the uneven efforts required to keep the reciprocating parts in proper motion. In other words, the fly-wheel stores energy through part of each revolution and returns it to the reciprocating parts at other portions of the revolution. The fly-wheel accordingly must generate impulses. In a simple compressor there would be two impulses per revolution; in a compound compressor, four. These impulses will give the fly-wheel a certain period of oscillation, depending on the amount of the impulses and the weight and radius of gyration of the fly-wheel. Care must be taken that this period of oscillation of the fly-wheel does not coincide too closely with the natural period of oscillation of the motor and the electrical circuit to which it is connected. The feature is not one that requires the attention of the user of the compressor, but to insure satisfaction to himself he should make certain that the matter has been given attention by the manufacturer of the compressor motor. For a given combination of synchronous motor and compressor there will usually be a considerable number of fly-wheels, differing in weight and diameter, whose period of oscillation will be absolutely safe. Some may be too light for the mechanical requirements of the compressors. Others may be so heavy that their cost will be inordinately high, but there will always remain a considerable number of reasonable dimensions from which a final selection may be made. As an appendix to this discussion, a brief outline of what has been done in practice may be of interest.

The Anaconda Copper Mining Co., at Butte, Montana, is pursuing the policy of centralizing its air-compressors. Four such central compressor plants have been placed in operation and marked economies obtained by so doing. In the three older plants induction motors with rope drives have been used. The total installed capacity varies from 1700 to 2400 hp. per plant, and the units range in size from 300 to 800 hp. For the most modern plant, direct-connected synchronous motors were decided upon after careful consideration and the size of individual units increased to 1200 hp. Three of the units have now been in successful operation for more than a year. A fourth unit is being installed and two more are to follow, making the ultimate total installed horse-power in this one plant 7200 hp., capable of compressing 45,000 cu. ft. of air per minute to 90 lb. pressure.

Apart from the size of the units and the use of direct-connected synchronous motors, this plant is unique in refinements that have been incorporated to maintain a high efficiency and an even load-factor. An elaborate receiver system is employed, the compressors discharging into large steel cylinders from which the mains leading to the machines using the air draw their supply. The combined capacity of these cylinders is sufficient to equal the total output of the compressor plant for nearly half an hour. Constant pressure is maintained in these receivers hydraulically, the water in the bottom of the tanks being received from an open water-tank on the hillside above the plant, at a sufficient elevation to provide the required pressure of 90 lb. All the air contained in the receivers may thus be used at

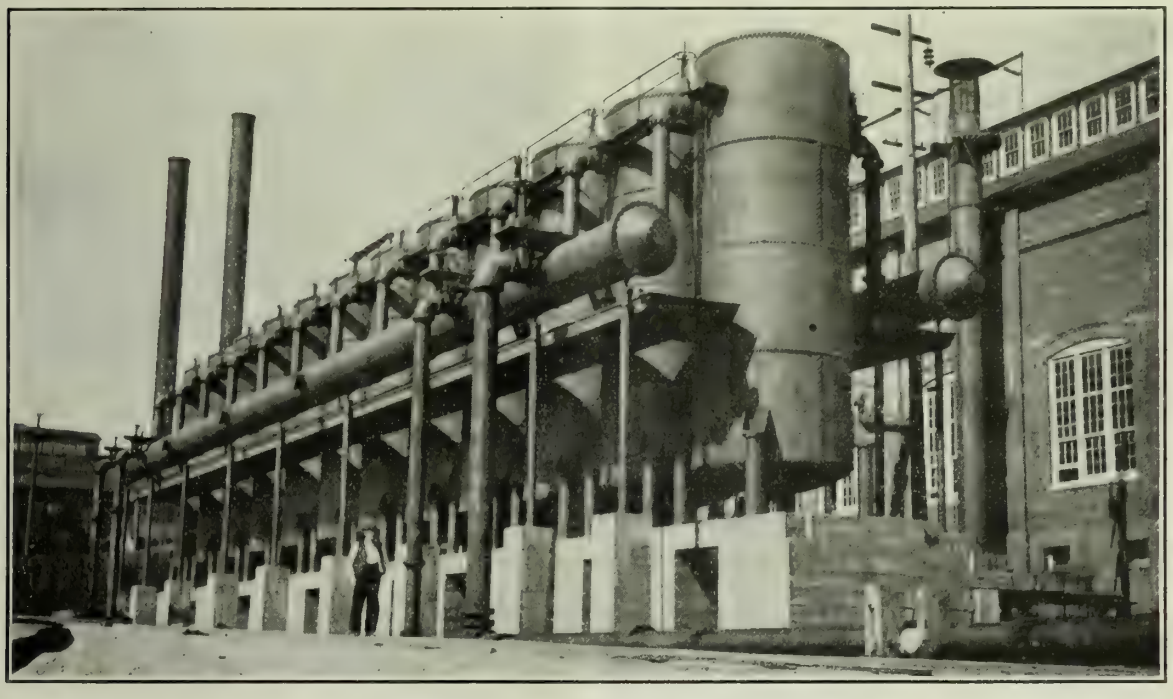
full pressure, and it is impossible under any circumstances to exceed this pressure. The receiver system permits the compressors and the motors driving them to be operated always at full load and maximum efficiency. Large variations in demand are taken care of by starting or stopping an additional compressor unit.

It will be seen, therefore, that in designing this station every benefit that might accrue from the centralization of the compressing machinery has been taken advantage of. The cost of buildings, foundations, machinery, and maintenance has been cut down to a minimum per cubic foot of air. Transmission losses between the motor and the compressor have been entirely eliminated. The apparatus is operated at maximum efficiency and the load-factor is so good and the absence of peaks so marked that the power company can afford to make a marked concession in its charge. Further, the synchronous motors employed in this plant are designed to carry their full normal mechanical load with fields overexcited so as to obtain 80% power-factor leading in the motors. With the entire plant of 7200 hp. in operation, this feature will permit of enough corrective effect being obtained to greatly compensate for the low power-factor of some 15,000 hp. of induction motors operating elsewhere about the company's properties.

The synchronous motors installed at the Anaconda company's plant are built with squirrel cage windings on the revolving fields. They may in case of necessity be self-started, but are not designed primarily as self-starting motors. As there is almost always some pressure in the receiving system of the compressors, arrangements have been made to reverse the valves on the compressors and permit each one to act as an air-engine and bring its motor up to speed, after which the motor is synchronized in the ordinary manner. As a refinement, an automatic synchronizer has been included in the switchboard equipment, permitting the motor to be synchronized without any attention from the operator, when it reaches the proper voltage and speed. Should pressure in the receivers fail, due to some accident, the motors can still be started by applying alternating current to the armature windings.

As an instance of what can be done in the designing of a synchronous motor of this size, as to efficiency and stability, a description of the motors in this plant is presented. The motors are all rated normally at 1200 hp., 3-phase, 60 cycles, 2400 volts, 75 r.p.m. They have a continuous overload capacity permitting their operation at 1500 hp. and 80% leading power-factor in the motors. They are engine type in construction, the spiders of the revolving field being in halves, assembled directly on the shafts of the compressors. At full load they have an efficiency slightly in excess of 95%. A corresponding induction motor designed for a reasonably good power-factor would not have better than 92% efficiency. Accordingly, in this plant of 7200 hp., where there is a saving in efficiency of about 3%, or something over 200 hp., the cost of which when capitalized means a very considerable investment.

The engineers of the Anaconda Copper Mining Co. were at first somewhat fearful that these synchronous motors would not be sufficiently stable on the line, particularly if considerable power-factor correction were attempted with them, and accordingly the manufacturers agreed to guarantee successful synchronous operation without tendency to fall out of step or 'hunt' under conditions of from ¼ to 1¼ load with the voltage varying from 200 to 2600 volts and at various power-factors ranging from 80% leading to 100%. A maximum of 2½ times full-load torque with the motors operating at unity power-factor was also guaranteed. After operating for over a year the motors have proved that they will more than meet the guarantee regarding stability made for them and have shown themselves in every way equal in operation to any induction motors, while allowing a considerable improvement in efficiency over what might have been obtained from induction motors, and at the same time permitting of large power-factor correction altogether impossible with the induction type. The determination of the Anaconda company's engineers to double the size of this plant, using motors of exactly the same design as those now installed, is good evidence of their satisfactory performance.



COMPRESSED-AIR RECEIVERS, ANACONDA C. M. CO.

MINERAL WATERS in Argentina are to be investigated by the Division of Mines, Geology, and Hydrology of the Ministry of Agriculture according to a general plan which comprises the description and determination of the nature and topography and classification of mineral springs, the properties of the waters, their curative effects, and other data which will serve as a basis of legislation on the matter. It is stated that Argentina is the only country which for hydro-mineral wealth is on a par with France. The radio-active properties of the waters, in view of the great value attributed to this new form of energy by modern science, are considered a factor of great importance.

Geology of Culebra Cut

By D. F. MacDonald

*The slides in Culebra cut are attributable to two general causes: (*a*) a primal cause, the weak and unstable geological condition of the rocks through which the cut passes, attributable only to nature; and (*b*) the oversteepness and height of the slopes, the blasting, and other work attributable only to man.

In the main, the weakness, and, therefore, the sliding tendency of the rock is due to peculiar local geological conditions. The presence of fossil oysters, corals, gastropods, and remains of other marine animals in the sedimentary rocks found at intervals across the Isthmus, is evidence that the Atlantic and Pacific oceans were in connection over the present land barrier during Tertiary time. During that period, islands of older rocks, like the present islands of Panama bay, showed at intervals above the shallow ocean which existed where the Isthmian land now stands.

These oldest rocks consist of (*a*) re-crystallized conglomerates and breccias, as found at Bas Obispo, and locally, near the Pacific. These are overlain by (*b*) agglomerate lava flows and tuffs, as between Empire bridge and Las Cascadas. The next younger rocks (*c*) are the light colored tuffs of Pedro Miguel, Miraflores, Diablo ridge, and the lower slopes of Ancon hill. Later than these are (*d*) the dark soft shales and marly clays, found from one-fourth mile south of Empire bridge to the Miraflores locks. Probably equivalent to these dark shales are the argillites and argillaceous sandstones of Lion hill, Gatun, and Mount Hope. The upper part of the Gatun formation seems to be equivalent to the Bohio conglomerates. Deposited later than (*d*) are the greenish volcanic clays, unstratified in character, and with red oxidized beds representing land conditions of deposition. This formation contains lava flows; also, lignitic shale beds, showing fossil ferns, and other vegetation, which is confirmatory evidence that while they were being formed above sea-level, swamp conditions prevailed locally. The youngest series of bedded rocks (*e*) have a basal bed of coral limestone, overlying which are yellowish weathering consolidated clays, a bed of limy conglomerate, and the youngest beds of limy argillite. All of the Isthmian sedimentary rocks are cut by intrusions of basic lava, mostly basalt, and by plugs of meta-breccia, pushed up cold by some of the lava intrusions. The lavas and breccias are strong, but most of the sedimentary rocks of Culebra cut are unerystallized, loosely cemented, sheared, and cut by fissures and faults, so they are very weak and unstable. Through their interstices and joint and fault-planes they absorb a large amount of the heavy tropical rains, which further weakens them, and which increases their tendency to deform and slide.

There are four distinct types of slide, classified by the geologists as follows: (*a*) structural breaks and deformations resulting in slides; (*b*) normal or gravity slides; (*c*) fault-zone slides; (*d*) weathering and surface erosion.

The structural break and deformation slides are the most troublesome and most important. Their first manifestations are cracks or fissures, approximately parallel to the side of the cut, and from a few to a hundred yards or more, back from it, and from each other. Each fissure is usually traceable on the surface for several hundred yards, and each gradually widens with time. The next stage of this type of slide is the tilting of the large blocks toward the canal, usually accompanied by upward bulging of the bottom of the cut, opposite the moving block. For a few weeks, or even for a year or more, this tilting, settling, and bulging may continue before the real slide comes. This last stage consists in the collapse of the basal part of a moving block, due to the pressure of its upper part, and to the weakening effects of the deforming and shearing movement that it has undergone. When this stage is reached, the block rapidly disintegrates, and, in a few hours, or a few days, it becomes a gravity slide of débris at the bottom of the cut.

The causes of this type of slide are the weakness of the rocks, and the height and steepness of the slopes. These conditions induce deformation, or almost imperceptible flow-movement of the high banks toward the excavation, with consequent cracking and shearing of the slope material, and bulging at the bottom of the cut, all of which tends to further weaken the rocks until finally they collapse.

Normal, or gravity slides, occur where the cut intersects beds of porous material lying on top of relatively impervious material, and thus causes a muddy, slippery zone to form along the contact between the pervious upper and impervious lower layers. If the latter dip toward the canal, or if there is much lateral pressure from higher ground, the material above the zone of contact is almost sure to slide. The Cucaracha and Paraiso slides are of this type, but, like most slides of this kind, they are now practically over. This type of slide, it is predicted, will not, from now on, in the progress of the work, be large nor important.

The fault-zone slides are occasioned primarily by sheared and weakened zones in the rocks, due to fault displacements. Where fault-planes are intersected by the plane of the canal slope, large masses of rock in the acute angle between the two planes generally fall into the excavation; or where the fault-plane dips, the overhanging rocks—hanging wall of the plane—often crush downward into the excavation. The most notable fault-zone slides are the La Pita slide, and that about 600 ft. north of La Pita, which, on August 20, 1912, in a few minutes, let down about 300,000 cu. yd. of material and carried away a hundred yards of the East Diversion.

The heavy tropical rains erode and trench the slopes and wash the weathered surface material into the cut. Weathering and disintegration of most of the rocks of Culebra cut is rapid, because the iron and magnesia compounds which they contain are readily oxidized on exposure to the atmosphere. The new oxides formed take up more room than the old product, and the change of volume thus brought about causes the rock to crumble and fall to pieces. These rocks also contain some soluble limy cementing material, which, when leached out by surface waters, helps along the disintegrating process. The loose surface product, which results from this rapid weathering, is swept from the slopes by the heavy tropical rains, and thus fresh surfaces are left exposed for further weathering action. Of course, the material washed into the cut in this way forms no perceptible hindrance to present excavation; still, it may be estimated that it would add about 65,000 cu. yd. per year to the sediment accumulating in the bottom of the canal. At 25c. per cubic yard for removal by dredging, this would swell the upkeep charges by $16,250 per year. Slopes that are clothed with a carpet of vegetation are relatively free from erosion, hence tropical vegetation will be encouraged to cover the slopes of the canal with its abundant growth, that washing by tropical rains may be minimized.

It is believed that the rock conditions along the canal will limit the slides within certain fairly definite bounds, and that when the slopes have been reduced to the proper angle, the slide problem will be practically solved. This angle will vary from almost perpendicular in the case of strong lavas, to one in five for the weaker rocks, or even one in ten in a few extreme cases, where deformation and faulting have been pronounced. Almost the only remedy of practical importance in the slide problem is to lessen the weight of the high weak slopes from the top, so as to reduce the tendency to slide, and to prevent, if possible, breaks and deforming movements. Slopes which have not moved will stand at a much steeper angle than those of the same material which have been sheared, cracked, and bulged by deforming movements. The first estimate for the excavation of Culebra cut designed slopes that were much too steep for the weak nature of most of the material through which the canal was to be excavated, but though slides of considerable magnitude are yet to occur, the sliding period will eventually be brought to a close, and the ultimate completion and successful operation of the canal cannot possibly be in any danger from slides.

*From the *Canal Record*.

Disposal of Tailing at El Tigre, Sonora

By Donald F. Irvin

The cyanide residue discharged from the plant of the Tigre M. Co. is an all-slime product, about 85% of which will pass a 200-mesh screen. Of the ore before grinding, about 60% is a natural clay slime, the rest requiring regrinding in tube-mills. This product is handled by Kelly filter-presses, and from them flows to waste.

In common with many mining properties operating cyanide plants in Mexico, the Tigre M. Co. has been obliged to prevent the injury of neighboring stockmen and ranchers by the poisonous effect of cyanide solution in the tailing discharged from its reduction plant. The stockmen are quick to resent such injuries, and in consequence cyanide residues must be judiciously handled, even in districts that are practically a wilderness, if lawsuits and injunctions against operation are to be avoided, to say nothing of bills for cattle poisoned by creek water. It should also be recognized that the Mexican bench, in decisions rendered in suits tried in southern Mexico, has affirmed the prior right of the agriculturist as opposed to the miner, so the rancher has the weight of the law with him in his contentions.

When cyaniding was begun at El Tigre this slime product was discharged directly into Tigre canyon, which is the bed of a torrential mountain stream, in the belief that the natural decomposition of the cyanide contents would be effected before reaching the Bavispe river, some 15 miles distant. The latter stream, during most of the year, carries a large volume of water, and supplies the municipality of Oputo, an irrigated district, some 60 miles south, and other water users as well. A very short run proved that there was poisoning of local livestock in Tigre canyon, so the stream-bed was immediately fenced with barbed-wire. This was possible, as the Tigre M. Co. owns all the land intervening, although it is used as a cattle range by various Mexican and American stockmen on both sides of the canyon. As a preventive, it served its purpose against cattle poisoning in the canyon, but the question of the quantity of cyanide in solution at the junction of the Tigre canyon and the Bavispe river was vigorously raised by the people of Oputo. In their minds, their case was strengthened by an epidemic of typhoid fever, which incited the management of the Tigre M. Co. to further measures designed to absolutely remove all chance of pollution of the canyon water, and coincidentally avoid any legal clash with the irrigation districts on the Bavispe river, although there never was a trace of cyanide found in the latter stream at any time. Solution samples taken in Tigre canyon 50 ft. from its junction with the Bavispe failed to show a trace of cyanide.

Various plans for storing the cyanide residue were considered, as that was decided to be the only desirable plan. Discharging the tailing dry and stacking with a belt-conveyor, in the manner used by the Zambona M. Co. in Sonora, was not feasible, as there is but very little storage room close to the filter plant. Damming the canyon itself is a dubious expedient, as it has a heavy grade and is not wide; furthermore, the summer rains are most violent, and at times approach cloudbursts in their intensity. Hence it was decided to retain the slime upon a high mesa, about two miles down the canyon from the cyanide plant. This mesa lies some 150 ft. above the stream-bed, and is about 40 acres in extent, about one-half of which is adapted as a unit for a reservoir site.

Knowing from previous experience elsewhere, as at Goldfield, that slime dams may be built up from their own semi-dried mud, used as wall material, the work upon the dam was started in the winter of 1911-1912, and also upon excavation of a ditch along the canyon wall from the filter plant to carry the slime to the damsite. The first work was the throwing up of a low preliminary earth and rock dam to hold the first of the slime, until it became dry enough to be useful as wall material. A low ridge in the centre of the reservoir site, running at right angles to the face of the dam, divides the storage room into two parts, and it was used from the beginning as a means of dividing the pond into two basins, one receiving the flow of pulp while the other is thickening.

TAILING POND. TRESTLE FLUME.

Inasmuch as settling recovers a fair amount of solution, in spite of loss by evaporation, and this solution contained small quantities of precious metals, cyanide, and lime, a decanting pipe was placed in each bay of the reservoir and the decanted solution was run through a zinc-box connecting with a triplex Aldrich pump, which can either return the solution to the mill or through a by-pass into the slime ditch above the point where it enters the dam. The pump was installed as a means of recovering all the water possible in the dry season, as well as for the sake of the solution itself. However, the mill is now running on a much smaller water consumption than was at first thought possible, and, as the natural water-supply is more abundant than formerly, the pump is used only as an adjunct to natural agitation of the thick slime tailing in the ditch as it comes from the filter plant to the reservoir. By dilution it thus effects a slight additional recovery of dissolved metal, which is caught in the zinc-box, although, as a rule, this is so small that the recovery thus made is quite insignificant. The dissolved metal in the pulp is now much less than was thought at first could ever be attained, hence the recovery in the zinc-box is small. The amount of solution decanted from the surface of the reservoir will vary with the seasons, naturally being greater in the rainy months—a low figure being 3 gal. per minute and a high being 12 gal. per minute. Percolation is now negligible, the other sources of loss of water being from evaporation and retention by the slime itself.

The essential benefit of the arrangement is that, beyond dispute, all cyanide tailing is kept from polluting the natural waters of the district, and the tailing is preserved on ground belonging to the Tigre M. Co. Although at present further metal recovery is not practicable by current metallurgical methods (they assay only 1.25 to 1.50 oz. silver per ton), at some future time they may represent a live asset. The discharged residue from the filter plant is very thick, and unless diluted by a small stream of water that enters the launder would not flow in the ditch, in spite of its heavy grade, which is 1 in 9, or about 11%. A series of determinations over a considerable period of time on the pulp issuing from the filter plant show an average moisture ratio of ½ to 1.

Before the additional water was added to the slime ditch the pulp would often back up in the ditch and overflow at the turns, and at every culvert that crossed the small side *arroyos* the slime would leap over the side of the launders. Raising the dam walls, care of the ditch and of the pulp involve some labor, and for this purpose three Mexican laborers live at the damsite and do all this routine work. These men are paid ₱2.50 and ₱2.25, and are the only labor charges incurred in maintaining the work. The carpenter work required in building the distributing launder along the crest of the dam was, of course, charged to construction.

In operating the dam it is thought best to discharge the slime as near the dam itself as possible, so that the heavier deposit may form there and the thinner part gravitate to the back of the pond, where the decanting pipes are placed. The photographs show the arrangement of discharge of the slime into the dam through a trestle flume, and also the manner in which the dam is built up. The trestled flume was chosen as a means of conveying the sluggish pulp along the crest of the dam and discharging it at that point with the minimum of labor and time lost in alterations, as the level of the slime pond rises.

Seeking added stability for the dam, an auxiliary dam was started below the main dam, after impounding of tailing had begun. This was commenced in much the same manner as the main dam was built, save that the slime was run into the second catch-basin through holes made in the wall of the big dam and allowed to flow in a series of small sections.

This lower dam is 50 to 75 ft. from the face of the main dam and is kept about 7 ft. lower. The crest of the main dam is 2 to 3 ft. thick and is seldom more than 1 or 2 ft. above the surface of the pond. The thickness of that portion of the wall that is below the surface of the slime in the pond is indefinite, for it is homogeneous with the slime of the pond itself, and hence it may be considered to be any thickness. This was shown by a washout during the past rainy season, when a crevasse was formed in the face of the dam during a tremendous downpour. The part washed out was narrow and deep, and showed the slime to be uniform, leathery, and compact from top to bottom, and this condition persisted for a number of feet back from the face of the dam. At the present writing (about November 1, 1912) the main dam holds, in round numbers, 60,000 to 65,000 tons of tailing and the crest of the dam is about 20 ft. above the ground-level at the highest point.

This method of tailing storage has no essential feature of special novelty, although it is unlikely that such a long and devious ditch is in use elsewhere to convey the tailing, and the remarkably coherent Tigre slime enables the dam to be built to a height that would otherwise be unsafe. In this connection it may be added that the face of the dam may be built up so as to impound tailing for at least three years at their present rate of increment, before it will be necessary to begin the construction of a second dam on the more roomy site immediately below the present one.

THE October output of the Rand mines was valued at $16,320,000, against $14,400,000 for the same month of last year.

Antimony Mining in New South Wales

By J. E. CARNE

*Antimony mining ranks fourteenth in the New South Wales mineral industry in total value of production to end of 1910. Owing, however, to unstable market conditions, it has never assumed a permanent character, the output resulting chiefly from spasmodic efforts during boom periods of inflation, with intervening seasons of depression and almost cessation. Under local conditions, even normal prices afford but modest profit when the metal is unassociated with gold. Hence mining for antimony alone practically ceases when market depressions occur. The intermittent character of the industry is best exemplified by the following analysis of the output: Boom prices in the periods 1880-1882, 1890-1894, and 1906-1907 were accountable in ten years for an output valued at £245,644, as against £57,215 for the remaining period of the duration of the industry, which dates from about 1874. During the brief boom of 1906-7 the local value of 50% antimony ore rose to £30 per ton. During the periods of depression, values have receded to even £5. In consequence of the limited demand in 1909 and 1910, the local production amounted to only 95 tons 9 cwt. and 96 tons 17 cwt., respectively, chiefly as a secondary product in gold mining. As an index to ordinary market values of antimony, compared with boom figures, the following averages have been computed from an interesting table of the average monthly prices of antimony in New York for 1901 to 1909, inclusive. These disclose remarkable uniformity when the boom years (1906-7) are excluded. For the seven years 1901-5 and 1908-9 the average price works out at 8.29c. per pound, while for the boom years mentioned the average is 18.96c. The position was no better in 1910, notwithstanding the duty; the production was believed to be less than 75 tons of ore.

In the early eighties antimony reduction works were established at Carangula, in the Macleay River district, at Hillgrove, and Metz. Works were also started at Taylor's Arm, in the Nambucca district, but for a number of years these have been abandoned. During the recent boom, 1906-7, a smelting plant was built by the Metals Smelting Co. at Balmain, and about 32½ tons of antimony produced, but these works closed when prices fell. In the beginning of gold-mining operations at Hillgrove, great difficulty was experienced, owing to the association of antimony with the gold. In 1882-3 Messrs. Newbery, Vautin, and others patented a process for separation of these metals and saving of the antimony, the antimony being volatilized as oxide and recovered in suitable flues, the gold being recovered from the roasted residues by ordinary crushing and amalgamation. The method adopted subsequently at Hillgrove was of this character.

The principal antimony deposits in New South Wales occur near the junction of slate and granite at Hillgrove; at the Macleay river in Permo-Carboniferous or Carboniferous sandstones and claystones; at Nambucca and Bellingen rivers in altered sandstones and slates and schistose rocks, traversed by large dikes; and at other places in Devonian slates and sandstones and gneissic granite.

MACHINES used in mining coal in the United States in 1911 totaled 13,819, an increase of 565 over 1910. Pennsylvania's production of machine-mined coal was 69,131,923 short tons, or 47.76% of the total; and Ohio's production was 26,556,630 tons, or 86.33% of the total. Although the total production of bituminous coal in the United States decreased from 417,111,142 tons in 1911 to 405,757,101 tons in 1910, the quantity undercut, or otherwise mined by machines, increased from 174,012,293 to 177,971,976 short tons.

DISCOVERY of petroleum deposits on the island of Chiloe, in Chile, has been confirmed by the governor of that island.

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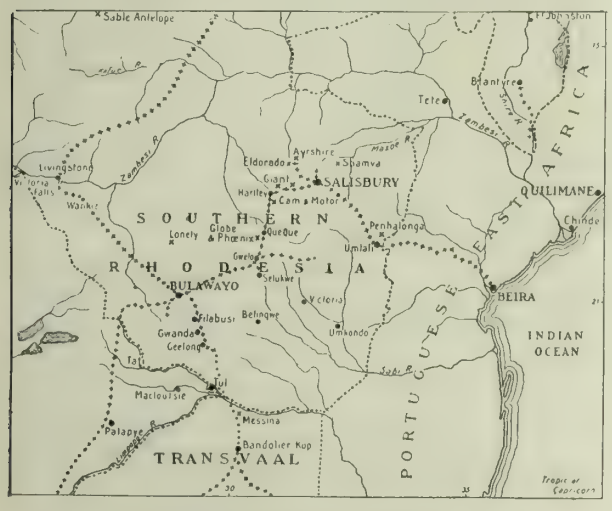
*Abstract by the *Australian Mining Standard* from *Bull.* No. 16, Mineral Resources Series, New South Wales.

Mining Progress in Rhodesia

SOUTH AFRICAN CORRESPONDENCE

No other mining district in Southern Rhodesia has come to the front so rapidly as Gatooma. Five years ago there was merely a gangers' hut by the railway track and one or two prospectors' camps in the vicinity to denote that such a place as Gatooma existed. Today there is a large flourishing township, and within a radius of 21 miles no less than 37 gold mills are working. In addition, mine plants are in course of erection and a number of ventures are approaching a stage at which they will require larger plants, so that a further increase in the gold output of the district in the near future may be expected with confidence. By far the most important area in the Gatooma district is the Eiffel Flats, years ago a favorite hunting ground of F. C. Selous. Today the Eiffel Flats present an animated appearance and in a year there will be even more activity.

The chief property on the Eiffel Flats is the Cam & Motor. Here two extensive veins have been developed, one in the Cam block and one in the Motor claims. As a consequence

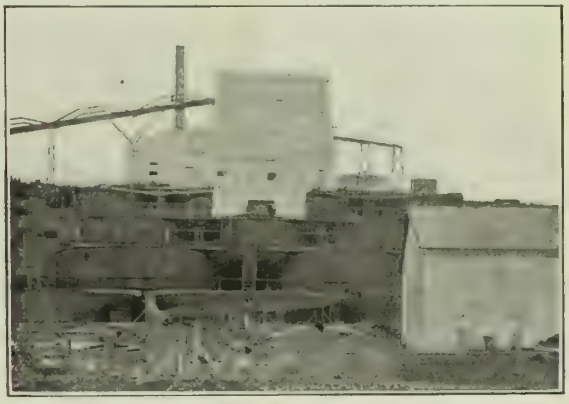


MAP OF SOUTHERN RHODESIA.

of the present development work it is estimated that there is developed in the two mines 1,000,000 tons of ore of an average assay value of 46s. per ton. Most of this is in the Motor, where development has been carried down to the fifth level and a large body of high-grade ore has been proved. Recent work has given results of exceptional interest. The first cross-cut is at 105 ft. south of the main shaft and shows a vein 14 ft. wide averaging 33s. 1d. per ton. At 225 ft. the vein is 91 ft. wide, assaying 44s. 2d. Production will commence next year. The method of treatment adopted is somewhat similar to Western Australian practice. A recovery of about 85% is expected from this method. The capacity of the plant will be 180,000 tons per year, but it will be designed with a view to early increase of capacity. It is expected that the equipment will be ready for work about next June, and it is certain that the Cam & Motor will advance to the front rank of Rhodesian mining.

Although the Giant Mines Co. at Gadzema is making a profit of £10,000 per month, the underground position can scarcely be termed satisfactory. At about the sixth level, between the old and new main shafts, a big lenticular mass of ore was found. The width of the orebody at this depth was as much as 140 ft. in places early in 1911, but it was found to pinch below the sixth level. Extensive diamond-drilling operations have been carried out to find the vein in depth, and the consulting geologist of the company, G. S. Corstorphine, believes that the work so far carried out "has very far from exhausted the possibilities of the lode existing below the seventh level." The third bore-hole put down intersected material somewhat resembling the orebody. Bore-hole No. 7 was put down to cut this and bore-hole No. 8 was directed vertically in a zone not yet explored and drilled to a greater depth than any previous hole. It is now announced that three bore-holes have proved the presence of an acid dike below the seventh level, with a strike parallel to the orebody. They also have proved a belt of mineralized schist of the same type as the orebody, with a low gold content and lying on the upper side of the dike. No. 11 is now being drilled to cut the schist body more centrally and is expected to decide whether this body is a news lens of auriferous rock, or is the faulted portion of the orebody in the upper levels. Results from the No. 11 hole will be awaited with keen interest.

For the past 18 months an important prospecting expedition has been at work in a little known portion of Rhodesia. This is the southern portion of northeastern Rhodesia, where the North Charterland Exploration Co. owns much territory. This company organized an expedition in the latter part of 1910, and after months of patient work a promising gold deposit was found at Madjimoio, close to the Anglo-Portuguese frontier. After a certain amount of work had been carried out it was decided to erect a small testing plant, and accordingly a Tremain steam stamp battery was ordered. The latest report is that rich specimens of gold and copper are being found. There seems, however, to be considerable doubt as to whether any



MILL AT GIANT MINES.

of the mineralized areas contain persistent orebodies. Much more work will have to be done before this point is proved, and now that the rainy season is coming on it is improbable that much will be done before next year. However, the discovery of promising gold and copper deposits in northeastern Rhodesia is at least interesting, since only one gold mine is producing in the whole territory; the Sassare in the Luangwa valley. Northeastern Rhodesia is rather inaccessible. The capital, Fort Jameson, is more than 300 miles distant from the nearest point on the railway and all transport is by porters. The country is unhealthy and in the absence of any profitable industries it is probable that no serious attempt to develop will be made for years to come.

Increased Gold Production in Mexico

Mexico was fourth in rank among the gold-producing countries in 1911, according to the figures of the U. S. Geological Survey, the output for the year being $29,196,000. This was an increase over the 1910 figures of more than $4,000,000, despite the unsettled conditions which prevailed in some portions of the Republic during the year. With a return to settled conditions and the continued introduction of modern mining and metallurgical methods into Mexico leading to renewed development of the great metal resources of the country, the gold output may be expected to increase still more rapidly.

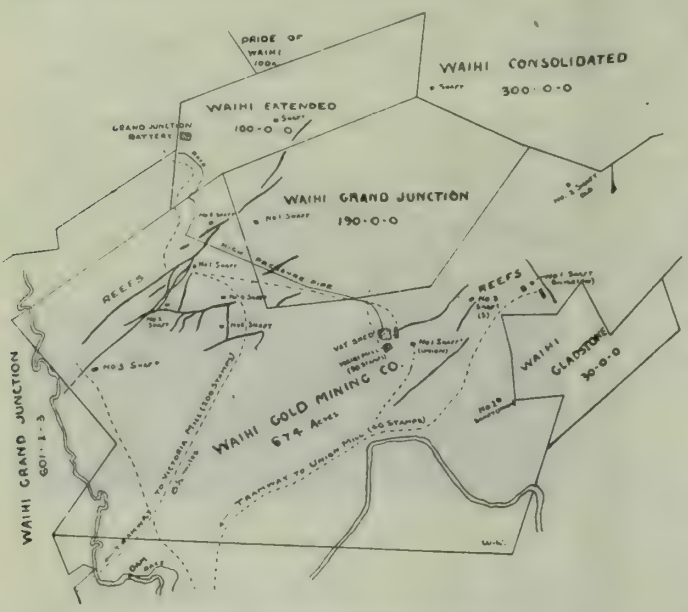
AT THE mines of the Sulitjelma company, Norway, the Elmore vacuum plant produced 1150 tons of copper concentrate during the month of October.

Precipitation of Gold and Silver by Carbon

By R. K. Cowles

*This paper is the outcome of experiments carried on and experience gained at the Waihi-Paeroa Gold Extraction Co.'s tailing plant at Waihi, New Zealand. The plant was erected to treat accumulated tailing which had been discharged into the Ohinemuri river by the Waihi stamp-mills. The Ohinemuri river is a common sludge channel for all mining débris, tailing, and ashes from the power-plants, the last being the cause of occasional high residues which gave so much trouble to the management.

The tailing was dredged from the bed of the river into barges by means of a Pohle air-lift, the power being supplied by a 13 b.hp. Tangye oil-engine driving an air-compressor and a centrifugal pump. The sand was elevated from the barges by bucket-belt elevators over screens, to



PRINCIPAL WAIHI MINES, NEW ZEALAND.

eliminate large particles and rubbish, into storage hoppers, and from there fed direct into four C. Judd Ltd. tube-mills. The method of treatment was fine grinding in a weak cyanide solution, agitation in Brown and McMiken tanks (Pachuca), filtration with turn-over vacuum filters, and precipitation with zinc shaving.

The comparatively high content of the residue in gold gave a great deal of trouble, and it was not until repeated experiments were carried out that the cause of the trouble was identified. While the content in silver remained stationary, the gold fluctuated greatly. To overcome this, finer grinding was tried, with poor results, except that more silver was recovered—the gold still remaining too high. It was well known that carbon would precipitate gold and silver, but its selective action was not known. When fine grinding did not give the desired result, other methods had to be sought. Knowing that there was a variable amount of half-burned coal among the tailing, it was decided to experiment with carbon.

A heavy freshet occurring at that time gave the opportunity on a large scale, as it brought down a large amount of half-burned coal. On the newly deposited tailing experiments were carried out, and it was found that silver residue, just after grinding, was normal, while the gold was slightly high. Samples were then taken every day from the B. and M. tanks and assayed, with the result that the gold content unmistakably increased while the silver content decreased until such a time when practically all the gold was precipitated, then the content of the silver residue started to rise, thus showing that the carbon had no apparent effect on the silver until nearly all the gold was precipitated. The following are the results of a few assays, showing the action of carbon on gold and silver in cyanide solutions. The samples were first taken from the overflow from the classifier, and then daily from the B. and M. tanks.

Sample.	Gold, oz.	Silver, oz.
No. 1.—From overflow	0.088	0.908
B. and M. tanks:		
first day	0.098	0.658
second day	0.102	0.634
third day	0.108	0.628
fourth day	0.112	0.672
No. 2.—From overflow	0.060	0.860
B. and M. tanks:		
first day	0.068	0.672
second day	0.088	0.654
third day	0.096	0.604
fourth day	0.096	0.684
No. 3.—From overflow	0.044	0.680
B. and M. tanks:		
first day	0.062	0.620
second day	0.084	0.610
third day	0.100	0.650
fourth day	0.100	0.814

No. 4.—Experiments were then made with gold and silver solutions in which ground clinker was placed, the whole being agitated for two days, with the following result:

	Gold, oz.	Silver, oz.
Before agitation	0.046	0.642
After agitation	0.013	0.504
Precipitated	0.033	0.138

No. 5.—Unconsumed coal-dust was also placed in a gold and silver solution and agitated for two days, but no precipitation occurred.

No. 6.—A sample of half-burned coal from the river was assayed, and was found to contain 0.102 oz. of gold and 0.604 oz. of silver.

No. 7.—A sample of charcoal (in small lumps) found floating in the lime tank was assayed and found to contain 1.760 oz. gold and 1.792 oz silver. This showed that it was imperative to eliminate the charcoal associated with lime used for settling purposes.

By comparing the time of the river freshets and the slime residue of the tailing taken at that time, it was found that the residue was higher than at any other period. From this it was concluded that fresh carbon precipitated gold and silver more freely than old.

To eliminate the carbon two 6-ft. Union vanners were installed. Though these were overtaxed, the desired result was at once obtained. Besides removing the carbon, the light river sand was also removed. The output of the plant was 80 tons per day, and that amount was run over the vanners. The vanners were driven at about 120 revolutions, with a belt travel of 6 ft. per minute, and with a fall of 8 inches in the whole length. The distributing-box was placed 18 in. farther down than is usual, while the pulp discharged from the lower side. The water-distributer also was placed lower down the table. The sand was from ¼ to ⅜ in. thick as it came comparatively dry over the head, where it was washed off with a series of solution jets into a launder.

In the assays No. 1, 2, and 3 there was no apparent precipitation of silver until nearly all the gold was precipitated, but in the experiment No. 4 and assays No. 6 and 7 silver was shown as being precipitated in equal and greater quantities than gold. From this apparent contradiction it is assumed that, while the silver was being dissolved, a very small amount was being precipitated, showing that the dissolution of silver up to a certain point was quicker than the precipitation.

*From the *Proceedings* of the Australasian Institute of Mining Engineers.

End of the Simmer & Jack

After a chequered career of about seventeen years, the Simmer & Jack East mine has gone under, its failure to keep its head above water being due to a combination of natural and artificial causes. Situated in a low-grade and broken area, the yield has never equalled expectations while, like other properties in the same area, it had to carry a huge capital of ordinary and debenture scrip. It is a unique experience on these fields to see a fully equipped gold mine like the Simmer East put up for sale to the highest bidder, because, as a matter of fact, not more than half a dozen gold mines through the long length of fifty miles have proved failures, or been unable to meet their liabilities and pay dividends at some time or another. The property was controlled and nursed by the Consolidated Gold Fields of South Africa until it was considered injudicious to continue that policy any longer, and following the usual mode of procedure with unsatisfactory or exhausted properties, it is to be absorbed by another under the same control. When put up for sale at auction the other day, the Knights Deep company became a conditional purchaser for a quarter of a million sterling, the necessary amount being supplied by the Consolidated Gold Fields of South Africa to the purchasers for twelve months, free of interest. The Knights Deep has an option to work the mine for a year on certain conditions and to purchase during that time for 100,000 shares to be issued to the Consolidated Gold Fields. Here, then, is a mine with a nominal capital of £700,000, some of which shares have been subscribed for at double their par value and upon whose property debentures to the amount of £900,000 have been issued, acquired by a neighboring concern for 100,000 shares of the nominal value of £1 each. Seeing that the mine is equipped with a 200-stamp mill and can earn working profits ranging from 3s. per ton upward, having quite recently made a profit of £6000 per month, the terms upon which the Knights Deep has acquired the property are certainly advantageous, and will probably result in the Simmer East being purchased on the terms offered during the continuance of the option.

Mineral Production for 1911

In spite of the decrease in the production of iron, the value of the total mineral production of the United States for 1911 reached the enormous figure of $1,918,184,384. Of this the value of the metals was $672,179,600, the remainder representing the non-metals. Coal led the list with a value of $626,366,876; pig iron was second, with a value of $327,334,624; clay products third, $162,236,181; copper fourth, $137,154,092; and petroleum fifth, $134,044,752. The following table shows the output and value of the ten leading mineral products during 1911.

	Quantity.	Value.
Coal		
Bituminous ..... short tons	405,757,101	$626,366,876
Anthracite ..... long tons	80,771,488	
Pig iron ..... do	23,257,288	327,334,624
Clay products		162,236,181
Copper (from domestic ores) ..... pounds	1,097,232,749	137,154,092
Petroleum ..... barrels	220,449,391	134,044,752
Gold ..... troy ounces	4,687,053	96,890,000
Stone		76,966,698
Natural gas		74,127,534
Cement ..... barrels	79,547,958	66,705,136
Lead ..... short tons	406,148	36,553,320

These and other figures of production are discussed in an advance chapter from 'Mineral Resources of the United States' for 1911, by W. T. Thom, of the U. S. Geological Survey. While the total value for 1911 is about $70,000,000 less than for 1910, it is greater than that of any other year except the banner year of 1907, when the $2,000,000,000 mark was passed. Indeed, it is only in the last thirteen years that the mineral output of the country has been above the billion-dollar mark. Fourteen years ago, in 1898, it was only $724,272,854, and ten years before this, in 1888, it was but a little over $500,000,000.

In spite of the decrease in the total value of the mineral output in 1911, a considerable number of products showed a marked increase, 45 of the minerals for which statistics were collected by the Geological Survey having increased in production, against 21 which showed a decrease. Thus, anthracite coal increased to the value of nearly $15,000,000; lead and zinc each increased more than $3,500,000; silver increased $1,750,000; petroleum more than $6,000,000; natural gas nearly $3,500,000; and sulphuric acid nearly $3,000,000. The products showing the greatest decreases were pig iron, more than $84,000,000; bituminous coal, about $18,000,000; clay products, nearly $8,000,000; and cement, $2,000,000, although the amount of cement produced was 1,750,000 bbl. in excess of that produced in 1910.

Goldfield Consolidated Report

During the month of October 1912 the total production of the Goldfield Consolidated Mines Co. was 30,573 tons, containing $456,779, or an average of $14.94 per ton, according to the report of C. D. Kaeding, assistant superintendent. Of this, 29,782 tons was milled with an average extraction of 90.48%, and 791 tons was shipped of an average value of $20.24 per ton. The net recovery from all ore was $13.57 per ton. The total net realization was $242,163, or $7.92 per ton. During the month, 4084 ft. of development work was performed. The total cost of mining, development, transportation, milling, office and general expense was $5.67 per ton, distributed as follows:

Mining (including stoping and development)	$3.16
Transportation	0.07
Milling	1.93
Marketing	0.05
General expense	0.37
Bullion tax	0.04
Marketing ore	0.11
Total cost of operation	$5.73
Miscellaneous earnings	0.06
Net cost per ton	$5.67

In the Combination the 136-BX stope, on the second level, was extended, and produced 505 tons of ore averaging $26.50 per ton. The 246-C stope, 450 ft. east of the shaft between the third and fourth levels, was extended and produced 518 tons of ore averaging $38.10 per ton. The sill being cut on the orebody in the 414-C raise produced 276 tons of ore averaging $32 per ton. The 402-DX raise being run from the 492 intermediate below the fifth level, 250 ft. east of the shaft, discovered ore and produced 88 tons averaging $34.60 per ton. In the Mohawk the 40 drift on the 150-ft. level, going north from the Sheets-Ish workings, produced 185 tons of $26.40 ore. The 107-X drift, driven in the hanging wall under the Sheets-Ish workings, on the 250-ft. level, disclosed a body of ore which has not been opened at any other point, and produced 82 tons averaging $28 per ton. This new orebody should produce a considerable tonnage of good grade ore. The 215-PX stope, between the first and second levels, 560 ft. northwest of the shaft, produced 500 tons of $30.20 ore. The southern end of the 307 stope, between the second and third levels, was extended and produced 1160 tons of $26.50 ore. The 490-R stope from the intermediate between the third and fourth levels, and just south of the big 354 stope, was highly productive, yielding 1738 tons of ore averaging $218.40 per ton.

The 420-S stope in the Clermont, between the 600 and 700-ft. levels, just south of the 413 sill, produced 814 tons of $55.60 ore. This is the downward extension of the big 413 orebody and will produce a large tonnage of excellent grade ore. The downward extension of the 510 orebody, between the 750 and 900-ft. levels, produced 443 tons of $23.20 ore. The 700-F and G stopes, between the 1200-ft. level of the Grizzly Bear and the 1000-ft. level of the Clermont, produced 719 tons of ore averaging $67.60 per ton.

The 802 stope on the 1300-ft. level of the Grizzly Bear was extended and produced 227 tons of $45 ore. The stope carried up from the 220 drift in the Jumbo No. 2 produced 791 tons of $41 ore. A winze has been started on this ore-shoot, and the south drift on the 300-ft. level is being advanced to open the downward extension of the ore.

Eastern Metal Market Review

During November the Eastern metal market was characterized by flurries of activity with very little sustained buying. The best movements were in tin. While basic conditions are good, and consumpton very fair indeed, the market within the month has been adversely affected by the disturbed political conditions abroad, the presidential election, two holidays, and the tendency which develops toward the close of the year of curtailing heavy buying in order that yearly statements may be made as favorable as possible. As for the foreign market, it must be expected that conservatism will prevail until there is less war-talk, with its consequent effect on markets and finance. The general tone of the market is optimistic, as it is recognized that buying comes in waves rather than in a steady stream. There have been no heavy declines in the month except in lead.

Copper

While there was at one or two periods in November fair buying movements in copper, quiet prevailed at the end of the month. Domestic consumers, by reason of contracts, were not obliged to enter the market heavily during the month, and their needs are covered for at least a part of December. They are not so well supplied, however, that they can put active buying far off into the future, and favorable prices probably would start activity. About the middle of the month buying for export got a good start, but a renewal of fear that the Balkan war would embroil other than the original contestants halted the movement, and to the present foreign buying has not been resumed with any force. In this connection it may be mentioned that exports of copper for the month, up to and including November 30, totaled but 18,771 tons, the lowest for any corresponding time in two years, and an indication that Europe has bought less copper than was supposed, also that she must have a goodly store of the metal on hand. Prices in November advanced, the month setting in with a quiet market and quotations for 're-sale' or 'speculative' lots of electrolytic ranging down to 17¼c. f.o.b. New York, cash, and 17⅜c. delivered, cash 30 days, prices which prevailed but a few days when they advanced with a decidedly improved demand. The increase in stocks of 13,679,377 lb., as shown by the copper producers' statement for October, had little effect, as the figures had been anticipated and discounted. The upward trend in prices continued and caused consumers to again become reluctant to buy and trading eased off again. Then came the short-lived selling to Europe heretofore mentioned. Today finds the principal agencies holding to full prices of 17⅝c. cash, New York, for electrolytic, although the metal could probably be obtained from second hands at 17½c. cash, New York, for January to February delivery, and there is a tendency toward further weakness. While the manufacturers of brass and copper products are doing a satisfactory business, the rush has subsided and they are approaching a normal state of activity as a result of curtailment which has been noticed about election time. The Waterbury average or price paid for copper in October by large consumers in the Naugatuck valley, Connecticut, is 17¾c. W. A. Clark is quoted as saying that he thinks the copper outlook good, despite the present dullness; also that producers do not want to see prices go higher. He pointed out that at the present rate of consumption there is only about two months' visible supply of the metal in the world.

Tin

Statistics available on November 1 showed that in October there had been delivered into United States consumption 3850 tons of tin, a very fair quantity in view of the dullness of the market in that month. November opened with moderate sales, and the first ten days were quiet, but from November 10 to 16 there was the best demand for many weeks, and from 700 to 800 tons, mostly for spot and nearby, changed hands, the prices ranging around 50c. or lower. It was demonstrated during this period of activity that when tin exceeds 50c. buyers are disinclined to enter the market. In the week from November 17 to 23 there again was a big volume of sales very quietly negotiated which totaled over 1000 tons, the selling beginning at 49½c., the larger proportion of business being for deliveries running ahead to April, with the bulk for February, while considerable spot metal was taken also. This period of activity was brought to an end by renewed war talk abroad of a disturbing kind, which caused a reaction in London, and this caused lower prices in New York and a loss of confidence among buyers; but inquiries are coming forward again. Deliveries into consumption in November were officially reported at 4300 tons, and the amount available is estimated at 5100 tons. In stock and landing November 30 there was 1559 tons of tin. The auction sale of 2700 tons of Banca tin in Amsterdam, Holland, on November 28 realized a price equivalent to 49.55c. per pound c.i.f. New York.

Lead

The American Smelting & Refining Co. made two reductions in the price of lead in November, both of which were in entire accord with the expectations of the trade. On November 4 the price was cut $7 per ton, to 4¾c. per pound New York, which the other interests followed. It was said that so great was the dullness even following the decline that there were more sellers than buyers. November 21 the largest interest announced another reduction, which also was followed by independents, to 4½c. New York. With a season approaching in which demand usually is dull and competition still keen, the feeling continues unsettled.

Spelter

This metal has hovered around 7½c. New York during the month, sagging a little at times, but recovering. Reports were current early in November that the United States Steel Corporation had placed orders for 2000 tons of foreign spelter to be sent abroad again in finished products, thereby enabling the company to obtain the advantage of the drawback duty. The activity of the galvanizers and brass mills has meant a large consumption of spelter, a good part of which was contracted for at higher prices than now prevail. It has been predicted that there will not be any substantial declines in price in the near future in view of the approach of cold weather, which ordinarily causes interference with production.

Antimony

In the early part of the month there was considerable profit-taking on the part of dealers in antimony who undersold the import prices of 10½c. for Cookson's, 10c. for Haslett's, and 9½c. for Chinese and Hungarian grades. The re-sale prices were from ⅛ to ¼c. lower. Toward the end of the month prices were still lower for re-sale lots, and those quoted were: 10⅛c. for Cookson's, 9½ to 9¾c. for Hallett's, and 9 to 9¼ for Chinese and Hungarian.

Aluminum

The market for this metal has been firm throughout the month, and because of the inability of large interests to supply the metal for early delivery considerable foreign aluminum has found a market at good prices. In fact, aluminum has been much inquired about, both in ingot and product form. A representative of a leading interest said recently that his company was as busy as it cared to be. The statement is borne out by inquiries from consumers as to where the metal can be procured. Vast quantities of it are going into cooking utensils, of which the sale is being pushed, while the automobile industry is a great consumer. Prompt delivery aluminum is quoted at from 26 to 27½ cents.

Discussion

Readers of the MINING AND SCIENTIFIC PRESS are invited to use this department for the discussion of technical and other matters pertaining to mining and metallurgy. The Editor welcomes the expression of views contrary to his own, believing that careful criticism is more valuable than casual compliment. Insertion of any contribution is determined by its probable interest to the readers of this journal.

Sticking to the Job

The Editor:

Sir—It seems to me to be not at all surprising that many mining engineering graduates find other lines of endeavor more attractive, especially when they see nothing better ahead of them than the job of shoving a transit. I am one of the older graduates and can boast of a variety of experience in different kinds of jobs as miner, surveyor, assayer, instructor, superintendent, and consulting engineer, and after some thirty years of observation, I have become impressed with the conviction that the greatest possibilities for the graduate are on the practical end of the mining business. Many are trying it, and some have met with enviable success. It is a tradition established for ages with the average mining captain that "No dam man can show me anything in my mine"; and no matter how many thousands of dollars the engineer sees wasted in a year underground, any suggestion which he may make for improvement is met with the declaration, "It can't be done." Some engineers complain that no suggestion is given any attention, especially on the part of the directors, unless it comes through the man underground. Then why not become the man underground yourself, if you are strong enough to stand it? And if you are not strong enough or willing to stand it, the other fellow will certainly have the advantage. There may be some danger if you stick to a job too long that the job may stick to you.

CILMINEER.

Houghton, Michigan, November 18.

The Editor:

Sir—The illustrated joke on 'sticking to the job,' in your issue of October 19, is humorous and worthy of a smile, but, like most jokes, should not be taken too seriously, as 'Sonorense' appears to have done in his communication to you in your issue of November 9. 'Sticking to the job' has more significance than most young men appear to realize. On leaving the college with his diploma in his trunk, he may think that his days of study are a thing of the past, whereas the exact opposite is the fact. He must stick to his studying. The man who expects to succeed as a mining engineer must be willing to stick to his present job until a better is offered; he must be willing to spend ten or twelve hours in his employer's work, and then two or three hours in studying the mining magazines and latest books on mining, thus keeping abreast of the times on the best practice of mining all over the world. Unless he is willing to do this he had better choose some other vocation. There is room at the top, but this applies only to the man who succeeds. It avails nothing for a man to declare that he is 'unlucky' or that he has no 'pull.' He will probably have to suffer many hard knocks, and see many men moved ahead of him, but if he be a good student, a hard worker, and perseveres to the end, the chances are very much in favor of success being his portion.

S. F. S.

Charcas, S. L. P., Mexico, November 15.

Mining Conditions in Antioquia, Colombia

The Editor:

Sir—My attention has recently been called to a letter published in your issue of October 26, 1912, signed by Louis L. Maire, on 'Mining Conditions in Antioquia, Colombia.' Mr. Maire's letter is apt to give a decidedly erroneous impression of mining conditions in Colombia, and he indulges in exaggerations which are at variance with the experience of others in that country. Mr. Maire states "Antioquia is undoubtedly a rich country in minerals. Most of the streams carry gold in quantity that in California would be considered profitable to work." He then goes on, however, to exaggerate the difficulties naturally encountered in a new and undeveloped country, but ignores the fact that several million dollars of gold are being annually extracted from Antioquia mines, and that while there are several important enterprises, a very considerable part of this production comes from mining on a small and primitive scale.

But the most misleading statement is that "clear titles to property are almost impossible to secure." This is, of course, rank nonsense. Nor is it any trouble to denounce and secure adjudication of a mine. I have now in my office under examination several titles of mines in Antioquia, which were discovered and located (by giving a preliminary *aviso* to the Alcalde or Mayor) on January 31, denouncement before the Governor of the Department made in February, possession given by the Government in July, and the definite title issued on October 30 of the same year. All these proceedings were taken by Americans.

The fees are very small; the denouncement fee for a gold or silver, quartz or placer mine being 50c. and the fee for title being only $4 plus a few sheets of stamped paper. The only parts of the proceedings which involve any expense at all are the possession proceedings, when the expenses of transportation of the Alcalde or Inspector of Police and his secretary have to be paid. Even the fees of the surveyor are low, and the annual taxes are extremely moderate, being $1 per year for each claim. The size of a placer claim is 2 by 5 kilometres, and a vein mine consists of three pertenencias.

I have known prospectors to travel and discover good mining property at an expense of $75 per month, so that when Mr. Maire says "the cost of living is extremely high and traveling costs a small fortune," he is wide of the mark. Of course, if the prospector is of the silk-stocking type and desires an abundance of imported luxuries, he will have to pay accordingly. I do, however, agree with Mr. Maire that Colombia is not a poor man's mining country. Only scientific prospecting and development on a comparatively large scale, say, $25,000 up, will pay the American who has a higher standard of living than the native, but for the miner with some capital or backing and for the capitalist, Colombia today seems to offer one of the best fields in the world.

P. J. EDER.

New York, November 18.

The Measure of Precision

The Editor:

Sir—Having much appreciated the sound common-sense paper of F. P. Rolfe, I was very sorry to see the impolite treatment given that gentleman by the *Mining and Scientific Press* in the issue of June 22. Mr. Rolfe's answer in your issue of October 12 again reminds me of the subject.

In making a measurement of width on a lode, one naturally takes it as nearly as it would seem practical, under average conditions, to work it. As Mr. Rolfe says, "lode-widths are usually measured to the nearest inch." As a matter of fact, those who live around mines come to realize that miners never break ground to the nearest inch. It is often impossible to say exactly where the wall or limit of the ore is to two or three inches. The sampler gets into a habit of taking each measurement in about the same way, which will not usually coincide with the way the ore is mined to within an inch or two. In other words, he makes a constant error. In his 'Principles of Mining,' H. C. Hoover puts this constant error at 10% for sampling the average mine by assays. Most mining engineers will agree that the constant error in measuring the width of a vein is more than one inch. Quoting Mr. Rolfe's article, therefore, "it is mathematically incorrect to calculate the average width to anything less than a whole inch." "The writer has not been able to find this principle definitely stated as a law in a mathematical textbook, but it would appear only a matter of common-sense that, in determining the mean of a number

of quantities, the result should be expressed to the same degree of accuracy as that observed in *measuring* the several quantities." This is true wherever there is a constant error, and while it is true that all measurements should be made, and are made by all practical people, to within the limits of the constant error, Mr. Rolfe's statement will follow.

I venture to suggest, Mr. Editor, that when you were writing you had before you the article by H. S. Munroe, which you published two weeks afterward in your issue of July 6. Now it happens that Mr. Munroe was not talking about the accuracy required in taking measurements, but about the accuracy of a mean of several possible measurements as being representative of the mean of an infinite number of quantities which it would be impossible to measure.

To illustrate the difference, suppose two measurements are made of a lode, one 6 ft. and the other 10 ft. The mean is 8 ft. If each measurement is made to the nearest inch, we may say that the mean of the two quantities is 8 ft. to the nearest inch. It is very improbable, however, that the lode will actually average 8 ft. to the nearest inch when it is mined. Applying the formula you quote, the mean probable error is over 16 inches, which is a very much greater quantity than the one inch which represents the accuracy to which the measurements were taken. It is also more "than the difference between tweedledum and tweedledee."

I think the *Mining and Scientific Press* should realize that some of the best of us are apt to have weak spots in our training, and that therefore we should refrain from using such terms as "nonsensical flapdoodle" when we happen to find some one else's soft spot. I do not refer only to the one article, but I take this opportunity here where the spot really happened to be hard enough to strike fire.

The formulæ quoted by Mr. Munroe and used by Mr. Garthwaite are not applicable to the use to which they put it; that is to say, to the general sampling of a mine. It must be evident that if, by extremely close sampling, the absolute average of the surface exposed in the drifts and raises of a mine were known, it would not be equivalent to the average of the material when mined. As a matter of fact, the subject does not admit of any exact mathematical treatment, but requires the application of ordinary common-sense to the deduction of approximate working methods.

In an article written about ten years ago and republished in T. A. Rickard's 'Sampling and Estimation of Ore in a Mine,' I gave a practical method of determining the mean probable error. It is based on dividing the blocks of ore into parcels, each of which is as compact a figure as possible; that is, not a long thin figure. A square block like that illustrated in Fig. 1 may thus be

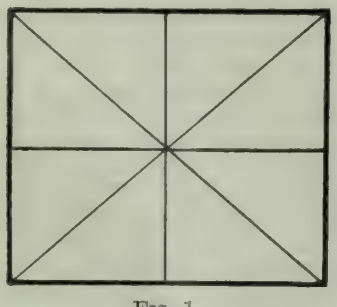


FIG. 1.

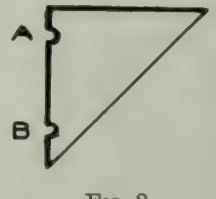


FIG. 2.

divided into eight right-angle triangles. Then one side only of each triangle is a sampling face.

Suppose now that, in Fig. 2, which is one of the triangular packages, samples are taken at *A* and *B*, two points which are near two corners of the triangle. We presume that the average of these two samples represents the face to a little greater degree of accuracy than the average of the whole face would represent the whole triangle. This is a fair common-sense assumption. The mean probable error (according to the formulæ quoted by Mr. Munroe) is given by the deviation of either of the two samples from their mean, multiplied by a constant (which under certain assumptions is 0.6745). We therefore take half the deviation of either of the two samples from their mean to be approximately the mean probable error of sampling the triangle. It is not intended that only two samples should be taken on each triangular face. It is evidently better to take more than two, but the mean probable error must not be thereby decreased, as it would be by the formulæ used by Mr. Munroe. It must still remain the average of all the deviations of the samples from their mean; namely, $\frac{d_1 + d_2 + d_3 + \ldots d_n}{n}$ where d is, as before, the difference between each sample and the average of them all, and n is the number of samples. The mean probable error thus estimated is not reduced to zero by taking an infinite number of samples along the face, as it is by the formula which you quote.

I am not presuming that the mean probable error is not reduced by taking a number of packages; that is, compact triangles. In fact, my article in 'Sampling and Estimation of Ore in a Mine' was intended to show this as much as anything. When all the triangular packages in a mine have been combined, however, my method shows that there is a much greater probable error than that given by the probability formulæ quoted by Mr. Munroe.

BLAMEY STEVENS.

Temascaltepec, Mexico, October 26.

[Mr. Stevens, like Mr. Rolfe, is apparently led into error by failing to distinguish between the physical operation of measuring the width of a vein, which is subject to a variety of experimental errors, and the mathematical operation of determining the average of a series of measurements, a process which is subject to a rigid and exact analysis. He further compounds this confusion by introducing such factors as the practicable stoping width of a vein, and the error in sampling, which leads to much the same result as though a biologist, in endeavoring to make out the details of muscular structure, were to put a whole quarter of beef in the field of his microscope. Correct conclusions concerning mathematical problems can only be attained by careful analysis of the problem, and can only be clearly expressed by precise use of language.

Mr. Rolfe's statement, which Mr. Stevens quoted, is a perfectly general one in regard to the average of the mean of several measured quantities, and contains no qualifying statement as to constant, or other, errors. Applying this general statement to the measurement of the width of a vein is to say that the average of a series of measurements of the width no more closely approximates the true width than does a single measurement. With one who does not see the fallacy of such a statement discussion is surely useless, since logic is futile. Such a statement made before a mathematical society would have provoked comment beside which our characterization of it would seem almost Chesterfieldian.

Not improbably, however, both our correspondents are endeavoring to indicate that though the measurements are taken to the nearest inch, they are in reality nowhere near so accurate and it is, therefore, permissible and desirable to express the average only to the same degree of precision as the original measurements apparently possessed. Following a similar line of thought, students in assaying were formerly taught that it is unnecesary to weigh the fluxes used in assaying, since it is necessary, in any case, to estimate the amount required. Generalization concerning such compounding of approximations is impossible. Estimating the quantity of flux required is certainly convenient, and is often safe, especially if the operator is experienced. It is, on the other hand, apt to lead to serious errors at times. Similarly, if the accuracy of measurement of a variable quantity is low, if the number of measurements is too few to give a true average, or if a constant error is involved, then it may be justifiable and desirable to

arbitrarily modify the results obtained by ordinary mathematical processes. This, however, is an experimental detail and is aside from the topic under discussion. To repeat, the measurement of the width of a vein is a physical operation, limited and governed by a great number of experimental conditions. The determination of the average of a series of measurements is a mathematical process, of which the principles are as immutable as the laws of the Medes and Persians. Mr. Rolfe, Mr. Munroe, and ourselves were all discussing the accuracy of the mean of several measurements, if the English language can be taken at its face value. Mr. Stevens is discussing the measurement of the width of a vein. To take up the rest of Mr. Stevens' interesting letter in detail would both require too much space and take us too far afield. Two points, however, require attention. The statement that the average of two measurements, one being 6 ft. and the other 10 ft., and both accurate to the nearest inch, is 8 ft. to the nearest inch, involves the assumption that the vein increases uniformly in width from the 6-ft. point to the 10-ft. point. If no assumption is made as to the vein (which may pinch to less than 1 ft. between these two points), the probable error is a little over 16 in. Finally, in regard to the probable error as computed by Mr. Stevens, it surely must be unnecessary to point out the error of his statement that $\frac{d_1 + d_2 + d_3 + \ldots d_n}{n}$ does not have a value of zero when n becomes infinitely great.—EDITOR.]

California Miners' Opportunities at the Panama-Pacific Exposition

The Editor:

Sir—Probably the most important business which the California Miners' Association will transact during its convention in San Francisco, December 9 to 12, will be the serious consideration of tentative plans relating to the scope and character of California's exhibit of mining and metallurgy at the Panama-Pacific Exposition. It will lie largely with this representative body of practical men whose technical knowledge and wide experience have made these industries all that they are today to urge the early initiation of the work that must be done before 1915 in making California's exhibit of its mineral wealth a worthy representation of the progress of the Golden State. Many members of this Association have expressed themselves to me as strongly favoring the adoption of a definite policy on the part of the California Miners to coöperate with the Exposition authorities in making the mining and metallurgical exhibit of this state unique and the most comprehensive of its kind in the history of world's fairs. There is no reason why this ambitious program should not be accomplished.

We've got the men,
We've got the mines,
We've got the money, too.

The experience of Frederick J. V. Skiff, director-in-chief of the Panama-Pacific Exposition, as the director of the exhibit of mines and metallurgy at the Columbian Exposition, and as director of exhibits at the St. Louis Fair, has specially fitted him to supervise the planning and installation of such a display as the California mining industry deserves.

A golden opportunity presents itself to the mining men of this state to show to the world how wide is the range of its mineral wealth, and how rich are the rewards of those who exploit its resources. Beyond all doubt the California mining exhibit could be made one of the star attractions of the Exposition. The whole world associates the very name of California with that alluring word, gold. Every visitor will be drawn by every instinct of curiosity and every impulse of sentiment to see what California will have to show the world in its display of the historic features and the technical and economic progress of its most famous industry. Our guests will not be satisfied with a hurried hodge-podge of ore and machinery, all too obviously advertising the private interests of favored firms or corporations. They will expect to see a faithful reproduction of the development of mining and metallurgical methods from the days of '49 to the dredges and stamp-mills of 1915. In its entirety, the impression of the immense mineral wealth of this state must be as inspiring a spectacle as the panorama of the Panama canal itself. In fact, even this colossal enterprise does not represent a much greater excavation of rock and earth than has been dug and blasted and hydraulicked from the flanks of our Sierra Nevada. Well may the miners of California boast of the proud fact that the pioneers and their successors have produced enough gold to pay five-fold the cost of constructing the Panama canal. It is fitting that an area be reserved commensurate with the achievements of California miners, not only in regard to their services to the state and nation, but to the world.

Because of the exigencies of spaces, California's exhibits have heretofore occupied a more restricted area than will be necessary at our great fair. Its display at the Louisiana Purchase Exposition at St. Louis in 1904 covered a space of 43 by 103 ft. But between Harbor View and Golden Gate park there will be no excuse for crowding. California miners have now the opportunity to reserve a piece of ground of sufficient size to do some justice to the wonderful mining possibilities and realities of this state. Indeed, there are many good reasons why California's mining exhibition should be shown to be in every sense in a class by itself. A separate building constructed upon the Spanish mission plan with spacious patios would be most attractive in its exterior and interior. California granite, marble, sandstone, slate, terra-cotta, brick, and other building materials should compose its structure. Perhaps its steel frame could be put together with every girder and every bolt the product of California iron ores. Within its walls ores, oils, and other mineral products would be displayed. Models would show the operations of mining and metallurgical work. Photographs and moving-pictures should give a vivid portrayal of the different phases of the mining industry from its early stages to the present time. There will be unlimited opportunities for the mining counties of California to vie with one another in the presentation of interesting films depicting the discovery and development of their mineral deposits. Then there may be most effective ways of arranging arrastres, rockers, long-toms, Mexican ladders, and other primitive appliances so as to contrast strikingly with the improvements of today.

But one roof cannot house the ensemble of California's display. The long and rainless summer season at San Francisco will permit open-air features such as have never been possible elsewhere. This favorable condition will enable us to present a most graphic representation of the mineral resources of California and their exploitation. It will be necessary and practicable to select a site, preferably upon a steep slope, where the various mining ventures so successfully operated in California may be arrayed, *en echelon,* one feature rising above the other.

The whole plan might be a reproduction of a cross-section of the Sierra Nevada, contiguous to the Mother Lode. On a flat space in the foreground a modern dredge could be shown at work. Above it would lie two low foothills, between the contour of which might appear placer-mining scenes. Prospectors, either in the flesh or in the form of wax dummies, could be seen at work with pick, shovel, and pan. Periodically they would strike 'pay-dirt.' Then the varied conditions of gravel-mining should be reproduced in their logical succession. Rockers, sluice-boxes, wheelbarrows, buckets, and windlasses would be followed by hydraulic mining on a more or less comprehensive scale. Old river channels would then be revealed on the ridges, and there drift-mining would be duplicated. All the dynamic geology of the erosion of auriferous strata and the concentration of 'pay-streaks' in the beds of ancient and modern streams could be shown at low cost.

Elsewhere a miniature of the Mother Lode might appear. Silhouetted conspicuously against the sky-line would stand the 'gallows-frames' where hoists would lift skips laden with quartz apparently from the depths of the earth. The familiar adits and shafts could be made as natural

as in real life. Mules and men and Lilliputian locomotives would emerge from the mouths of adits drawing tram-cars laden with ore. The methods of shaft-sinking, stoping, mine-timbering, drilling by single or double hand, as well as by modern machines, should all be shown. Systems of supplying pure air to miners and the newer arrangements for promoting their safety should also be represented. In the background above this section of the Mother Lode a panorama effect of the High Sierra should tower. These snowy peaks would indicate the inexhaustible wealth of water and power representing the power of millions of horses waiting to be harnessed.

Another terrace could show the course of the canyon of the Sacramento through the famous copper belt of Shasta county, with the great white dome of Shasta looming majestically over the scene. There the copper ores could be shown on the successive stages of their journey from the mine to pure metal. Smelting plants would produce matte and blister copper, while electrolytic refineries would turn out salmon-red cathodes and ingots. Other features of mining work could be shown in a highly instructive manner. Steam-shovels burrowing busily, aerial tramways transporting ore across canyons, hydraulic elevators rattling away with their floods of muddy water and gravel, belt conveyors, and other ingenious labor-saving devices in vogue in California could be shown in operation.

Metallurgical Methods

The plan of the terrace effects would be particularly advantageous in arranging the metallurgical exhibits of California, as it would be convenient to bring the ores by gravity to the mills and reduction works. As the gold-bearing quartz is trammed or hoisted from the levels of the model mine it should be conveyed to the grizzlies and rock-crushers in sufficient quantities to keep a 5-stamp mill running throughout the Exposition. Visitors could be given a vivid impression of the way the gold is won from the rock by watching the automatic feeders shake the crushed ore down into the mortars where the dropping stamps would crush it to pulp. The process of amalgamation upon the silvered plates would be interesting, while the clean-up and retorting of the cheesy balls of amalgam would be fascinating. Then the motions of the concentrators and the various styles of vanners would exhibit another phase of the recovery of gold and silver. The roasting and chlorination of sulphides would follow in the natural order. Tailing would be transferred to a series of cyanide vats, where the leaching and newer agitation methods would be shown, together with the ultimate precipitation of the gold in the zinc-boxes, or by its recovery by electro-deposition.

Other metallurgical methods employed in California would be interesting. The smelting of ores will be most instructive. As an unique feature of metallurgical work in this state, it will be especially desirable for the Government to coöperate with the California Miners by giving an exhibition of its up-to-date electrolytic bullion refinery now being operated in the San Francisco Mint. A number of prominent mining men believe that at least a thousand tons of auriferous quartz could be run through a mill at the fair, the proceeds of the clean-ups covering the expenses of operation. The mining of other minerals and the refining of their products would illustrate the wide range of the mineral industry in California. Crude borax could be hauled from a miniature Death Valley and purified. Salt and the recovery of alkaline compounds would likewise be all part of California's great show. Of economic importance second only to gold, would be the oil exhibit. Models would show the occurrence of oil in porous strata, the methods of drilling for it, and the derricks. Illustrations of gushers will tell the story of many millions of dollars a year derived from this source. Then the storage of petroleum, its transportation by cars and pipe-lines, and its final distillation and separation at the refineries, in so far as the details may be made public by the refining companies, would be a valuable feature of California's mineral exhibit.

Economic Importance of the Exhibit

The men who will be chosen to plan and install California's great mining exhibit must not only be practical miners and metallurgists, but they should possess powers of imagination which will enable them to exercise artistic taste and to evince a sense of the esthetic in evolving the details of this display. No mining district in all the world has had so romantic a history. Its retrospect should inspire California Miners to make the most of their opportunities to set forth the daring deeds of the Argonauts, and the achievements of the two generations that have kept up their good work.

When one considers the cost of making so elaborate a display, the transient nature of its glory is an apparent factor. Great as is its educational value, all will agree that practical results must be later accomplished. The fundamental purpose of exhibiting the multifarious phases of the mining and metallurgical industry of California is to promote the material welfare of the state. Each exhibit should represent most clearly just what is being done by our miners, and what may be accomplished by those who will follow their example by investigating the rich mineral resources within our borders. With each stage of mining operations there should be shown certified cost-sheets, giving in detail the expense of taking rock out of the ground and of extracting its content of the various metals and products. Each stage from stoping ore to stamping bullion, together with overhead and incidental charges, should be shown on the debit side. To the credit of the mines would appear the receipts from the bullion and mineral products sold. Thus each exhibit of the mining, metallurgical, and oil industries would have a more practical interest to the visitor by showing the economics of their operation on a commercial scale.

All mining men who saw the California mining exhibit at the Midwinter Fair in San Francisco in 1894 will recall the lasting impression it made upon all who beheld its many interesting features. Although we do not regard our little local fair as in the class of the Columbian or Louisiana Purchase Expositions, there was much merit in this endeavor of energetic and public-spirited Californians. How much this exhibit of mining and metallurgical activities of nearly nineteen years ago really helped these industries it is impossible to estimate. But all mining men who have with broader vision watched the remarkable development of the mineral wealth of this state since then now fully realize that the cost of this exhibition in the Midwinter Fair was returned many times over in the influx of capital which followed. Today there are vast riches in the mineral districts of California awaiting the investment of capital which will surely be attracted to this state if the demonstration of the results being obtained by our producing mines are properly displayed by capable men.

Harold French.

Berkeley, California, November 27.

Placer mining has been carried on continuously in the Bonnifield region of Alaska since 1903, and although the production of gold there has never been large, the output has been steady. The inaccessibility of the region and the high cost of transporting supplies to it have prevented the mining of any but the richest ground, but if the proposed Government railroad to the interior by way of Susitna and Nenana valleys should be built, the mining industry would be greatly stimulated. A schist belt, similar to that in which most of the Alaska gold districts occur, crosses the Bonnifield region, so that the geologic conditions are favorable for the discovery of additional gold-placer areas. Veins containing iron sulphide and some gold have also been found, and although these are not now being mined, it is possible that the region may some time support a considerable lode-mining industry.

Nitrate production in Chile for the year ended June 30 amounted to 2,469,000 tons, of which Europe took 1,711,000, United States 503,000, Great Britain 132,000, and all other countries 114,000.

Special Correspondence

BLACK HILLS, SOUTH DAKOTA

REPORT OF MINE INSPECTOR.—DIVIDENDS PAID.—GOLDEN REWARD ROASTING PLANT.

The annual report of R. L. Daugherty, State Mine Inspector, covering the fiscal year ended October 31, has just been issued, and shows the mining industry of the Black Hills to be in a highly prosperous condition. The gold production is greater than ever before, and the accidental deaths are only one-half of the smallest number previously reported. With 3000 men at work underground in the Black Hills, there were during the year but 3 deaths from accidents. The report gives the following statistics of production (except the average per ton, which I have calculated):

Name of producer.		Production.	Av. per ton.	Employees.
Homestake	1,529,474	$6,596,000	$4.312	2600
Golden Reward	52,583	323,847	6.158	133
Wasp No. 2	158,840	308,596	1.942	100
Mogul	59,384	242,568	4.085	86
Trojan	62,061	.....	.....	111
Lundberg, Dorr & Wilson	21,264	77,497	3.644	14
New Reliance	12,984	34,268	2.639	32
Victoria	3,347	14,672	4.382	32
Deadwood Standard	3,500	9,382	2.680	28
*Smaller companies and individual shippers	22,236	416,969	.....	642
Placer mining (estimated)	.....	11,800	.....	30
Totals	1,925,673	$8,035,599	$4.166†	3808

*This includes the bullion production of the Trojan, but does not include the employees and tonnage of that company.
†Average.

The Homestake paid $1,310,400 in dividends during the year and the Wasp No. 2 $85,000. Operations by close corporations such as the Trojan, Richmond Operating Co., and Golden Reward, together with Lundberg, Dorr & Wilson, lessees, and individual mine-owners bring the profits of the year to over $1,500,000.

The Homestake operated continuously throughout the year. The most important work was the completion of the Spearfish hydro-electric plant. This, with the Englewood plant, gives the company a total of 5450 hp. There was being used, on October 31, 2850 hp., and the work of changing to electric power about the plant is still in progress. The average stamp-duty at the Homestake for the year was 4.182 tons per stamp per day, for the 1000 stamps for the 366 days of the year, not calculating lost time, which is almost negligible. The Wasp No. 2 makes a big record, when the value of the ore is considered. The Golden Reward is doing important work in erecting a roasting plant. It is the first company of recent years to attempt the roasting of the blue and sulphide ores of the Bald Mountain district as a preliminary to cyaniding. The operation of the plant will be watched with much interest, as its success will mean much to the miners of that district, where there are large quantities of good-grade milling ore that cannot be treated by the methods in use at present.

Among the group of smaller producers mentioned, New Reliance, Victoria, and Deadwood Standard operated only a portion of the year. Lundberg, Dorr & Wilson treated large quantities of custom ore, mainly from the Mogul, after the burning of that company's mill in March last. The figures given represent ores from the Big Bonanza and Buxton mines. Placer-mining shows a small output, and it appears that the dredge at Mystic has not operated with much success. Aside from the precious metal production, the report mentions the sandstone quarries at Hot Springs, which during the year turned out $80,000 of building material, and the United States Gypsum Co., at Rapid City, which operated seven months and produced $31,000 of gypsum products, including stucco and building tile.

BUTTE, MONTANA

LEACHING PROCESSES.—A NEW COMPANY.—ELECTRIFICATION OF RAILROADS.

The much-heralded leaching treatment of chrysocolla in the granite at Butte is likely to prove anything but perfectly plain sailing. In the first place, it has been generally held that chrysocolla is not easily soluble in sulphuric acid solutions of the strength usually considered permissible in leaching practice. Then again, there are iron and calcium minerals in the gangue of the silicate ores which are probably equally as soluble as the copper and which will tend to foul the solutions and probably cause other troubles. But assuming that the copper has been satisfactorily secured in solution as copper sulphate, it is next proposed to precipitate the copper by electrolysis. That this is a possibility is, of course, well known, and that it is done commercially in the electrolytic refining of copper is equally well known. But that it can be carried out profitably on the dilute solutions derived by leaching methods has been heretofore considered impracticable by electro-metallurgists. The stumbling-block, of course, is the resistance of the dilute solutions. It is considered poor practice in an electrolytic copper refinery to permit the copper sulphate solutions to fall below 15%, or the sulphuric acid solution to fall below 6%. When the solutions become weaker than this, the current consumption increases unduly. Some recent experimenters claim to have overcome the various difficulties, and it may be that they will be overcome in practice. However, it is well to call attention to some of the difficulties, in view of the fact that a popular impression is gaining ground that the general methods to be employed are new and especially applicable to the chrysocolla at Butte.

A. B. Wolvin, president of the Butte & Superior Copper Mining Co., has organized the Butte-Duluth Mining Co. to take over the Montgomery, Macarona, and portions of the Altoona, Amazon, and Colleen Bawn mining claims. The property lies east of the East Butte mine and adjoins the claims of the Bullwhacker Copper Co. The ground is believed to contain large bodies of silicious copper ore, which it is proposed to mine by means of steam-shovels. Stripping of the slight overburden is now in progress preparatory to beginning work with the shovel. It is proposed to ship the high-grade ore direct to smelters, but the low-grade ore will be leached on the property. A 500-ton leaching plant is planned, and the construction of the first unit of 100 tons is under way.

Several of the small, irregular producers of the Butte district have sunk shafts to surprising depths, in view of the showings. The Davis-Daly, Raven, Tuolumne, and Butte-Alex Scott companies all have shafts in the neighborhood of 2000 ft. deep, but there is comparatively slight production to show for all this work. So that the popular cry for depth seems, after all, not to be the panacea for every failure to produce profits.

The proposed hydro-electric power companies' consolidation, discussed in a recent letter, is probably a preliminary step in the long-talked-of electrification of the transconti-

nental railways in their steep hauls over the mountains. The Butte, Anaconda & Pacific railway expects to use 8000 hp. for its line between Butte and Anaconda, and it is now announced that the Chicago, Milwaukee & Puget Sound railway is considering the electrification of its line over the Continental divide, and possibly also the Belt mountains divide and the Coeur d'Alene mountains divide. From 16,000 to 20,000 hp. would be required for these purposes. If the railways begin using electric power, Montana water-power will be rapidly developed and utilized.

JOPLIN, MISSOURI

NEW MILLS AT MIAMI.—FEDERAL LEAD CO. ENTERS DISTRICT.—NEW FIELD IN OKLAHOMA.

At Miami, Oklahoma, four mills are being built. They are the Mizpah, the Cactus, the Chapman & Lennan, and the Prairie. Within a week or two work is to start on the Carson & Dodson mill. Each of these plants has a capacity of 250 tons; they are modern in design and should add greatly to the output of concentrate from the district. Gas-engines are used in each mill, and air-compressors are employed for operating the drills. New development down to 324 ft. shows ore, a slanting zone having been reached which is touched at comparatively shallow levels in the eastern part of the district but which dips steeply to the west. Because of the heavy volume of water in the lower ground pumping operations have lowered the water only to the 224-ft. level. In the deep workings lead ore is especially abundant, often equaling the average zincblende in alluvial. Any one of these mills in the ordinary district would show a capacity of 350 tons, but due to the complex character of the Miami ores more careful milling is necessary. The initial grinding is to ⅜ in. instead of ½ in. as is the practice in other districts.

Development on an extensive scale has been started by the Federal Lead Co., one of the largest lead-mining concerns in the Flat River district of eastern Missouri. The advent of this big company in southwestern Missouri means much to the Joplin district. Following an extensive drilling campaign southwest of Prosperity, shaft-sinking has started. Thin sheet ore, 2½% zincblende and 1% lead, has been found. It is similar to the sheet ore of the other big mines of that district. The Federal company has also found a deeper run of ore, at 230 ft., on the old Troup farm, south of Webb City, and shafts will be sunk. Former development on this land, which resulted in a heavy output of ore, was conducted at much shallower levels.

A separate plant for the treatment of sand and slime is being constructed at the Coahuila Mining Co. property at Duenweg, and all the old tables will be removed and replaced by new tables in the new plant. The new plant is of steel and concrete, and contains eight sludge tables in addition to the classifiers, settling-tanks, and other machinery necessary to treat the ore in the best manner. Recovery of the fine is growing to be recognized as an important factor in local milling practice.

Northwest of Lincolnville, Oklahoma, a new zinc and lead field is being opened. The nearest mines are those of the north Miami field, 2½ miles to the south. Prospecting with churn-drills has been going on in this isolated region for a number of months, but little news of the important discoveries that have been made has leaked out. Following strikes in several drill-holes, a number of shafts are being sunk. The region lies in a rolling prairie country that is celebrated because of its luxuriant crops of timothy hay. Shafts are now being sunk by J. O. Goodwin and J. M. Cooper, of Baxter Springs, Kansas; Ward and McReur, of Kansas City and King Springs, Missouri; Beck & Co., of Joplin; Price & Co., of Joplin; Mark Hall, of Joplin; E. H. Evans, of Onawa, Iowa; George Meece and William Waugh, of Joplin; and a number of other companies. Zinc and lead ores, sometimes occurring in rich pockets, but more often found in thin disseminated ground, are found at a depth of 155 ft., continuing down to 165 ft. and sometimes reaching to 185 feet.

A siphon system of draining the drifts of the Chapman & Lennan mine at Galena, Kansas, is interesting in that it has reduced pumping expense to a minimum. There is, in fact, no expense in keeping the siphon system in operation. The siphon is in the workings of the old Prudential land, recently taken over by Chapman & Lennan. A big area of old ground has been developed, but does not drain to the pump-shaft owing to intervening ridges of ground, representing the barren streaks in the old ore pockets. Formerly a 10-hp. motor was employed to lift the water over one of these intervening walls, and this necessitated a big expense. Since the laying of a 2-in. siphon pipe the motor has been taken out. The pipe was laid from the water-filled drift over the obstruction and with a 20-ft. fall there was suction enough to keep the water going after the pipes were once full and the stream started.

SALT LAKE CITY, UTAH

ACTIVITY AT ALTA.—WALL ROLLS DISCARDED.—FUTURE OF SOUTH UTAH.

Alta is the scene of increased activity, despite the fact that winter always finds it snowbound. The most important event has been the announcement of an extensive campaign of deep development by the Michigan-Utah. This company, which is a consolidation of several properties, has developed several good bodies of ore above the level of the Solitude adit, which reaches about 800 ft. under the mountain, but the consensus of opinion of several engineers who have been making thorough examinations is that deep development is the proper policy, especially with a view to finding a continuation of the old Emma ore-zone. The company has ample funds for a thorough campaign. The $200,000 bond issue has been paid off, and money for exhaustive work has been provided by new interests which have entered the company, headed by the Boston firm of Hornblower & Weeks. At the same time negotiations are in progress looking toward a consolidation of the Flagstaff, Columbus, and Columbus Extension properties to drive a long adit to drain and develop these mines at depth. One of the greatest handicaps of the district for years has been the heavy flow of water, which has prevented deep development until consolidation and strong financing made long drainage adits possible.

D. C. Jackling, president of the Utah Copper Co., announces that the property is again producing the normal amount of ore for the first time since the strike was declared. The mine is sending out 20,000 tons per day, which is the highest point ever reached. The other mines are in operation, but they have not yet fully reached normal. The Utah Copper, which employs largely unskilled labor, has found it easier to get men than the underground mines, which must recruit their forces with skilled miners. Steady progress is being made, however, although it may be some time before all the mines have full crews. Following the visit of Martin Miles, of London, representing English stockholders, the New Utah-Bingham is resuming work. The company has been reorganized and funds provided for further development. Ohio Copper has abandoned the Wall rolls and will replace them with other crushing machinery. The company has increased its production to between 1800 and 2000 tons per day and is planning to enlarge the mill to handle 3000 tons. The Utah Metal Mining Co. has not resumed operations since the strike, but the announcement is made that it will start soon, and that the long bore will be completed some time next spring. There is still about 1300 ft. of work to be done to complete the task of running under the mountain from the Bingham to the Tooele side, and provide means of transportation to the Tooele smelter, as well as facilities for deep development of many of the Bingham mines.

The International Smelting & Refining Co. has not yet resumed operations in the copper smelter, closed as a result of the Bingham strike, but has two of its lead stacks operating steadily. It is stated that the other two

stacks will be ready in January, and that ore is available to keep them all going. Local shareholders are debating seriously over the future of South Utah, which has just issued a report showing a net loss for the year ended June 30, 1912, amounting to $31,114. This is the old Cactus mine, reorganized as the Newhouse Mines & Smelters Corporation, and again reorganized as the South Utah. Salt Lake people bought heavily of Newhouse stock on 'inside' information when the shares were quoted around their highest point, and many of them have stuck with it in the hope that a profitable mine would yet be developed. The report shows that the ore contains 1 to 1.6% copper, but is so scattered and the difficulties in milling are so great that the cost of producing copper reached 15½c. per pound. The company secured an average price of 13.45c. per pound. The optimistic hope that high copper prices may enable the company to keep going and possibly develop new orebodies. Meanwhile, plans are being made to use a portion of the mill to treat the lead-zinc ores from the neighboring Horn Silver mine. Another mine which is confessedly on the ragged edge, but which is showing surprising vitality, is the old Consolidated Mercur. The annual report shows net operating earnings of $10,797, with dead work done amounting to $17,498. The company will keep on work, continually looking for new ore, so long as it can break even.

JOHANNESBURG, TRANSVAAL

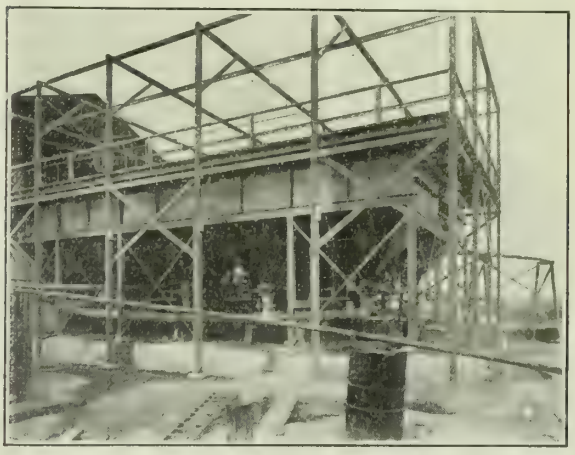
Optimism in Rand Journalism.—What the Mines Show.

The articles by T. A. Rickard, 'Persistence of Ore in Depth,' appearing in the *Mining and Scientific Press* August 24 and August 31, have attracted some attention here, more particularly where the East Rand Proprietary property comes in for attention. The local technical journal does not seem pleased with being charged with avoiding giving publicity to Mr. Hellmann's testimony as to the impoverishment of the Rand banket ores in depth, but perhaps your contributor does not know that, apart from the policy of the local technical journal being not to decry the Rand or draw attention to its shortcomings, its aim is rather to please the mining groups and one group in particular, than circulate the whole truth about local mining affairs. Every paper of any influence on the Rand is expected to pursue the same course; the local mining journal is not the only one pursuing this policy, and therefore is to be equally blamed with the rest, the only explanation being, perhaps, that "needs must where the devil drives."

There are, however, when all is said and done, few mining fields in the world where the veins are so persistent in depth as on the Rand. What makes their persistence perhaps most remarkable is the fact that they are conglomerates, naturally the most uncertain of any of the sedimentary rocks. That these conglomerate reefs maintain their value in depth is, however, quite another matter; the bulk of the reliable evidence available on the Rand being that gold content has declined in depth. It is scarcely correct to say that in every case the gold content has decreased, but there are certainly six reliable decreases to one reliable improvement.

Starting on the Western Rand, no mine, perhaps, has suffered through falling grade as much as Randfontein Estates. The Champ d'Or outcrop mine always was a profitable one, while its deep-level relation is closed down because it was unprofitable. The same, but less striking, state of affairs exists between Vogelstruis Estate and Vogelstruis Deeps, but the conditions are reversed at the Main Reef West, which recovers 31s. per ton as compared with 27s. for its neighbors at the outcrop, the Aurora West and New Unified mines. The next reliable instance may be found in that the Robinson and Ferreira mines recover 40s. per ton, while the Robinson Deep has to be satisfied with 32s. per ton. The Village Main also recovers about 40s. per ton, while its neighbor to the dip obtains but 30s. per ton.

Much has been said about the City Deep being an exception to the rule, for here the recovery averages 36s. 6d. as against an average of 32s. 5d. among its four outcrop neighbors. But in every other instance going east, the gold recovery has consistently decreased with depth, the present recovery of 28s. 6d. per ton at the Geldenhuis Deep being represented by 21s. 6d., the average recovery of the Jupiter mine, now the deepest gold mine in the world. Then comes Simmer & Jack with 22s. 9d. per ton recovery, as compared with 16s. 10d. for the Simmer Deep; while if the gold recovered at Brakpan, 32s. 6d. per ton, is compared with that at Benoni, New Kleinfontein, and New Modderfontein, 34s. per ton, it will be seen that even the celebrated Brakpan mine barely holds its own with the average of the outcrop mines in the matter of the grade of ore sent to the mill. It will therefore be seen that out of twelve reliable instances extending over a length of fifty miles on the Rand, only two instances of an improved yield in depth can be quoted, and in these instances the improvement is about a pennyweight per ton. It is, of course, impossible to predict at what depths mining on the Rand will become unprofitable, since as much depends upon working costs as upon gold content; but the Simmer Deep, with a gold recovery of 16s. 10d. per ton and working cost of 15s. 9d., although fully developed and in full swing, has not succeeded in paying a



FILTER PLANT, CROWN MINES.

dividend. A similar state of affairs exists at the Jupiter mine, with a gold recovery of 21s. 6d. and working cost of 19s. 9d. But these two mines are situated in notoriously low-grade areas and afford no indication of the depth at which the other mines may be placed in a similar position.

BOSTON

Dow Troubles.—Nevada-Douglas Dividend.—Lawson at it Again.

The aftermath of the Dow troubles is being looked after by degrees in Boston, and it is apparent that every effort will be made to have the companies formerly sponsored by Dow placed on a clean, strong basis. Notices have been mailed to stockholders of the Franklin Mining Co. advising them of a special meeting called for December 18, to take action regarding litigation to be instituted against the former directors arising out of the Dow trouble. The directors have decided, in order to forestall criticism, to have proxies to the meetings run to others than themselves. Accordingly, proxies accompanying the notices run to Herbert M. Leland and Harry M. Stonemetz, members of Stock Exchange firms. Franklin is the only one of the so-called Dow properties which is on a producing basis, and it is believed in Boston that if the difficulties in which Mr. Dow left it can be tided over, it will give a good account of itself.

Stockholders of the Nevada-Douglas Copper Co., at Yerington, have received notice of a dividend declaration of 12½c. per share by the directors, payable February 1, books closing January 10. This is the first dividend to come from the Yerington, or Mason, district, but will be

followed by one from the Mason Valley Mining Co. in March. The Mason Valley dividend will probably be 50c. per share and will be designated as a quarterly payment. It is not understood that the Nevada-Douglas directors have committed themselves to a quarterly dividend as yet, though stockholders are hoping the company will be able to pay dividends of at least 50c. per year, since $1 per year was freely predicted on copper selling at a lower figure than at present during the promotion period. The Nevada-Douglas dividend declaration was apparently disappointing, as the stock sold off freely immediately following the announcement. With all stock outstanding, the 12½c. dividend calls for a distribution of $125,000. A. J. Orem, the president, reports that the large floating indebtedness which the company had at the beginning of the year has been paid, current expenses met, and money is now accumulating in the treasury. Nevada-Douglas enjoys the unique distinction of having been promoted independently in Boston in the face of the hostility of the Stock Exchange and its official organ.

The present copper movement seems to be so strong that it is even reviving the dead 'wild-cats.' Recently it has been noticed that stock of the Iron Cap Copper Co., of Globe, is very scarce, owing to improved conditions at the property. Recent developments at the Superior & Boston are also helping the Iron Cap. This company will be recognized as the reorganized National Mining Exploration Co., which formerly enjoyed an active market on the Curb and which secured a loan of $100,000 from N. L. Amster some time previous to Mr. Amster's financial difficulties. The National Mining Exploration, now the Iron Cap, adjoins the Arizona Commercial, and it was thought at one time when Arizona Commercial was itself active and strong, that the smaller company would eventually be absorbed by it. Both companies fell on evil days and had to be reorganized, and National Mining Exploration was largely forgotten by traders.

Stockholders of the Bay State Gas Co., which was taken over by Thos. Lawson for the purpose of raising working capital to 'play the market,' will doubtless be glad to hear of Lawson's winnings, as there are nearly 4,000,000 shares of Bay State Gas outstanding, belonging, it is said, to nearly 100,000 people. The sum of $100,000 divided among 4,000,000 shares would mean a dividend of 2½c. per share, or about 10% on the present selling price of Lawson's much touted Bay State Gas or National Stock. On Tuseday November 19, the annual stockholders' meeting of the Bay State Gas Co. was held in Wilmington, Delaware, and the usual Lawson method of holding an annual meeting was gone through with. Lawson himself failed to appear on the scene, as was the case in the Trinity and First National meetings, but sent a representative. In the Bay State Gas meeting his secretary, Mr. McSweeney, represented him. As usual, a brief statement was made vicariously from Lawson and a good deal was said about the exceptional charter which the Bay State Gas Co. holds, this seemingly being the principal and most cherished asset of the company. It was stated that the funds of the company's treasury had been used for speculative purposes. It was admitted that the Government had investigated the company, but had finally given it a clean bill of health. When Mr. McSweeney was asked if Lawson's advertising bills were being paid out of the Bay State Gas treasury funds, he replied in the negative, saying "this was all Mr. Lawson's personal matter."

MELBOURNE, AUSTRALIA

ANOTHER VICTORIAN 'HOPE'.—AN AUSTRALIAN ALASKA GOLD MINES.—LOW WORKING COST.

In Victoria the chief excitement in the mining world during the past three or four weeks has been in connection with a development in the old and long-neglected Beaufort field. In the 50s when gold rushes were more plentiful than strawberries, its alluvial richness attracted a large number of diggers, many of whom made large fortunes. But, its surface wealth exhausted, the district was suffered to sink into the sleepy sadness characteristic of the abandoned mining field, and so it remained until recently a syndicate was formed to endeavor to find a deep channel. Some twenty drill-holes were put down, and eventually a shaft was sunk, which at a depth of 117 ft. was still in wash. As, however, the existence of a deep channel had been demonstrated by drilling, sinking was continued to a depth of 182 ft., and a drift was driven at 175 ft. This drift is now in 235 ft. in workable ground. Several drifts at different levels have developed a block of ground 350 ft. long and 200 ft. wide, from which 164 fathoms of gravel has been taken out, yielding 548 oz. of gold, the gravel treated having ranged in value from 2 to 12 oz. gold per fathom. The width of the channel is not yet determined. This property is known as the Hope. Adjoining it on the west is the West Hope, which has also found, by means of drilling, an auriferous channel, presumably an extension of that in the Hope. The prospects of the Hope and of at least two or three neighboring properties are distinctly favorable. There is no indication of trouble from water, firewood is abundant, and is obtainable delivered at 66c. per ton. It is estimated that a yield of a little over ½ oz. per fathom will clear all expenses, so that, if the average yield of 3⅓ oz. be maintained, there will be an ample margin of profit.

If Victoria has a promising little discovery in an old and long-deserted field, New South Wales has a still more promising one that cannot by any manner of reasoning be described as small. It is also in an area that has been worked for many years, but its delayed development has not been due, as in the case of the Victoria district, to its surface riches being worked out, but to the fact that it has never received fair treatment, having always been worked upon an inadequate scale. The scene of this new-old discovery is Yalwal, some 18 miles west of Nowra, the southern terminus of what is known as the South Coast line, a railway running almost due south from Sydney along the coast. The original discovery was made in 1871, but from then until quite recently it never had a show. It is essentially a large low-grade orebody that requires to be worked upon a tremendous scale, but its occasional enriched areas have simply been picked at here and there on the surface.

The gold occurs mainly as an impregnation in quartzites, slate, and conglomerates, and it is waste of time to attempt to mine the small intersecting quartz veins; the whole material must be extracted and treated if the work is to be done at a profit.' That is what the Yalwal Exploration Syndicate, for whom Ernest W. Spencer, formerly general manager for the Consolidated Gold Mines of New Zealand, has been sampling, surveying, and appraising the field for the past 16 months, is preparing to do. The auriferous zone has hitherto been limited to an area ¾ mile long and ¼ mile wide, being bounded by granite and dolerite. The gold-bearing belt is divided into two parts by a gully, on one side of which the sulphide zone is reached within 70 ft. of the surface, while on the other the oxidation indicates a depth of at least 200 feet.

Costs are not expected to exceed $1.50 per ton, including the treatment of slime, and Mr. Spencer expects to reduce them to $1.20 when a plant for the treatment of from 500 to 700 tons per day has been constructed. In fact, I understand that Mr. Spencer, though with a natural caution he announces that he expects the costs not to work out ultimately at more than $1.20, really anticipates that they will be reduced to considerably less than $1. If so the expected gross content of $2.20 per ton will yield a handsome profit. The latest bulk test of 1300 tons gave by amalgamation and cyanidation about $5.55 per ton with 200 tons of the richer sands still in the vats. The slime is said to contain 40% of the gold, and has not hitherto been treated in any way. Assays show the slime to be quite as rich as the sand. Apparently the vein here is a very big thing; the biggest Australia has had occasion to welcome for many a long day. It is to be hoped that it will come up to expectations.

General Mining News

ALASKA

Juneau

During October the Alaska Mexican 120-stamp mill worked 30.72 days and crushed 19,740 tons of ore, producing $23,326 in free gold and $25,258 from 408 tons of concentrate. The realizable value was $48,584, and net profit $18,959. The average per ton milled was $2.46. Development covered 406 ft., and the stock of broken ore increased 3975 tons.

The Alaska United Ready Bullion and 700-Ft. Claim mills worked 30.48 and 30.60 days, crushing 18,704 and 19,677 tons, respectively, yielding free gold worth $59,302 and $54,514 from 966 tons of concentrate, the total realizable value being $112,677 and net profit $62,018. Development covered 326 and 128 ft., while the stock of broken ore increased 2468 and decreased 1204 tons, respectively.

Nome

Nome will have a greater winter population this year than before. The number of people entering the district for the year to date is 1605, and the number leaving is 1287. Several parties will operate on the beaches and dumps during the winter. About 25 men will remain around Taylor creek and several will take out winter dumps in the Kougarok district.

ARIZONA

Cochise County

A 400-ton smelter, costing about $400,000, is to be built at Douglas for the Shattuck & Arizona mine. Shares of the latter have recently advanced, caused by persistent rumors of a consolidation with Calumet & Arizona which appear to have no foundation.

Gila County

The Gibson continues to make regular shipments of ore to the smelter, and may soon increase its working force. The Castle Dome, six miles west of Miami, is attracting attention. The rock here is mainly granitic, as distinguished from the schist formation of Miami, Inspiration, Live Oak, and other properties. At the South Live Oak drill-hole No. 4 is down 765 ft. in schist. Much caving has hampered drilling operations. At 1246 ft. the Southwestern Miami stopped drilling No. 8 hole. Development at the Superior & Boston has been encouraging of late.

Graham County

During the year ended August 31 the Shannon Copper Co. produced 16,406,336 lb. of copper, 2615 oz. of gold, and 170,695 oz. of silver, worth $2,594,866. Operating costs were $1,678,737; freight, refining, etc., $231,900, leaving gross operating profit of $684,229. Interest, development, and taxes reduced this to $560,614, while other revenue left a surplus of $596,738. Assets include cash, copper, and stores worth $611,725; liabilities include accounts payable, interest on bonds, and taxes, totaling $176,833. Dividend No. 4 absorbed $150,000. The surplus stands at $1,683,180. The net cost of copper, after deducting gold and silver content, was 11.42c. per pound. All departments have shown general improvement in their ability to operate at lower cost. The Shannon-Arizona Railroad Co., a subsidiary of the Shannon Copper Co., earned $15,723 above interest requirements. The latter's fiscal year will be changed to conform to the calendar year.

CALIFORNIA

Amador County

(Special Correspondence.)—At the Hardenburg mine the new 3-compartment shaft is down 1075 ft. A station and 300-ton ore-bin have been cut at the 1000-ft. level, and a cross-cut driven west to the old Hardenburg vein, and a drift is being driven on this vein. The formation is typical of the Mother Lode in this district. The 1000-ft. level gives more backs below the workings of the old mine than can be economically worked from one level, so at 850 ft. another chute and station is being cut out, from which point cross-cutting and driving will be started. A 20-stamp mill, the ironwork of which is being made by Knight & Co., Sutter Creek, is being built, and will be finished in the latter part of January 1913. Power throughout will be electric, supplied by the Pacific Gas & Electric Company.

Jackson, November 25.

Inyo County

During October the mill of the Skidoo Mines Co. crushed 717 tons of ore for the company and 435 tons for lessees, producing bullion worth $15,551, including $3264 from royalties and custom milling. Operating and development costs totaled $5034, leaving a net profit of $10,517 for the month.

Kern County

A rich discovery of gold ore is reported at the Tropico mine, near Rosamond, the next station to Mojave on the Southern Pacific railroad, and 80 miles from Los Angeles by automobile. The mine is in a detached section of the foothills near the Tehachapi range, at an elevation of 2600 ft. A drift, 190 ft. long, has opened ore worth from $5 to $1000 per ton; a winze and raise driven from the drift have returned $560 per ton. Another orebody 15 ft. wide, with high value in gold, has also been opened. The country rocks are rhyolite, dacite, and andesite. The Tropico M. & M. Co. holds a bond and lease on the claims and is composed of Los Angeles men.

The Yellow Aster M. & M. Co. is employing 225 men. A storage tank to hold 500 tons of oil is being built at the southwest end of the glory-hole.

Nevada County

At the 700-ft. level of the Fruitvale mine a station has been cut out and a raise driven to the hanging wall of the vein. Work has been temporarily suspended at the Black Bear claim. Rich ore has been discovered at the True Blue mine.

Plumas County

The Lost Creek district was extensively worked about about 1862, and produced a large amount of gold where 'break-outs' occurred from the gravel channel higher up in the Mooreville ridge. According to gravel miners, the proper channel has never been opened, as a long bedrock adit was necessary to reach it. A company interested with G. Sanborn, manager of the Antlered Crest mines, near La Porte in this country, expects to start work on this long adit this season, using Burleigh drills.

Shasta County

In the president's report to the stockholders in the Northern California Power Co., it is stated that within seven months two of the smelters in the county will resume work. Rate cutting by the Sacramento Valley Power Co. had reduced the Northern company's earnings, and the Sacramento company's entire holdings were purchased for $1,760,500. Gross earnings for the past fiscal year were $706,933. The present load is 34,740 hp., leaving 20,000 hp. installed and ready for delivery as soon as storage is finished. There are at present 7450 customers for power, light, and water.

The large dredge, costing $150,000, belonging to the United States Gold Dredging Co., working between Redding and Middle Creek, sank in the river on November 29. The boat is said to have a weak hull, and this is the second time it has sunk. The machinery will be saved.

Siskiyou County

This county was represented at the American Mining Congress, at Spokane, by gold and quartz specimens worth $12,000, in charge of C. L. Proebstel and L. A. Nash. The exhibit is the property of the county and is displayed at public expense. Large nuggets and pans of coarse gold are in the cases. The county plans to enlarge the exhibit for display at the San Francisco exposition in 1915.

Tuolumne County

The Gold Mountain Water Co. has sold its entire Sonora water system to the Sierra and San Francisco Power Co. for about $40,000. It is intended to thoroughly develop the system, and renew pipes about Sonora.

COLORADO

Clear Creek County

(Special Correspondence.)—The new 10-stamp mill situated near the portal of the Empress adit on Covode mountain will be started within ten days. Ore will be treated from the Pioneer mine. S. L. Work is operating under bond and lease. An important discovery has been made on the Bloom property situated on Democrat mountain. In the breast of the adit a 6-in. streak of polybasite has been found which shows assay values of 179 oz. of silver per ton. Crist & Sons are the owners. Parker & Co., leasing on La Plata mine, have started shipments of ore which bring a settlement of 1320 oz. silver per ton. The vein is 5 in. wide. Ground has been broken for the new mill to be erected at the Pelican mine by the Clifford Exploration Co. The plant will adjoin the Pelican mill and the initial capacity will be 100 tons. Edison concentrating machines will be installed. The Enterprise mine on Douglass mountain is receiving attention. This is a zinc property and a 10-in. orebody is exposed in the breast of the adit. D. M. Titus is owner. E. Wing has taken a lease on a block of ground on the Silver Glance mine on Democrat mountain. Driving has been started on a streak of ore 3 in. wide which is worth 391 oz. silver

MAP OF COLORADO.

per ton. A heavy tonnage of lead and zinc concentrate is being finished at the Scotia mill. Ore is being treated from the Pelican mine, work being done through the Diamond adit. F. Graham is lessee.

Georgetown, November 26.

Gunnison County

At 1300 ft. from the portal of the Copper Mountain adit of the Brant Independent Mining Co., a 2-ft. orebody has been opened. At the time the ore was thought to be 'rosin' zinc, but tests gave no zinc in the ore. Examinations made at the Golden School of Mines and by a specialist at St. Louis proved that the mineral was strontianite.

Lake County (Leadville)

The Arkansas valley plant is blowing in a new furnace, making five in full blast, and all of the roasters are working full time. Car shortage is improving daily. The Balkan war has affected the labor market in Leadville, and the Arkansas plant has difficulty in securing sufficient men. A zinc buyer for one of the largest zinc companies in the United States recently stated in Leadville that there is no question that the day will come when zinc plants will be able to handle 18% ore profitably, but at present all the plants are getting plenty of ore of a good grade and few bother about the low-grade material.

Ouray County

During the past two months several alterations have been made to the mill of the Wanakah Mining Co. A grinding-pan is now used for regrinding tailing. Slime tailing is run over a Deister table, which produces a very clean concentrate. Concentrate is now handled automatically. It is elevated to a sampler, from which it flows to a series of settling-tanks, each holding one carload. When filled, a car is placed opposite the door of a full tank, and the concentrate is allowed to fall into the car. Mr. Moule designed this system and it works well.

Routt County

Final plans have been made for the erection of a 400-ton mill and smelter for the Royal Flush mine at Hahn's Peak. H. O. Granberg, manager for the company, stated that over 10,000 ft. of development has been done, and $200,000 spent in the mine alone. The mill will be situated 2½ miles north of Hahn's Peak, and will be connected with the mine by a tramway 7700 ft. long.

Teller County (Cripple Creek)

The water trouble at the Vindicator and Golden Cycle shafts, at the east side of the district, has now been overcome by the installation of electric pumps in the latter shaft. The water is lifted to the 100-ft. level, and then flows through the Roosevelt tunnel, at a reduced cost compared with steam pumps. The electric pumps consist of two sets of 175-hp., 30-cycle, 2300-volt motors, driving triplex pumps at the 1600-ft. level, each pump lifting 400 gal. per minute. The motors are of the two-speed type. On a 24-hour basis the units will have an 85% load-factor. It is expected that the new pumps will save their cost in 15 months. On November 24 burglars broke into the Wild Horse mill, on Bull hill, and stole precipitate valued at $600 from the zincboxes, and got clear away. They were evidently familiar with the plant.

IDAHO

Blaine County

At the Wilbert mine considerable development is being done, and the large surface orebody has been put in shape for winter work. At present there is a 25-ft. face uncovered. The ore deposits are flat and show layers of ore in which there is some waste mixed. Since the mill started there has been a gradual improvement in the concentrate produced. Three additional concentrating-tables were installed in November which increased saving by over 5%, and when two others are at work extraction will be about 80 per cent.

Shoshone County

(Special Correspondence.)—Drilling and shoveling contests were held during the visit of the American Mining Congress to this district, and proved of interest. In the former, the trial consisted of drilling 15 minutes in hard grano-diorite, using ⅞-in. steel and a 9½-lb. hammer, and was won by Stokes and Germain, who drilled 36$^{9}/_{16}$ in., followed by other teams doing 32⅞, 32½, and 32⅜ inches.

In the shoveling trials, 3 cu. yd. of 1-in. stone and sand had to be shoveled over a 3-ft. wall. This was done in 7 min. 2 sec., 8 min. 15 sec., and 8 min. 20 sec., respectively.

Wardner, November 30.

Development at the Snowstorm Extension group is promising. The adit has been driven 1900 ft., and the face is about 1500 ft. below the surface. One cross-cut has been driven 380 ft. and two others about 30 ft. each. There is plenty of water and timber on the property. The annual meeting of the Black Traveler Mining Co. was held last week at Mullan. The vein has been cut at a depth of 320 ft., and has been opened for 87 ft., showing 18 in. of ore worth from 6.5 to 11.5% of copper and 6 oz. of silver per ton. At the Marsh mine the new owners will spend $50,000 in developing the silver-lead orebodies in the property. New machinery is on the ground. From an orebody on the 800-ft. level 60 tons per day is being produced. The Empire Mining & Development Co. has acquired the King and Wonder claims on Pine creek. High-

grade copper ore has been opened in the 1800-ft. level of the National Copper mine adit, which is 4500 ft. long.

During October the Mammoth mill treated 16,933 tons from the Stewart mine and saved 73.12% of the silver and 84.59% of the lead, the concentration being 8.31 to 1. Mine expenses were: breaking ore, 41c. per ton; tramming, 15c.; gravity tram, 3c.; timbering, 49c.; shoveling 31c.; and other sundry costs bringing the total to $2.14 per ton. Development cost 23c., making mine costs $2.38 per ton. Milling costs totaled 32c. per ton. The month's output was worth $109,540, and net profits were $62,255.

Visitors to the sessions of the American Mining Congress at Spokane visited Wallace on November 30. There was a dinner and entertainment in the evening. On Sunday morning they inspected the large electric hoist at the Hecla mine. From Burke the mining men went to Mullan, and electric trams carried them two miles into the mountain

PART OF IDAHO.

to see the large underground station. The Morning mill was inspected, and the McQuisten tubes seen in operation. Sunday afternoon the visitors spent at Kellogg, where are the Bunker Hill & Sullivan and Federal company's Last Chance mines.

The Federal M. & S. Co.'s net earnings for October were $116,000, as compared with $87,000 in September and $60,000 in August. The company operates the Last Chance mine at Wardner, the Morning at Mullan, and Standard Mammoth at Mace.

MICHIGAN

Houghton County

The Calumet & Hecla Mining Co. has declared a dividend of $12 per share, calling for a distribution of $1,200,000, and a total to date of $122,650,000. The Superior Copper Co. is developing the West lode, which is said to be averaging 50 lb. of 'mineral' per ton. The Quincy has declared a dividend of $1.50 per share, making a total of $5 per share for this year. The copper production for 1912 is estimated at 22,250,000 lb., as against 22,252,943 lb. during 1911, and profit as $1,280,000, against $489,737. Total cost per pound of copper is 10.63c. During the first ten months of the current year Calumet & Hecla has produced 58,301,646 lb. of copper; Osceola, 14,792,925 lb.; Ahmeek, 13,568,955 lb., Tamarack, 6,450,004 lb., Isle Royale, 6,696,291 lb.; Allouez, 4,474,780 lb.; Superior, 3,401,709 lb.; and Centennial, 1,370,435 lb. The Calumet & Hecla Co. is making a large installation of 65 motors, of 40 hp. each, for equipping its mines and smelters with electric drive. The motors are being supplied by the General Electric Company.

MONTANA

Fergus County

The New Mine Sapphire Syndicate, a British corporation, shipped over two tons of raw sapphires last week from its Yogo mines to the London office. About two such shipments are made annually to Europe, where the sapphires are cut into gems. Many are then returned to this country for sale, having to bear the addition of heavy import duties. The raw stones are heavily insured against loss during transit. The Yogo sapphire mines are now the largest in the world, and the occurrence of the gems is unique. They are found in disseminated crystals through basic dikes called monchiquite by petrographers. The dike rock slacks on exposure, and the sapphires are concentrated from the resulting material either on concentrating tables or in sluice-boxes.

Silverbow County

(Special Correspondence.)—Sunday work has been resumed at the mines of the Anaconda company, but the continuance of the same depends on the ability of the smelters at Anaconda and Great Falls to deal with the ore which is being hoisted. The shaft of the Tuolumne mine is down 2000 ft. Net earnings in October were $33,000. There is little prospect of a dividend this year. The Butte-Alex Scott has opened a vein of rich ore on the 200-ft. level. Ore shipments are to be increased to 250 tons per day. A vein 20 ft. wide, averaging over 4% copper, was opened on the 1800-ft. level. At the North Butte, on the 2600-ft. level, an orebody has been proved 15 ft. wide, carrying bornite and glance, and will average 6% copper with gold and silver. Thomas F. Cole and other Duluth capitalists have been in Butte for several days, and have organized the Rainbow Lode Development Company.

Butte, November 27.

NEBRASKA

Considerable interest has been aroused in the discovery of soluble potash salts in certain lakes in western Nebraska which are shallow and are from 50 to 500 acres in extent, occupying depressions among the sand hills. Jesse lake covers about 400 acres and varies in depth from 30 in. to dryness. Samples of water tested at the Mackay School of Mines, at Reno, Nevada, showed the following results:

Sample.	Gm. soluble salts per 100 c.c. dried.	K_2O in total salts.
No. 2	2.90	29.91
No. 3	3.34	40.09
No. 4	47.72	24.97
No. 5	1.32	....
No. 6	2.08	....

Concentration varies with the different stages of the lake. Experiments are being made on the property either to market crude salts or extract the potash and other by-products.

NEVADA

Esmeralda County

A suit has been filed in the District Court against the owners of or claimants to the Dewar claim, in the Klondyke district. The case is somewhat complicated, but the property is regarded as one of the best in this promising district near Goldfield.

The estimated November production of the Goldfield Consolidated Co. is as follows: Ore treated, 27,614 tons; gross value recovered, $429,000; operating expenses, $185,000; net realization, $244,000.

Clark County

A lease has been taken and work started on the famous 600-ft. level of the Quartette mine. From this level ore termed 'crysocolla,' containing free gold, was mined, and

large dividends were paid. A cave-in occurred some years ago and the stopes were lost, and it is expected that much skill will be needed to get through.

NYE COUNTY

The ore from the Steffner lease of the Manhattan Consolidated company is refractory, and a roasting-furnace is to be erected at a cost of $12,000. Antimony has kept extraction down from 65 to 80% by amalgamation and cyaniding, and 96% is expected to result from the new process.

Word was received at Manhattan last week that potash had been discovered by the Railroad Valley Saline Co., which has been drilling during the past summer, and a rush has set in for that district. An automobile load of Tonopah men has gone out, and others will follow.

STOREY COUNTY

All the pumps in Ward shaft have been taken out, the station at 2100 ft. braced up, and the shaft closed indefinitely.

NEW MEXICO

SOCORRO COUNTY

Development at the Ernestine M. Co. continues in the same excellent grade of ore. Before using the new automatic sampler for the custom ore business, the equipment at the Deadwood mines is undergoing a series of tests in conjunction with the old system of sampling, to determine its accuracy, and after a few further adjustments, all ores will be handled by it. The mill is running steadily, averaging 350 tons per week. Grading is under way for the permanent shaft at the Johnson mine of the Oaks Co. and plans are being perfected for extending the adit through to the end-line. At the Pacific, good ore is coming from the stope and the several development headings. The Consolidated, being worked under lease from the Socorro Mines, is yielding an excellent grade of milling ore. Work has just been started on the Trilby group and it is the intention to ship ore to one of the custom mills. A gasoline hoist may be purchased within a few weeks. Some of the best ore now milled in the district is coming from the Little Charlie mine of the Mogollon Gold & Copper Co. Arrangements have been made with one of the local plants to furnish current and an electric hoist will be installed.

OREGON

GRANT COUNTY

(Special Correspondence.)—At the Ben Harrison mine, at Granite, the mill construction is finished, and 20 stamps, vanners, and a tube-mill are being installed. By the end of the current year it should be working full time. The mine is well developed to a depth of 500 ft. with an adit, and a shaft in the adit 100 ft. A 16-drill, electrically driven air-compressor has been installed.

Granite, November 19.

SOUTH DAKOTA

LAWRENCE COUNTY

Two of the Black Hills operators, the Wasp No. 2 and Golden Reward, have installed Donaldson tilting furnaces for melting precipitate. Many advantages are claimed for this furnace, and in this district, where good coke is expensive and not easly secured, these crude-oil furnaces are desirable.

Open weather so far this fall has materially benefited the miners who are doing outside work. There has yet been no snowfall worth mentioning, a decided contrast to last year, when by the middle of November there was deep snow and good sleighing. Indications point to a mild winter, a boon to the operators, some of whom were forced to shut down last winter on account of the severity of the weather.

UTAH

BEAVER COUNTY

Operations at the South Utah mine during the year ended June 30 resulted in a loss of $31,114. The report of production from the general manager covers the period from September 1, 1910, to June 30, 1912, when 426,002 tons of ore was milled, averaging 1.142% of copper. The yield was 5,747,983 lb. of copper, 47,002 oz. of silver, and 2413 oz. of gold. Ore shipped totaled 701 tons, averaging 12.39% copper with some gold and silver. The ratio of concentration was 12.51 to 1. The total cost per pound of copper was 15.5c. Between the 700 and 800-ft. levels there remain 90,000 tons of 1.5% copper ore, and 15,000 tons of 1.4% ore between the 700 and 600-ft. levels. Assets include copper, gold, and silver, and supplies on hand worth $138,318.

SALT LAKE COUNTY

It is stated that after several months' trial of the rolls of E. A. Wall they have been discarded, having proved unsatisfactory. He has instituted a suit against the Ohio Copper Co. for $36,000 for payment for the rolls. Between 1700 and 2000 tons per day is being treated in two sections of the mill. It was in the second section, temporarily out of commission, that the Wall rolls were installed in an effort to secure a better recovery from the copper ore. When other machinery is installed the mill should treat at least 3000 tons per day. In compliance with the reorganization plan, there has been canceled bonds worth $240,000. Less than 50,000 shares remain to be taken by the underwriters. On November 27 the ore shipments from the Utah Copper mines was 21,000 tons. Wages have been increased from December 1.

UTAH COUNTY

During the year ended November 1 the Colorado Mining Co., at Provo, produced 11,191 tons of ore worth $247,899, with a net value of $153,636. The fiscal year started with cash on hand totaling $110,748, and closed with $103,060. When the Knight mill is working, low-grade ore from the mine can be handled at a profit.

WASHINGTON

STEVENS COUNTY

The Aurora Copper Mining Co., at Chewelah, will spend $100,000 in new plant. It will be a duplicate of the United Copper, and have 100 tons capacity. The ore from the mine will be carried by aerial tramway a distance of 5280 ft., with a fall of 750 ft. It is intended to consolidate the power-plants of these two mines. The new machinery at the Copper King mine is now working, and 20 men are employed on three shifts. An official map of the Chewelah mining district is being prepared by R. B. Thomas, mineral surveyor.

CANADA

BRITISH COLUMBIA

At Grand Forks smelter the Granby company is constructing a second slag conveyor, really an addition to the present system. The original plant, which is a belt conveyor, carries slag or waste material to the north end of an old dump, while the present installation will convey slag to the south end. During the week ended November 23 the Granby smelter treated 23,844 tons, one furnace being down for a few days, the total for the current year being 1,118,459 tons. The shipping mines of the Boundary district sent out 35,168 tons during the week. The British Columbia Copper Co. treated 15,255 tons at the smelter at Greenwood, making a total of 580,180 tons for the year.

It has been decided to increase the capital of the Kootenay Gold Mines Co. to $500,000. On the Hardscrabble vein 900 ft. of driving has opened over 10,000 tons of ore. Platinum has been found in the dikes cutting the orebody.

YUKON

The Yukon river terraces on the left limit, seven miles below Dawson, which were staked early in October, are to be the scene of the most systematic undertaking in deep-channel placer mining in the history of the Yukon. It is proposed to drive an adit from the face of the hill through the bench and avoid shaft-sinking. It will also serve to drain the claims. This is the first adit started in the Yukon to sink for channels, or what is locally called 'second bedrock.'

KOREA

The Chosen Mining Co. has just bought a Lane slow-speed mill for its plant at Yeng Byen, and if the results obtained are as satisfactory as anticipated six or seven more mills of the same type will be installed. These are the first mills of the kind to be employed in Korea, and the results obtained in operation on the Yeng Byen ore are awaited with much interest.

MEXICO

(Special Correspondence.)—Notwithstanding reports to the contrary issued from Mexico City, the country is in a state of chaos. Many mining companies have been robbed of money, powder, rifles, mules, and all kinds of supplies, and it is never known when other bands of rebels will descend on the districts. As the fear of Diaz recedes to the background, the lawless element of the country grows bolder and bolder.

Calabacillas, Sinaloa, November 18.

CHIHUAHUA

Rebels have captured W. N. Fink, superintendent of the San Toy Mining Co. at Santa Eulalia, and are holding him for $5000 ransom. The money was sent out by the company, and he was released, and stated that he had been fairly well treated. The rebels took horses from the San Toy corral, and stores worth $5000 from Ketelson and Degetan stores in the town. They also went to the Santo Domingo camp for plunder, but retired on learning that the camp was armed.

Mining men in this state say that a revival in the mining industry is evident, judging by the number of denouncements made each day, while more prospectors than ever are in the hills.

At the end of the 1100-ft. adit, at a depth of 650 ft., of the Julieta mine at Troya, a rich orebody carrying gold has been cut. This mine is owned by Santa Rosalia people, and is managed by Paul Ginther. During the revolution the property was worked as usual.

At the smelter at Morse a new clubhouse for employees is being erected, with a special apartment for the women of the colony. J. R. Enlow is superintendent. On November 15 the smelter treated 800 tons. Paul and Henry Ginther, of Santa Rosalia, have acquired 1300 hectares of surface and underground rights in the Cerro de las Cruces section of the Carnargo district, containing large deposits of iron ore. These are near the projected Chihuahua-Monclova railroad, which the National Lines railroad will soon begin constructing.

A Canadian syndicate, headed by Paul Ginther, is to build a 2000-ton cyanide plant costing ₱1,000,000, at Parral. It will be the largest mill in Mexico. The syndicate is acquiring more mining properties in the district and Minas Nuevas.

The Rio Tinto company has resumed work after a two weeks shut-down. The property is now protected by a garrison of Federal troops. In partnership with several others, Victoriano Huerta has made the following denouncements: 32 pertenencias on the Rancho de Avalos and 30 pertenencias in the Sierra del Carrizalillo in the Santo Domingo section of the Aldama municipality in the state of Chihuahua. J. H. Williamson, of Chihuahua, denounced 54 pertenencias in the terreno de la Hacienda de Tabalaopa, municipality of Chihuahua. Murray Crossette, of Cusihuiriachic, has denounced 30 hectares in the municipality of Cusihuiriachic and district of Benito Juarez. W. J. Wallace, of Cusihuiriachic, has denounced 10 pertenencias in la Sierra de Los Angeles in the municipality of Cusihuiriachic and district of Benito Juarez. Raymond Allison, representing Paul Ginther, has denounced 300 hectares in the Sierra de las Cruces in the district of Camargo and municipality of Santa Rosalia. Edgar Kock, of Parral, has denounced 6 pertenencias on the San Juanico and La Almancena ranches in the district and municipality of Parral. J. C. Gonzales has denounced 21 hectares in the mineral of Buena Vista in the municipality of Santa Barbara, and 6 hectares in the mineral and municipality of the same place.

Personal

Professional men are invited to send news of their engagements and travels. Such news is interesting to friends.

C. F. TOLMAN has gone to Idaho.

CHARLES A. CHASE is at Telluride.

H. A. STROUT is here from Nevada.

W. M. BEAMAN is in San Francisco.

C. A. NONES has gone to New York.

FRED J. SIEBERT was in town recently.

D. W. BRUNTON has gone to St. Louis.

H. V. WINCHELL is at Wallace, Idaho.

HENRY KRUMB was in Missouri recently.

ERNEST GAYFORD was in Montana recently.

BERNARD MACDONALD has returned to Parral.

R. B. LAMB is in Cobalt on examination work.

R. ROBERTS is in Rossland, British Columbia.

FRED T. GREENE is in the Coeur d'Alene district.

J. H. G. WOLF has gone to New York and Philadelphia.

W. W. GRANGER has returned to Denver from South Dakota.

A. N. WINCHELL was in Minneapolis this week and has gone to New York.

RALPH ARNOLD was in San Francisco during the week and has gone to Texas.

E. L. BECK, of Goldfield, Nevada, has gone to Charcas, San Luis Potosi, Mexico.

FREDERICK G. CLAPP is at Bartlesville, Oklahoma, reporting on oil properties.

FREDERICK LAIST was in San Francisco last week and has returned to Montana.

C. A. H. DESAULLES is manager for the United States Zinc Co. at Pueblo, Colorado.

TAKESHI KAWAMURA has returned to Tokyo by way of Siberia, reaching there on October 25.

L. D. GODSHALL has been appointed manager for the Tecopa Consolidated Mining Company.

H. C. HOOVER has been elected a member of the board of trustees of Leland Stanford University.

WALTER LYMAN BROWN has returned to the Gold Coast as manager for the Abbontiakoon Mines, Limited.

J. W. MALCOLMSON and L. R. BUDROW were in San Francisco this week and have gone to Tonopah and Goldfield.

F. W. BRADLEY, L. L. JAMES, and JAFET LINDEBERG are delegates from Alaska at the California Mining Association meeting.

HOWLAND BANCROFT expects to spend December in Boston, New York, and Philadelphia, returning to Denver near the holidays.

J. B. TYRRELL left for England on November 30. His address while in England will be 224 Salisbury House, London, E. C.

R. E. HAZARD, president of the Sambenigno Mines & Estates Co., Ltd., was in New York recently and will visit Europe before returning to Colombia.

ROBERT LINTON has recently been in Colorado examining some lead-zinc properties in the Kokomo district, and is now engaged in an examination of iron ore properties in Cass and Marion counties, Texas.

Obituary

JOHN P. JONES died at Los Angeles on November 27. Born in Hereford county, England, in 1828, he was brought, at an early age, to Ohio, and in 1849 joined the rush of gold seekers to California, where between 1850 and 1867 he was prominent as an Indian fighter, miner, sheriff, and state senator. He went to the Comstock in 1867, where he became superintendent of the Kentuck and Crown Point mines. His faith in the Crown Point made him a rich man when the bonanza was discovered in 1870. Elected United States senator from Nevada in 1872, he held that office for over thirty years, retiring in 1903.

Market Reports

LONDON QUOTATIONS

(By cable, through the courtesy of C. S. Burton & Co., New York.)

	December 5.
Camp Bird Ltd	$ 5½
El Oro	4½
Esperanza	9⅝
Oroville Dredging	1½
Santa Gertrudis	6⅞
Tomboy	6¾

COPPER SHARES—BOSTON

(By courtesy of J. C. Wilson, Mills Building.)

	Closing prices, December 5.		Closing Prices December 5.
Adventure	$ 5¼	Mohawk	$ 62
Allouez	38	North Butte	34½
Calumet & Arizona	76	Old Dominion	55½
Calumet & Hecla	540	Osceola	105
Centennial	18	Quincy	80
Copper Range	53½	Shannon	13½
Daly West	8½	Superior & Boston	1½
Franklin	8¼	Tamarack	38
Granby	68½	Trinity	4½
Greene Cananea, ctf.	9½	Utah Con	11
Isle-Royale	33	Victoria	2
La Salle	5½	Winona	1¼
Mass Copper	5⅝	Wolverine	71

NEVADA STOCKS

(By courtesy of San Francisco Stock Exchange.)

San Francisco, December 5.

Atlanta	$ .13	Montana-Tonopah	$1.90
Belmont	8.50	Nevada Hills	1.35
Big Four	.57	North Star	.23
Buckhorn	.70	Ophir	.36
Con. Virginia	.37	Pittsburg Silver Peak	.73
Crown Point	.45	Round Mountain	.33
Florence	.60	Sierra Nevada	.42
Goldfield Con.	1.62	Tonopah Extension	2.57
Halifax	1.25	Tonopah Merger	.81
Jim Butler	.62	Tonopah of Nevada	6.35
Jumbo Extension	.26	Union	.28
MacNamara	.17	Vernal	.10
Mexican	1.85	West End	1.35
Midway	.32	Yellow Jacket	.30

OIL SHARES

(By courtesy of San Francisco Stock Exchange.)

San Francisco, December 5.

Associated Oil	$44.00	Monte Cristo	$ .95
Brookshire	.58	New Pa Pet	.53
Caribou	.90	Palmer	.18
Claremont	.60	Palmer Union	.18
Coalinga Central	.20	Premier	.40
De Luxe	.70	Republic	.15
Maricopa 36	.30	United Oil	.32
Maricopa National	.20	W K Oil	1.95

MINING STOCK QUOTATIONS—NEW YORK

(By wire from C. S. Burton & Co., New York.)

	Closing Prices. December 5.		Closing Prices. December 5.
Alaska Mexican	$ 13⅜	McKinley-Darragh	$ 2⅜
Alaska Treadwell	40	Miami Copper	26¼
Alaska United	23¾	Mines Co. of America	2⅝
Amalgamated Copper	80¼	Nevada Con	22½
A. S. & R. Co.	71½	Nipissing	8½
Braden Copper	9⅜	Ohio Copper	1¼
B. C. Copper Co.	4½	Ray Con	21½
Chino	43¾	Tenn. Copper	40
First National	2	Tonopah Belmont	8½
Giroux	3⅜	Tonopah Ex	2½
Goldfield Con.	1½	Tonopah Mining	6½
Greene-Cananea	9½	Trinity	6
Hollinger	15⅜	Tuolumne Copper	2⅜
Inspiration	19	Utah Copper	60½
Kerr Lake	2⅜	West End	1¼
La Rose	2½	Yukon Gold	3
Mason Valley	12		

ASSESSMENTS ON COMSTOCK MINES.

Company	No.	Del. Board	Sale Day	Amt.
Ophir	90	Nov. 3	Dec. 9	.15
Crown Point	13	Nov. 7	Dec. 4	.10
Alpha Con.	19	Nov. 11	Dec. 4	.03
Scorpion	21	Nov. 23	Dec. 18	.01
Bruns. Potosi	3	Nov. 24	Dec. 19	.01½
Con. Virginia	22	Nov. 24	Dec. 20	.15
Sierra Nevada	32	Nov. 28	Dec. 23	.10
Challenge Con	60	Dec. 2	Dec. 27	.05
Overman	40	Dec. 3	Dec. 24	.05

LOCAL METAL PRICES

San Francisco is not a primary market for the common metals except quicksilver. The prices quoted below therefore represent sales of small lots and are not such as an ore-producer could expect to realize. Ore contracts usually call for settlements on the basis of Eastern prices, less freight and treatment charges. The prices quoted are in cents per pound, except in the case of quicksilver, which is quoted in dollars per flask of 75 pounds.

San Francisco December 5.

Antimony	12—12½c	Quicksilver (flask)	41
Electrolytic Copper	18—18½c	Tin	52—53½c
Pig Lead	4.60—5.55c	Spelter	8¼—8½c

Zinc dust, 1400 lb. casks, per 100 lb., small lots $9.50—9.75; large $7.50—8.50

METAL PRICES

(By wire from New York.)

NEW YORK, December 4.—Copper is now quiet and sales are nominal; buyers are holding off for better prices. Lead is still quiet and weak with little demand. Spelter remains quiet. Average daily prices for the past week, in cents per pound, based on wholesale transactions, standard brands, are given below.

Date.	Electrolytic Copper.	Lead.	Spelter.	Silver, per oz.
Nov. 21	17.43	5.50	7.23	62⅞
" 22	17.38	5.49	7.18	63
" 23	17.38	5.49	7.18	63
" 24	Sunday.	No market.		
" 25	17.38	5.49	7.18	63
" 26	17.38	5.49	7.15	63
" 27	17.38	5.49	7.13	63
" 28	Holiday.	No market.		
" 29	17.38	4.31	7.13	63⅛
" 30	17.38	4.31	7.13	63⅛
Dec. 1	Sunday.	No market.		
" 2	17.38	4.30	7.10	63⅞
" 3	17.38	4.20	7.10	64⅛
" 4	17.38	4.20	7.10	63⅛

SILVER

Below is given the average New York quotation, in cents per ounce, of fine silver for the months indicated:

	1911.	1912.		1911.	1912.
Jan.	53.81	56.25	July	52.57	60.67
Feb.	52.23	59.06	Aug.	52.17	61.32
Mch.	52.76	58.37	Sept.	52.43	62.95
Apr.	52.32	59.20	Oct.	53.37	63.16
May	53.31	60.88	Nov.	55.77	62.73
June	53.04	61.29	Dec.	54.85	....

COPPER

Daily quotations on copper as published in this column represent average wholesale transactions on the New York market and refer to electrolytic copper. Lake copper commands normally from 1-5 to 1-4c. per lb. more. Below are average monthly quotations in cents per pound:

	1911.	1912.		1911.	1912.
Jan.	12.29	14.09	July	12.47	17.19
Feb.	12.26	14.08	Aug.	12.41	17.49
Mch.	12.14	14.68	Sept.	12.20	17.56
Apr.	12.02	15.74	Oct.	12.19	17.32
May	11.99	16.03	Nov.	12.61	17.31
June	12.39	17.23	Dec.	13.55	....

COPPER SURPLUS

Figures showing the visible supply of copper at the beginning of each month are now widely available. Below are given the amounts, in pounds, known to be available at the first of each of certain months.

		U. S.	European.
January	1911	122,030,195	230,264,280
January	1912	89,454,695	178,329,920
February	"	66,280,643	153,820,800
March	"	62,939,988	141,125,680
April	"	62,367,557	137,806,000
May	"	65,295,368	134,176,000
June	"	49,615,643	117,801,600
July	"	44,335,004	107,817,920
August	"	50,281,280	113,285,760
September	"	46,701,376	112,743,680
October	"	63,065,587	107,396,800
November	"	76,744,967	

UNITED STATES PRODUCTION AND CONSUMPTION

(Compiled from reports of the Copper Producers' Association)

	Production.	Domestic deliveries.	Exports.
October 1911	118,255,442	64,068,656	60,084,349
November	111,876,601	68,039,776	67,049,279
December	122,896,697	65,988,474	79,238,716
Total for 1911	1,431,938,338	709,611,945	754,932,733
January 1912	119,337,753	62,343,901	80,167,904
February	116,035,809	56,228,368	63,148,096
March	125,694,601	67,847,556	58,779,566
April	125,694,001	69,513,846	53,252,326
May	126,737,836	72,702,237	69,485,945
June	122,315,240	66,146,229	61,449,650
July	137,161,920	71,093,120	60,121,600
August	145,628,521	78,722,418	70,485,150
September	140,089,819	63,460,810	60,264,796
October	145,405,453	84,104,734	47,621,342

LEAD

Lead is quoted ordinarily in cents per pound or dollars per hundred pounds delivered at St. Louis or New York. The difference is normally 15c. per hundred pounds, and any larger or smaller difference is promptly met by sales. The daily price in New York is published each week in this column. Below are the average quotations by months:

	1911.	1912.		1911.	1912.
Jan.	4.48	4.43	July	4.50	4.71
Feb.	4.44	4.03	Aug.	4.50	4.54
Mch.	4.39	4.07	Sept.	4.48	5.00
Apr.	4.41	4.20	Oct.	4.27	5.08
May	4.37	4.20	Nov.	4.30	4.91
June	4.34	4.40	Dec.	4.45	....

ZINC

Zinc is quoted as spelter, standard Western brands, and based upon St. Louis or New York delivery. While New York quotations, as a matter of convenience, are commonly used, relatively little spelter actually goes to or comes from New York. The bulk is shipped direct from the plants in the Mississippi Valley to manufacturers, due allowance being made for freight. New York daily quotations are published in this column each week. Below are given averages by months:

	1911.	1912.		1911.	1912.
Jan.	5.45	6.42	July	5.70	7.12
Feb.	5.52	6.50	Aug.	5.95	6.96
Mch.	5.56	6.57	Sept.	5.86	7.45
Apr.	5.40	6.63	Oct.	6.10	7.36
May	5.35	6.68	Nov.	6.38	7.23
June	5.50	6.88	Dec.	6.30	....

Zinc-dust is quoted separately, the price being based upon the cost of spelter in Illinois and the cost of preparation. About half the zinc-dust used in the United States is imported through San Francisco. Delivery prices are determined largely by quantities and contracts.

QUICKSILVER

The primary market for quicksilver is San Francisco, California, being the largest producer. The price is fixed in the open market, and, as quoted weekly in this column, is that at which moderate quantities are sold. Buyers by the carload can usually obtain a slight reduction, and those wanting but a flask or two must expect to pay a slightly higher price. Average monthly quotations, in dollars, per flask of 75 lb., are given below:

	1911.	1912.		1911.	1912.
Jan.	44.60	43.75	July	48.00	43.00
Feb.	48.40	46.00	Aug.	50.00	42.50
Mch.	52.50	46.00	Sept.	47.50	42.12
Apr.	50.90	42.25	Oct.	46.12	41.50
May	46.50	41.75	Nov.	45.50	41.50
June	46.50	41.30	Dec.	44.50	...

TIN

New York prices control in the American market for tin, since the metal is almost entirely imported. San Francisco quotations, averaging about 5c. per lb. higher than New York, are quoted weekly in this column. Below are given average monthly New York quotations in cents per pound:

	1911.	1912.		1911.	1912.
Jan.	41.25	42.53	July	42.40	44.25
Feb.	41.61	42.96	Aug.	43.32	45.80
Mch.	40.16	42.58	Sept.	39.75	48.64
Apr.	42.18	43.92	Oct.	41.18	50.01
May	43.11	46.05	Nov.	43.12	49.92
June	44.61	45.76	Dec.	44.65	....

Current Prices for Chemicals

(Corrected monthly by Braun-Knecht-Heimann Co.)

Prices quoted are for ordinary quantities in packages as specified. For round lots lower prices may be expected, while in smaller quantities advanced prices are ordinarily charged. Prices named are subject to fluctuation. Other conditions govern Mexican and foreign business.

	Min.	Max.
Acid, sulphuric, com'l, 66°, drums, ℔ 100 lb	$0.75	$1.00
Acid, sulphuric, com'l, 66°, carboy, ℔ 100 lb	1.00	1.50
Acid, sulphuric, C. P., 9-lb. bottle, bbl., ℔ lb	0.13	0.18
Acid, sulphuric, C. P., bulk, carboy, ℔ lb	0.09½	0.12
Acid, muriatic, com'l, carboy, ℔ 100 lb	1.60	3.00
Acid, muriatic, C. P., 6-lb. bottle, bbl., ℔ lb	0.15	0.20
Acid, muriatic, C. P., bulk, carboy, ℔ lb	0.10½	0.15
Acid, nitric, com'l, carboy, ℔ 100 lb	5.25	6.50
Acid, nitric, C. P., 7-lb. bottle, bbl., ℔ lb	0.16	0.22
Acid, nitric, C. P., bulk, carboy, ℔ lb.*	0.12½	0.15
Argols, ground, bbl., ℔ lb	0.20	0.25
Borax, cryst. and conc., bags, ℔ 100 lb	3.00	4.35
Borax, powdered, bbl., ℔ 100 lb	3.25	4.25
Borax glass, gd. 30 mesh, cases, tin lined, ℔ 100 lb	10.50	13.50
Bone ash, 60 to 80 mesh, bbl., ℔ 100 lb	4.50	5.50
Bromine, 1-lb. bottle, ℔ lb	0.55	0.65
Candles, adamantine, 14 oz., 40 sets, ℔ case	4.60	4.80
Candles, adamantine, 14 oz., 60 sets, ℔ case	5.25	5.45
Candles, Stearic, 14 oz., 40 sets, ℔ case	5.00	5.20
Candles, Stearic, 14 oz., 60 sets, ℔ case	5.70	5.90
Clay, domestic fire, sack, ℔ 100 lb	1.50	2.00
Cyanide, 98 to 100%, 100-lb. case, ℔ lb	0.20¾	0.24¾
Cyanide, 98 to 100%, 200-lb. case, ℔ lb	0.20	0.24
Cyanide, 129%, 100-lb. case, ℔ lb	0.27½	0.28½
Cyanide, 129%, 200-lb. case, ℔ lb	0.26¾	0.27½
Lead acetate, brown, broken casks, ℔ 100 lb	8.75	9.65
Lead acetate, white, broken casks, ℔ 100 lb	10.00	10.25
Lead acetate, white, crystals, ℔ 100 lb	11.75	12.25
Lead, C. P., test., gran., ℔ 100 lb	13.00	15.00
Lead, C. P., sheet, ℔ 100 lb	15.00	18.00
Litharge, C. P., silver free, ℔ 100 lb	11.50	13.50
Litharge, com'l, ℔ 100 lb	8.00	9.50
Manganese ox., blk., dom. in bags, ℔ ton	20.00	25.00
Manganese ox., blk., Caucasian, in casks, ℔ ton (85% MnO_2—4% Fe)	42.50	50.00
Nitre, double ref'd, small cryst., bbl., ℔ 100 lb	7.00	8.00
Nitre, double ref'd, granular, bbl., ℔ 100 lb	6.50	7.50
Nitre, double ref'd, powdered, bbl., ℔ 100 lb	7.25	8.00
Potassium bicarbonate, cryst., ℔ 100 lb	12.00	15.00
Potassium carbonate, calcined, ℔ 100 lb	15.00	18.00
Potassium permanganate, drum, ℔ lb	0.11	0.12½
Silica, powdered, bags, ℔ lb	0.03	0.05
Soda, carbonate (ash), bbl., ℔ 100 lb	1.50	1.75
Soda, bicarbonate, bbl., ℔ 100 lb	2.25	2.75
Soda, caustic, ground, 98%, bbl., ℔ 100 lb	3.15	3.50
Soda, caustic, solid, 98%, drums, ℔ 100 lb	2.65	2.85
Zinc shavings, 850 fine, bbl., ℔ 100 lb	12.05	13.50
Zinc sheet, No. 9—18 by 84, drum, ℔ 100 lb	10.25	11.50

*Extra charge for packing nitric acid for shipment to conform to regulations.

Current Prices for Ores and Minerals

(Corrected monthly by Atkins, Kroll & Co.)

The prices are approximate, subject to fluctuation, and to variation according to quantity, quality, and delivery required. They are quoted, except as noted, f.o.b. San Francisco. Buying prices marked *.

	Min.	Max.
Antimony ore, 50%, ℔ ton	*$22.00	$25.00
Arsenic, white, refined, ℔ lb	0.05½	0.05½
Arsenic, red, refined, ℔ lb	0.08	0.09
Asbestos, according to length and quality of fibre, ℔ ton	100.00	350.00
Asbestos, lower grades, ℔ ton	5.00	50.00
Asphaltum, refined, ℔ ton	10.00	20.00
Barium carbonate, precipitated, ℔ ton	42.50	45.00
Barium chloride, commercial, ℔ ton	42.50	45.00
Barium sulphate (barytes), prepared, ℔ ton	20.00	30.00
Bismuth ore, 10% upward, ℔ ton	*75.00	upward
Chrome ore, according to quality, ℔ ton	10.00	12.50
China clay, English, levigated, ℔ ton	15.00	20.00
Cobalt metal, refined, f. o. b. London, ℔ lb	2.50	
Coke, foundry, ℔ 2240 lb	14.50	15.00
Diamonds:		
Borts, according to size and quality, ℔ carat	2.00	15.00
Carbons, according to size and quality, ℔ carat	50.00	90.00
Feldspar, ℔ ton	5.00	25.00
Firebrick:		
Bauxite, ℔ M	175.00	
Magnesite, ℔ M	190.00	275.00
Silica, ℔ M	42.50	47.50
Flint pebbles for tube-mills, ℔ 2240 lb	19.50	22.50
Fluorspar, ℔ ton	10.00	15.00
Fullers earth, according to quality, ℔ ton	20.00	30.00
Gilsonite, ℔ ton	35.00	40.00
Graphite:		
Amorphous, ℔ lb	0.01½	0.02½
Crystalline, ℔ lb	0.04	0.13
Gypsum, ℔ ton	7.50	10.00
Infusorial earth, ℔ ton	10.00	15.00
Magnesite, crude, ℔ ton	5.00	7.50
Magnesite, dead calcined, ℔ ton	20.00	25.00
Magnesite, brick (see firebrick).		
Manganese ore, oxide, crude, ℔ ton	10.00	25.00
Manganese, prepared, according to quality, ℔ ton	30.00	70.00
Mica, according to size and quality, ℔ lb	0.05	0.30
Molybdenite, 95% MoS_2, ℔ ton	400.00	500.00
Monazite sand (5% thoria), ℔ ton	150.00	200.00
Nickel metal, refined, ℔ lb	0.45	0.60
Ochre, extra strength, levigated, ℔ 100 lb	2.25	3.25
Platinum, native, crude, ℔ oz	45.00	50.00
Silex lining for tube-mills ℔ 2240 lb	32.50	35.00
Sulphur, crude, ℔ ton	20.00	25.00
Sulphur, powdered, ℔ ton	40.00	45.00
Sulphur, 80%, ℔ ton	16.50	18.50
Talc, prepared, according to quality, ℔ ton	20.00	50.00
Tin ore, 60%, ℔ ton	475.00	500.00
Tungsten ore, 65%	425.00	475.00
Vanadium ore, 15% V_2O_5, ℔ ton	150.00	180.00
Wolframite (see tungsten ore).		
Zinc ore, 50% up, ℔ ton	*15.00	20.00

Concentrates

Most of these are in reply to questions received by mail. Our readers are invited to ask questions and give information dealing with the practice of mining, milling, and smelting.

METALLIC filament lamps from Germany during the seven months of 1912 numbered 20,000,000, valued at $6,000,000.

MOLTEN SILVER absorbs oxygen in large quantities. The gas is given off as the metal solidifies, and results in a blistered appearance of the bullion.

IN the gasoline-engine cylinder, the highest temperature reported is in the neighborhood of 4000°F. This is at the hottest portion of the exploding mixture of gas and air.

METRIC CARAT as the standard of weight for diamonds has been adopted by 50 leading jewelers of the United States. Under this standard a carat will weigh 200 mg., a reduction of 5.3 mg. from the old system.

COAL production of the world in 1911 totaled 1,300,000,000 short tons, of which the United States contributed 496,221,168 tons; Great Britain, 304,518,927 tons; and Germany, 258,223,763 tons, these three countries producing over 80% of the world's supply.

REDUCERS used in assaying are argol, flour, or charcoal. The relative reducing powers of these are, respectively, 1, 2, and 4. The lower powered reducers are generally preferred because the increased quantity required insures a more even distribution throughout the charge.

PROOF of the annual labor required by statute on unpatented mining claims is made by filing of affidavits to that effect. In Nevada the affidavit must be filed within 60 days after the completion of the work. It has been held that a single affidavit may cover the work on several claims, but in jurisdictions where the point has not been raised it is well to avoid the possibility of controversy by filing separate affidavits.

THIRTEEN nuggets weighing over 1000 oz. of gold each, have been found in Victoria, Australia. Their names and weights are: Nugget of 2844 oz. gross weight found in 1857; Welcome Stranger, 2520 oz. in 1869; Welcome, 2217 oz., in 1858; Blanche Barkly, 1743 oz., in 1857; Precious, 1717 oz., in 1871; Canadian, 1619 oz., in 1853; Lady Hotham, 1777 oz., in 1854; Sarah Sands, 1117 oz., in 1853; Viscount Canterbury, 1114 oz., in 1870; Heron, 1008 oz., in 1855; and three nuggets of 1034, 1011, and 1000 oz. respectively.

GEOLOGICAL SURVEY parties numbering 13 were employed in Alaska during 1911, including 12 geologists, 4 topographers, 2 engineers, and 30 packers, cooks, and other auxiliaries. The length of the season ranges from three to six months. The areas covered by geologic exploratory surveys amounted to 8000 square miles; by geologic reconnaissance surveys, 10,550 square miles; and by detailed geologic surveys, 496 square miles. Sixty-eight stations for measurement of stream flow were maintained in the Yukon-Tanana region.

ZINC-DUST is an impalpable powder which forms in the distillation of zinc when the zinc vapor is cooled too rapidly in the condensers or is diluted by too large a volume of gas. It may constitute a large proportion of the metallic zinc obtained in electrothermic zinc smelting; but in ordinary retort smelting it usually amounts to between 3 and 10% of the reduced zinc. The powder consists of metallic zinc, with about 10% of oxide, which probably exists as a film surrounding the metallic particles. Marketable zinc-dust must not contain more than 10% of zinc oxide, and must pass through a 100-mesh screen. Its most important use is in precipitating gold from cyanide solutions, and is also used in the dyeing industry, fireworks, making hydrogen, and electrozincing.

TO produce high-grade cyanide bullion after the acid treatment of zinc-box precipitate, the zinc sulphate must be completely removed. The ordinary clean-up press does not as a rule wash efficiently. The treated precipitate should be allowed to settle as soon as all action has ceased in the acid tub. The zinc sulphate solution is then pumped through the clean-up press, and the settled precipitate agitated with a large bulk of hot water. Dilution with hot water should be carried on while filling the press. The cakes should be finally washed with clean hot water and air-dried.

COST of forwarding sectionalized machinery over mountain trails is not entirely dependent on weight. A good mule will stand a double load of 200-lb. on each side better than a single load of 300 lb. in small compass. In the latter case the load shifts easily, causing the animal considerable discomfort. Loads of mixed machinery are often rearranged during the journey to suit the fitness or unfitness of particular mules. Loose fittings, bolts, and sundries should be securely sewed up in sacking before being boxed, since the average *ariero* has no compunction about opening up even small cases if he thinks that the load may be distributed to better advantage by so doing. All markings on sectionalized machinery should be indelible, since the constant loading and unloading of the packages soon obliterates any ordinary paint mark.

ANTHRACITE produced in Pennsylvania includes an appreciable quantity of usable fuel recovered from the old culm banks by washeries, and the unsightly monuments to the wasteful methods of early times are disappearing from the landscape in the anthracite region. The quantity of coal recovered in the 22 years since the first washery was constructed in 1890 has amounted to about 50,000,000 long tons, considerably more than the total production of anthracite at the beginning of the period. In 1911 the washery product amounted to 4,136,044 long tons. In addition to the coal recovered from the culm banks, 94,647 long tons in 1911, and 91,833 tons in 1910, were recovered from the bottom of the Susquehanna river by dredges. In the bituminous regions the principal use of washeries is to improve the quality of the slack coal used in the manufacture of coke by reducing the ash and sulphur, although considerable quantities, particularly in Illinois, are washed in the preparation of sized coal for household use. The quantity of bituminous coal washed at the mines in 1911 was 12,543,114 short tons. The washeries yielded 10,999,481 tons of cleaned coal and 1,543,633 tons of refuse.

MEASUREMENT of stream flow by means of floats is easily carried out and gives results sufficiently accurate for many purposes, such as estimating the supply available for mining operations. The floats in common use are the surface, subsurface, and tube or rod floats. A corked bottle with a flag in the top and weighted at the bottom makes one of the most satisfactory surface floats, as it is affected but little by wind. In flood measurements good results can be obtained by observing the velocity of floating cakes of ice or débris. In all surface-float measurements the observed velocity must be multiplied by 0.85 to 0.90 to reduce it to the mean velocity. The subsurface and tube or rod floats are intended to give directly the mean velocity in the vertical. Tubes give excellent results when the channel conditions are good, as in canals. In measuring velocity by a float, observation is made of the time taken by the float to pass over the 'run'—a selected stretch of river or creek 50 to 200 ft. long. In each discharge measurement a large number of velocity determinations are made at different points across the stream, and from these observations the mean velocity for the whole section is determined. The area used in float measurements is the mean of the areas at the two ends of the run and at several intermediate sections.

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EDITORIAL

SMELTER FUME is not always obnoxious and an unusual case of its utility is seen at the mines of the Société des Mines de Cuivre de Catémou, east of Valparaiso in Chile. To lower the cost of food the company owns and operates ranches and vineyards, and it has been found that the SO_2 in the smelter gases is remarkably effective in protecting the grape vines from the ravages of the *Phylloxera.* Perhaps California metallurgists may one day find a suitable field for their activities in the Sacramento and San Joaquin valleys.

HOMESTAKE metallurgy has been pioneer work in many particulars, and the great mine 'which made South Dakota famous' is known for more than mere size. We present this week a general account of amalgamation as practised in the Homestake mills and will later publish accounts of other phases of the work. Mr. Allan J. Clark and Mr. W. J. Sharwood have collaborated in preparing an extensive paper on the practice and costs in the Homestake mills, which was read before the Institution of Mining and Metallurgy, November 21. It is from this, through the courtesy of Mr. Sharwood, that we abstract.

COMPETITION on the Yukon is anticipated next year. The White Pass company, in an effort to stimulate traffic, has reduced rates to Dawson and announced the intention of running boats down the river to Fairbanks. In retaliation the Northern Commercial Company, operating steamers from St. Michael to Dawson, proposes to cut rates and make a stronger bid for traffic by the all-water route. Any lowering of rates will be of large benefit to the mining industry in the territory affected, and if it results, as it should, in stimulating new development, it will finally benefit the transportation companies as well. The Far North needs more and cheaper transportation above all else. The railway and steamship lines operating in that territory have severe conditions to meet and costs will always be high, but in many instances, at least, rates may be lowered to the mutual advantage of the companies and their patrons.

WATER is a distinct menace in the California oilfields, and it is well that the association of the petroleum producers which has been formed in Kern county is showing so much activity. The results from the limited amount of work already done toward protecting the wells is so encouraging that a meeting was held in San Francisco last week for thorough discussion. Laws now in force are inadequate to meet the present situation, and Mr. W. E. Sutherland suggests that oil districts be organized under the Wright law providing for drainage and reclamation districts. Necessary funds are to be provided by assessment based on total production, and each district is to have the widest latitude in administration, since the problems differ so greatly in different districts. A law to this effect is to be introduced at the coming session of the California legislature, but concerted action is necessary to secure its passage, and the miners should join with the oil producers in their effort to safeguard so important an industry.

SALE of the App mine under foreclosure marks the close of a mining enterprise long controlled by the late W. A. Nevills. The mine passes to the Central Land & Trust Company, of which Mr. T. W. Patterson, of Fresno, is president, in satisfaction of a deed of trust to cover a claim for $155,000. It is one of the best known properties on the Mother Lode and has been reputed to contain a large reserve. The property became involved through repeated borrowings by Mr. Nevills. Repeated examination has failed to confirm his estimates of the amount of ore developed. and several prospective sales have therefore failed despite the excellent situation of the mine and the known presence of a large ore-shoot. A bad cave in the workings has complicated the situation.

DISCUSSION at the meeting of the California Miners' Association held in San Francisco this week chiefly centred about the pragmatic phases of conservation of natural resources. In a meeting of those interested in the operation of mining properties it was only natural that the undesirable features of Federal administration of public lands, as affecting the mining industry, should become the subject of earnest and vigorous protest, and a superficial observer, noting the fervor of protest and the absence of any reply other than the paper written by Mr. W. C. Mendenhall and read by Mr. Charles G. Yale, might carry away a distorted view of the real situation. It was interesting to note that the appeal that the prospector should have the fullest opportunity to fare forth with his faithful burro in search of a treasure trove never failed to evoke the loudest and most prolonged applause. Similar discussion characterized the meeting of the American Mining Congress at Spokane, and has marked all recent meetings of mining men in the West. There is much to be said on the miners' side of the case; nevertheless many arguments adduced overlook the incontestable fact that this is 1912 rather than 1862, and by no possibility can Cripple Creek, the Klondike, Goldfield, and Tonopah be restored to pristine virginity. The general unrest on the part of the miner is none the less evidence that improvement can be made in the present situation. Unfortunately there is no general agreement as to what should be done. Chiefs of Federal bureaus respond to attacks made upon them by showing that in some cases complaint is based upon misunderstanding, and in others that the fault is in the law which they are charged to administer. Certainly there is need of change in the law and in practice as well. In the days of its infancy the California Miners' Association showed itself able to make its voice heard at Washington, and useful legislation was the result. Discussion is futile unless it ends in a well considered plan of action. Much as has been said of the present situation, it has not yet been covered adequately. Those who have taken part are mainly interested parties whose viewpoint is that of self-interest. What is needed is careful study by impartial men whose purpose is that of securing the maximum of good to the body politic. Responsibility for the laws rests with Congress, and to that body the miners must look for any permanent relief. Before Congress can enact legislation, however, that will be more than patch-work, it must be informed, and the only practicable way to inform Congress is through a study of the situation, in the West itself, by a competent investigating committee. Last year both the Forest Service and the Land Office were investigated at length by Congress, and it is worth noting that the miners did not present their complaints in any detail or in force. This was probably because the sessions of the committee were held in Washington. What is needed now is a real study of the difficulties as they exist in the West. This is the first prerequisite; securing the appointment of such a committee and provision that it be composed of interested men is an achievement which should present no great difficulty to the California Miners' Association, and would constitute a real step toward remedial measures.

Colorado's Testing Plant

An experiment of more than usual interest is being made at the Colorado School of Mines at Golden. In the effort to obtain the maximum of service for the state from the plant and equipment of the school, an unusually large and complete testing works has been built for treating ores in carload lots or even larger quantity. The building is of steel and concrete construction, and resembles an ordinary concentrating or cyaniding mill more than the conventional laboratory. It provides large open spaces, well lighted, and properly furnished with power, water, and other essentials. It is equipped with crushing, screening, roasting, concentrating, and other metallurgical machinery, all of full working size. Cyanidation and other equipment is to be added. When completed there will be little to differentiate this from other metallurgical mills save in the variety of the equipment and the presence of unusually complete supplementary laboratories. While all mining schools now maintain metallurgical laboratories, the school men have generally contented themselves, through choice or necessity, with more modest equipment.

In planning the testing works at Golden, Mr. Victor C. Alderson, the president, and his associates, had in mind three purposes: (1) To provide a working laboratory where students might become familiar with the actual machinery and actual processes used in metallurgy; (2) to furnish a testing works where any reputable engineer might conduct his own tests on ore at a nominal expense for use of plant; (3) to open the way for systematic research on the minerals and ores of Colorado with a view to better and more complete methods of treatment. With all these purposes, engineers within and without the state are doubtless in entire agreement, however much they may question the wisdom of the means employed when it comes to consideration of details.

Those in responsible charge of mining schools have ever before them the problem of maintaining a correct balance between theory and practice in the four years that students remain under their charge. For many years instruction was almost wholly in theory, and the future engineer was left to acquire his knowledge of practice in after life. Gradually, as the need of giving the students 'perceptive centres' came to be recognized, laboratory instruction was introduced. There is a fascination about machinery that goes to the head of an American like wine, and machinery in the laboratory leads to more machinery, until it has been questioned whether in certain institutions the instructors have not been lost in a maze of belts and cog-wheels. A large and imposing laboratory has advertising value, just as have the 'real pump and real water' seen on the modern stage. With our American trait of measuring success by numbers, any added equipment that resulted in more students and gave leverage for larger appropriations, loomed large. Unconsciously, we hope, instructors in the mining schools came to be swayed by the subtle spirit of the times, and scrambled. So far as training of mining and metallurgical engineers is concerned, we are firmly of the belief that fewer rather than more schools are desirable, and less rather than more elaborate machinery. In the school, students should be trained in theory and grounded in principles; in the field, the mine, and the mill are the places to learn practice, under the men who are doing things and under conditions involving responsibility such as students must learn to meet before they become engineers. If the

new plant at Golden had no other purpose than student instruction, we should look upon it as representing wasted money—money that might better be spent in sending the students to see the many excellent metallurgical plants that are found throughout Colorado. Fortunately the new testing plant is adapted to other uses, and with them we have more sympathy.

In every mining district the visiting engineer finds elaborate and well built mills that stand idle. In a large number of instances the reason lies in the fact that the mill was not properly designed to treat the ore available to it. Out of this fact and the insistent need that it indicates, has grown the business of testing ores in quantity, preliminary to designing and building a new mill. The largest and most successful companies never neglect this precaution—and they have their reward. At the Flat River mill of the Federal Lead Company, for example, there is a complete testing plant in which Mr. H. A. Guess tries proposed processes of treatment on ores from the scattered Guggenheim properties. The Anaconda Copper company maintains an extensive and expensive department for experiment and research. Nearly all manufacturers of mining machinery are prepared to demonstrate by test the efficiency of their devices on lots of ore shipped by possible customers. Independent commercial ore testing works, such as those of Ricketts & Banks, the General Engineering Company, Henry E. Wood & Company, and the California Ore Testing Company, are found in the principal cities, and in them ore in any quantity will be studied and tested. Competent engineers connected with these works will design treatment plants and will try on an ore any reasonable combination of standard equipment. It is impracticable for every engineer to maintain his own testing works, and equally impracticable for all to be permitted to run tests in private plants. There is therefore a field, how wide only experience can determine, for a general plant, free to the use of all engineers at nominal expense. We understand that owners of the commercial testing works in Colorado raised no objection to establishment of the state works at Golden, taking the broad ground that of any resulting increase in testing work, they would be able to obtain their share, and aside from that they would be better prepared than other engineers to use the state plant. Just how the matter will develop in practice remains to be seen, but any move to increase the care spent in selecting equipment and designing treatment plants, is highly to be commended. If the plant at Golden leads engineers and owners to know before they build, it will rapidly yield in savings far beyond its cost.

The third, and, as we see it, most important use to which the new testing works is to be put, is the definite study of materials and processes. It is proposed to use it to stimulate the mining industry of Colorado and to secure better results in treatment. Here lies a wide field in which there can be no competition. Colorado is a state of widely varied resources, and from being a gold-silver state is fast becoming one famed for the diversity of its mineral production. The tungsten and vanadium industry, but recently developed, suggest the possibilities that lie in development of entirely new industries. Improvement of old methods is not less important, since in Colorado as elsewhere thousands of tons of minerals are annually wasted because present conditions or present knowledge do not permit the making of a closer saving. No radical change is to be expected, but gradually the skirmish line of science must be followed by advance guard of technology, that the heavy infantry of industry may conquer new fields. The State never misuses money when it adds to human knowledge, and such a plant as that at Golden, rightly used, is potential of untold benefit. It must, however, be used. It avails nothing to erect a building and assemble machinery unless men and funds be also supplied. But the first part of the task is accomplished, and the Colorado legislature about to assemble should make a definite annual appropriation in amount sufficient to assure full use of the equipment. We may differ as to details in the matter of the design and use of the new laboratory, but if it be made a Western Charlottenburg, the hopes of its founders and the wishes of its friends, among whom we count ourselves, will be justified.

Decanting of Slime

Proposals to revert to decantation for general treatment of slime in cyanidation, are atavistic. The first great step in successful treatment of slime was the application of filtration to the problem. Fine material may be treated by decantation, but filtration introduces notable economies. The reason, as also the limitation to successful application of decantation, is not difficult to see when the behavior of finely ground material in solutions is analyzed. There is more pore space in a fine mud than in coarse sand settled in water, but the spaces between individual solid particles are narrower. It follows that the channels or openings through the mass are smaller and more tortuous. The mass is less permeable, and to obtain the same rate of flow extra force of some sort must be given to the liquid material which it is proposed to pass through the mass of solid particles. In settled sands the open spaces are sufficiently large to permit gravity alone to pull solutions through the mass at a rate that makes commercial results possible in treatment plants. With slime, to obtain the same rate of flow requires a vacuum or pressure.

The proposal to obviate this difficulty by continuous agitation and decantation has been made many times, and plants designed on this plan are in successful operation treating finely ground material that is really a sand. In them the individual particles are kept freely floating, each completely surrounded by solution, and never allowed to completely settle. As a result, there are no pore spaces, and the particle rather than the mass becomes important. The plan is ingenious and there is a field for such treatment plants, but not, we believe, a universal one. The reason lies in the difference in specific gravity between sulphides and silicious particles. The very ores that most need sliming for successful treatment are those in which the gold and silver is locked in the sulphides. It is to release this gold and silver that the ore is slimed. In practical operation of treatment plants where concentrates are cyanided, it is universally true that the sulphides are found to require more time for treatment than the other material. The relations of the valuable to waste metal are closer and complete solution of the gold and silver is harder to obtain. In continuous agitation and decantation, the first particles to settle are sulphides, and with them goes much of the gold and silver. The result is that the material which should receive the longest treatment really escapes from the system first, and there seems no general way to avoid this without completely destroying the process itself. The old process of decantation is available for coarse material; continuous decantation can be used on coarse and finer material and is useful for taking off the richer solution before vacuum filtration. For slime the best treatment is by filtration, and it is worth noting that the old Australian method, not covered by patent as it happens, of pressure filtration with hand cleaning, is still used. Our New York contemporary sees in decantation the future of slime cyanidation. We hold that for general use it is a backward step, however helpful it may be in special cases or in combination with filtration.

The Rosario Cyanide Plant

By A. L. Sweetser

Twenty-five miles east of Tegucigalpa, capital of the republic of Honduras, and two miles west of the town of San Jirancito, is situated the surface equipment of the New York Honduras Rosario Mining Co., which is the largest producer in Honduras, if not in Central America. The property may be reached either from Puerto Cortez, on the Gulf of Mexico, by a six-day trip over mountain trails on muleback, or from Amapala over a wagon road requiring four days for a saddle animal and about three weeks for heavy freight. Considering the isolated situation of the mine and the difficult problem of freighting heavy machinery to it, the following brief description of a cyanide plant recently constructed there should prove of interest.

The site selected for the erection of the plant has a slope of 37°, thus facilitating the transfer of material by gravity.

TRAIL THROUGH LOWLANDS. RAILWAY STATION IN HONDURAS.

The foundations consist of concrete piers which are sunk in the hillsides to a depth of 20 ft. and securely anchored to bedrock. In order not to disturb the natural condition of the loose gravel above the bedrock, all the holes for the foundation piers were not dug at the same time. For instance, where a building required two or three rows of five piers each, the order in which these holes were excavated and then filled with concrete was 1—4—2—5—3. This method prevented the loose surface material from sliding and causing the disturbed gravel to creep, as might have occurred were all the holes excavated at the same time. On these concrete piers steel I-beams were laid, on which were placed the buildings, consisting of board floors and corrugated iron sides and roofs.

Wherever the building required a large floor space, the gravel of the hillsides was cut down and leveled. Then retaining walls of concrete were built along the back and sides. The angle of these walls is 67°, and they have a thickness of 4 ft. at the bottom, but taper off to 1 ft. at the top. The back wall is also reinforced by concrete braces, built at an angle of 35°. These vary in height and thickness, according to the height of the retaining wall. The composition of the concrete used throughout the construction was 1 cement, 3 sand, and 5 parts of stone. All the concrete was reinforced, during the pouring, by the insertion of old mine rails, pieces of cable, and scrap iron. The total consumption of cement in the construction was 15,000 barrels.

In addition to the mill, there are the following buildings: A general office which, in addition to other modern equipment, contains a printing plant for the production of the daily report sheets for the various departments and general notices; a large store-house and assay office, with latest appliances for facilitating rapid and accurate work; mechanical, electrical, and carpenter shops, and houses for the storage of lime, cyanide, and zinc. A central telegraph and telephone station connects all departments of the mine and mill with the general office, and also permits communication with all towns toward Puerto Cortez, on the Gulf of Mexico, and Amapala, on the Pacific, over a hundred miles distant. Dwelling houses, with well ventilated rooms, electric lights, toilet, and shower baths, and a large dining hall complete the number of buildings. A small ammonia ice-plant enables the cooks to serve some delicacies not often found in a mining boarding house. All the vegetables come from the company's farm, and all the lumber used in constructing the buildings and in the mine is produced in the company's sawmill from timber from the forest, 9 miles distant, also belonging to the company.

Cyanide Plant

The general exterior arrangement of the cyanide plant can readily be seen from the accompanying photograph of the same, and the interior arrangement of the ore dressing machinery is shown by the flow-sheet.

Flow-Sheet

1. Fairbanks-Morse scale.
2. Tipple.
3. Grizzly.
4. 2 Gates crushers, type K 4.
5. 1000-ton ore-bin.
6. 20 1850-lb. stamps; four batteries of five each.
7. 2 Dorr classifiers.
8. 2 Allis-Chalmers tube mills, 22 by 5 feet.
9. 1 Dorr classifier.
10. 1 tube-mill to complete sliming of pulp.
11. 2 settling tanks, 10 by 20 feet.
12. Screen on which cyanide and lead acetate are dissolved by solution.
13. Pachuca tanks, 15 by 45 feet.
14. 2 storage tanks, 10 by 20 feet.
15. 2 Merrill filter-presses; capacity 220 tons.
16. 2 strong and weak-solution tanks, 10 by 15 feet.
17. Zinc-dust precipitation.
18. Refinery.

Operation

The ore, as delivered at the mill, averages about 25 oz. silver and 0.46 oz. gold per ton. In addition to these metals the ore also contains copper, lead, iron, and antimony in small quantities. The stamps are in separate battery units, so that when it is necessary to make alterations, or repairs, only one battery of five stamps is hung up at a time. Each stamp weighs 1850 lb., drops 100 times per minute with a fall of 6 in. The stamp-duty is 10 tons per stamp per day, thus making the mill capacity of 200 tons daily, although an excess of 20 tons has frequently been treated. The ore is mixed with lime, in the bin, by means of wooden chutes from the crusher floor. Each battery is fed by Challenge feeders and the ore is crushed in the strong cyanide solution from the Merrill presses, which is pumped from the precipitation house by means of two Aldrich triplex pumps (10 by 10 in.) to storage tanks above the mill, whence it flows by gravity. The weak solution, similarly pumped, is used as a wash for the Merrill presses.

On leaving the settling-tanks the solution and pulp flow over a screen on which is placed the required amount of cyanide and 50 lb. of lead acetate. From repeated tests during the six months the mill has been in operation an average of 500 lb. of cyanide is required for each Pachuca tank of pulp. The pulp in the Pachuca tanks is agitated by means of compressed air supplied by an Ingersoll-Rand duplex compressor, 5 cu. ft. of air being furnished to each tank. The amount of sluicing water, used to remove the cakes from the filters, per ton of dry slime treated is about 4½ tons; the ratio of wash solution per dry ton of slime is 2.9 to 1.

Precipitation is accomplished by means of zinc dust agitated by compressed air. An extraction of 91 to 96% is obtained and the difference between the theoretical and the actual extraction is less than 1%. The press precipitate is melted into bars which average in weight about 125 lb. These are shipped to Perth Amboy, New Jersey.

ROSARIO CYANIDE PLANT, SAN JUANCITO, HONDURAS.

Electric Power

All of the mill machinery is motor-driven. General Electric induction motors, 60 cycles, are principally used. The Gates crushers are driven by 25 hp. form K motors, using 6.6 amperes and a 75-hp. form M motor, using 20.5 amperes, drives each tube-mill. For the pumps 25-hp. motors are used, 2 hp. for the Dorr classifiers, and 15 hp. for the filter-presses.

The present system of electric power dates back ten years, when the first electric plant was installed. From this time the electrification of both mine and mills has proceeded rapidly, until now there are two hydro-electric generating stations, furnishing 6600 volts and supplying 50 motors, having an aggregate capacity of 2100 horse-power.

The water, furnishing the initial power, is taken from the San Juancito and Escobales rivers, and conducted in a wooden flume 3½ miles to a point 1355 ft. above the town of San Juancito, whence it descends in a spiral-riveted, iron penstock, made with expansion joints to provide for changes in atmospheric temperature. The water pressure of 520 lb. per square inch acts on Pelton water direct connected to 6600-volt generators. The Guadalupe generating station is three miles below the town and utilizes the water escaping from the San Juancito spillway. Each station can, if necessary, carry the entire working load at a slightly diminished efficiency. The service is practically continuous, there being a demand on the power system at all hours. Electric power is transmitted to the sub-station at the mill, 2 miles distant, whence it is distributed throughout the mill, mine, repair-shops, assay office, and lighting system.

The average demand of the mill is approximately 450 hp. and that of the mine 600 hp. At the mine there are two 800-hp. air-compressors, producing 2000 cu. ft. of air for drilling purposes, and also six 5-ton General Electric mine locomotives which gather the ore on the different levels of the mine. It is sent to the adit-level and later to the mill, two miles distant. The mine has been in operation over thirty years and the underground workings now amount to 60 miles. The trackage of 35-lb. rails and 2½-ft. gauge is being laid through the mine as rapidly as possible to facilitate the transportation of ore to the mill and the workmen to the various stopes.

All the machinery in the mill is direct connected to motors. The stamp units are belt-connected to a counter shaft driven by motors, which are in duplicate in case one should be out of commission. All wiring is in iron conduits and the lighting service at the mine, mill, on the surface, and in other buildings consists of 800 Mazda incandescent lamps and 25 arc lights. On the battery-floor of the mill carbon filament incandescent lamps are used, because the vibration due to the impact of the stamps causes a large breakage in the case of metallic filament lamps.

The American Cyanamide Co. of Niagara Falls, Ontario, is making extensions to its plant, which, when completed, will cost about $500,000 and will more than double the present capacity of the concern. The company is engaged in the manufacture of atmospheric nitrogen by the Frank and Caro process, the power being derived from Niagara Falls. During 1910, at the beginning of which year the company commenced the manufacture of cyanamide, the exports of cyanamide to the United States were valued at $211,200, while during 1911 these exports had increased to $338,775. The exports for the current year are expected to be much greater, making the additional plant necessary to keep pace with the growing demand.

A strong Johannesburg syndicate has been formed to work a promising occurrence of cassiterite on the edge of the Chishawasha valley to the east of Salisbury. T. R. Williams, formerly consulting metallurgist to H. Eckstein & Co., is busy investigating the treatment of the material. A large tonnage is already partly proved and there is talk of erecting a compressor plant with a view to expediting development.

Precious metal produced in Dutch Guiana during 1911 amounted to 30,713 oz., which is 4061 oz. less than the output of the preceding year. This production was obtained by means of hand work by 'pork-knockers' (individual prospectors) and a few companies.

Evolution of an Electrolytic Refinery—I

By Harold French

Most depositors of bullion at the San Francisco Mint, after they have paid their melting, parting, and refining charges, deductions averaging about ⅛c. on the dollar, are interested to know how the silver and gold are separated from the base alloy preparatory to coinage. The public owns several Federal refineries which operate upon nearly $100,000,000 worth of crude bullion each year. It is of importance to know how this work is conducted, whether or not it is managed with a due regard for efficiency and economy, and with studied efforts to improve this service for the benefit of producers of precious metals, whose interests the mints and assay offices are intended to promote. The impression prevails in many quarters that most government work is done in a more or less wasteful haphazard fashion, and that little attention is paid to 'taking up the economic slack.' That this has not been the case in the Mint and Assay service during the last decade is demonstrated by the many marked improvements in the processes of parting and refining at the several Federal plants.

Parting with HNO_3

Only within the past few years have the mint metallurgists discontinued the time-honored process of parting bullion with boiling acids and adopted the more up-to-date electrolytic system of separation. Although these older methods are no longer employed by the Government, they are still in vogue at some private refineries, for economic reasons which will be explained later in a comparison of the results obtained by the selection of processes most suitable for varying grades of bullion. An exposition of the former operations of the Mint parting plants may seem like a retrospect of ancient history, but the fact that the acid treatment is extensively employed in commercial work makes it of present interest. Occasionally an assayer is required to refine bullion on a small scale for the purpose of producing metals, and modification of the processes below may be resorted to with satisfactory results.

In the acid process it is importaant to carefully select crude bullion as free as possible from tin, antimony, bismuth, arsenic, and iron. If these impurities amount to more than 20% of the alloy they yield oxides, either insoluble or nearly so, which form a pasty coating over the surface of the metal and protect it from the attack of nitric acid. Whenever these metals are present in sufficient quantity to retard operations, it is necessary to fuse the base alloy in crucibles with nitre or ammonium chloride. At one time $HgCl_2$ was stirred vigorously into the molten mass to expel volatile chlorides of these objectionable constituents, but its use was later abandoned. Extremely base bars were set aside for the sulphuric acid treatment, providing that they did not contain much lead or copper. The presence of copper was always welcome in alloys which were to be dissolved in nitric acid, as each part reduces the amount of silver that had to be added to the gold in order to render the alloy soluble. At first, from 2.75 to 3 parts of silver-copper-lead alloy were added to each part of gold. Of this, the greater part was silver, but the more copper the bullion contained the more rapid was solution. Although the consumption of nitric acid increases with the percentage of copper present, the saving in time effected was deemed more advantageous. Experiment led to the eventual reduction of the alloy of silver and copper to 2⅓ parts to one of gold.

Formerly the alloy was dipped from the crucible and poured with a circular motion into a galvanized iron tub of water, where it cooled in the form of granules, but in late years more satisfactory results were obtained by casting the metal into slabs 1 ft. long, 3 in. wide, and ⅓ in. thick. In this form the bullion while digesting would not pack into a sticky mass. The parting was performed in a 'corroding-house,' a rectangular structure, provided with sliding doors, and covered with a hood connecting with the flues. About 3 ft. above the floor 12 compartments were built within the enclosure, arranged in two rows of 6 each. In each of these rested porcelain crocks 21 in. diam. and equally deep, surrounded by water, which was rapidly brought to the boiling point by the introduction of steam through an injector. Into each of these was placed a charge of 175 to 200 lb. of granulated alloys or slabs, covered with an almost equal weight of strong commercial HNO_3. In an hour the violent action had somewhat subsided, then steam was turned into the water bath and the crocks were kept boiling gently for 6 hours, when the greater part of the silver and the base metals had passed into solution. The gold remained in the form of a lumpy clay-like residue.

Water was then added to dilute the strong solution of nitrates, and after the subsidence of the suspended particles, the liquid was siphoned off into wooden tubs and emptied into the silver precipitation tank. Fresh water was again added to the crocks, and the contents vigorously stirred, allowed to settle, and the liquid again siphoned off and disposed of in a similar manner. The crocks were again filled with concentrated nitric acid, boiled, and stirred at frequent intervals for the greater part of another working day. This second charge of acid was saved and used on the next batch of granulated alloys or slabs, while the residual gold was repeatedly washed, first by decantation and finally by filtration through cotton cloth. The remaining 1 or 2% of silver and base metal was reduced to a trace by transferring the pulverulent gold to cast-iron pots and boiling with concentrated H_2SO_4 for several hours. This solution was then ladled off, the gold dumped into wooden tubs, and washed with hot water, until the soluble sulphates had been removed by repeated decantation. The almost pure gold was then placed in a movable tank, fitted with a perforated false bottom, over which rested a filter-cloth. Hot water was run continuously through the filter until the contents were 'sweetened.' The gold was finally air-dried in an oven over a slow fire, transferred to crucibles in which it was toughened, if necessary, by oxidizing fluxes, skimmed with semi-fluid bone-ash, and melted into bars of bullion, ranging from 996 to 998 in fineness.

The solutions from the crocks, together with the wash-waters, were emptied into a large wooden tank. Salt was thrown in, forming thick curdy silver chloride which required most vigorous stirring until all of the silver had been precipitated. Care was taken to avoid an excess of salt, on account of the slight solubility of silver chloride in sodium chloride. After the precipitation had been proved complete by testing with a few drops of HCl in a sample of the clear solution, the liquid was siphoned off, and the thick silver chloride was scooped into filters lined with cloth and mounted on trucks. Hot water was allowed to percolate through the mass on the filter until the soluble base chlorides were removed. The nearly pure silver chloride was then transferred to a rectangular, lead-lined tank, in which granulated zinc was added for the purpose of reducing the silver to its metallic form, according to the simple formula,

$$2AgCl + Zn = 2Ag + ZnCl_2$$

A pitcher or two of H_2SO_4 was added to remove the undissolved lumps of zinc remaining after the chemical action had diminished. The reduced silver was then shoveled with copper scoops into the movable filters and thoroughly 'sweetened' with hot water. The finely granular metal was next placed in a cylinder where a powerful hydraulic press squeezed most of the moisture out of the mass and left it in the form of a cake, which, after being completely dried in an oven, was ready for melting. The final drying was formerly done over a wood furnace, but a steam-drying apparatus has been found to be a more rapid and economical method. The cakes were laid upon shelves of steam pipe

and in a couple of hours were fully desiccated. The resulting silver bars were comparatively free from objectionable base metal and usually assayed between 998 and 999 fine.

The H_2SO_4 Process

The high cost of operation weighed heavily against the HNO_3 process. Not only was the initial cost of HNO_3 high, but it was consumed without yielding any marketable by-product. Sulphuric acid could be purchased for as low as ¾c. per pound, while HNO_3 ranged from 10 to 12c. per pound. Another disadvantage of the nitric acid process was the high cost of zinc which was used to decompose the silver chloride, which, as well as the copper contained in the crude bullion, was run into the sewer at a considerable loss to the Government. The manufacture of copper sulphate as a by-product at the end of the H_2SO_4 process proved so profitable to the Government, that this method early superseded the older one. Base bullion containing a considerable quantity of lead and copper had to be subjected to the nitric acid treatment, since when the copper present exceeded 7% the basic sulphate was formed, which, being almost insoluble in boiling H_2SO_4, coated the bullion and greatly retarded the solution of the metals alloyed with the gold. The formation of lead sulphate was similarly objectionable.

To reduce the cost of refining operations, the Government installed complete sulphuric acid parting plants at the Mints. The history of the San Francisco refinery and its numerous improvements serves as a good example of practice. A long room on the west side of the building was used for boiling the auriferous alloy and precipitation of the silver, while a room 41 by 52 ft. contained the filter tanks, in which the precipitate was 'sweetened.' The floors were covered with a thick coating of asphalt, which, being impervious to acid, was readily cleaned whenever solutions were spilled. Underneath each chimney two large cast-iron kettles were placed over a coal-fired brick furnace. The fumes were carried to the stacks through hemispherical hoods resting upon the kettle. Later improvements led to the use of a Roessler condenser, which effectively eliminated the disagreeable vapors of SO_3. Granulated metal slabs containing 2 to 3 parts of silver to 1 of gold were placed in these kettles, and H_2SO_4 in sufficient quantity to effect its decomposition was added. Three parts of silver to one of gold permitted the best rate of solution. Larger quantities of silver were found to be detrimental, as the gold was left in a more finely divided state, and the particles suspended in the heavy solution were difficult to settle. Occasional slight losses occurred when the proportion of silver was too high. During the last few years of the sulphuric acid operations, the superintendent of the refinery reduced the alloy of silver to an average of a little over 2¼ parts to 1 of gold. While the silver did not then dissolve so rapidly, the gold was recovered in a more easily collectible form, and the consumption of acid was less, with a corresponding decrease of labor and reagents. As a rule, the workmen were employed throughout the year, and time was not so great an object as it is now. Occasionally, when deposits suddenly increased, as during the bonanza years of the Klondike, the proportion of silver was raised, so that the parting could be rushed.

Generally, about 600 lb. of alloyed metal was the charge of each kettle, and usually two were run together. Out of the total of 1200 lb. which was parted each day, from 300 to 360 was fine gold. In terms of Troy weights, this would equal from 4375 to 5260 fine ounces per day, valued at an average of nearly $100,000. Allowing 11 months of 25 working days per year, the old refinery could turn out $27,500,000 each fiscal year. A typical run was made in 1900-1, when its output reached $27,637,869.74 in gold and $5,277,047.92 in silver, a total of $32,914,917.66. With four kettles at full boiling, 10,000 oz. of gold could be turned out per day, together with nearly 25,000 oz. silver. But as most of this silver was used over and over again in the method of inquartation, the net production of silver used for coinage or sold as 'mint fine bars' was much less, the remainder being 'locked up' in the process until accounted for in the annual settlement. The same consideration applied to the HNO_3 process.

To each charge of 600 lb. of metal, about a ton of H_2SO_4 was added. Formerly the refiners dipped this dangerous liquid into the kettles, receiving many an ugly burn. Later 1600-lb. drums were handled with great risk on an elevator and brought to the side of the kettles, where they were lifted by a chain block to a height sufficient to siphon their contents into the kettle by means of a bent iron pipe. As the acid used was 66°B., these siphons were always started by filling with the same liquid, as the effect when water is suddenly added to strong H_2SO_4 is well known. In 1905 this cumbersome manner of manipulating these heavy drums was abandoned. A sump was sunk in the street into which the drums were dumped and the acid was elevated by compressed air to a tank in the loft between the chimneys. The gold boilers drew the acid for their kettles through pipes leading downward from the storage-tank, and regulated its flow by convenient stop-cocks.

Early each afternoon the kettles were charged with metal and acid. The gold boilers started fires beneath them, and watched the boiling carefully, retarding it with cold acid or lowering the heat if the action became too violent, so as to prevent an overflow. At the close of the day's work they would leave the locked kettles in the care of the Mint watchmen, who would replenish the fires at intervals during the night. By the next morning the slabs of alloy had been reduced to a pasty mass of brown gold submerged in a greenish-white solution of silver and base sulphates. From 30 to 50 gal. of fresh acid per kettle was added, and the sticky mass stirred until the gold remained in a granular form, with occasional lumps of undissolved alloy. The fires were allowed to die out, the solution cooled slightly, and the suspended gold allowed time to settle.

Two rectangular tanks, 18 ft. long, 5 ft. wide, and 3 ft. high, covered with a sloping roof of sliding doors and lined with heavy sheet lead, adjoined the gold-kettles. Slabs of copper 2 ft. long, 1 ft. wide, and 1 in. thick lay on the bottom of each tank or stood against its sides. Fresh water, as free from chlorine as possible, half filled the tanks. The hot solution from the gold-kettles was siphoned into these tanks of water. As its temperature exceeded 600°F., steam was generated with almost explosive violence. Crystals of pure silver sulphate formed upon the copper, giving a milky color to the water as some of the silver sulphate dissolved. A quadruple coil of lead pipe lay in the bottom of the tank, through which steam was passed to keep the solution at the boiling point, effecting more rapid precipitation of the silver by the copper. About seven years ago steam injectors were found to heat the silver solutions more rapidly, besides offsetting much of the evaporation by condensation of part of the steam. The solution was repeatedly agitated until tests with salt showed no traces of silver—usually after nearly two days' boiling. It then contained about 300 lb. copper and nearly 3000 lb. of H_2SO_4, for the most part free. This was well worth saving, but until 1901 a large part of it was permitted to run into the sewer at a heavy loss to the Government.

After the silver and base sulphate had been siphoned from the parting-kettles, the residual gold was ladled out into four small cast-iron pots, in lots of about 100 lb. apiece. The next morning these were placed over cylindrical furnaces, coal-fired, and boiled for four or five hours with concentrated H_2SO_4. About six 1-gal. pitchers of acid were added every hour until 1 o'clock, the previous charge having been removed. In later years the base metal was more readily extracted by stirring nitre into the boiling acid. When the last boiling bath became less turbid, indicating that only a fraction of 10% of silver or base metal remained, the solution was ladled and drained off, and the gold dumped into a wooden tub fitted with a cover. The nozzle of a hose was inserted through the top and hot water played upon the gold, the temperature of which was three times as high. The clouds of steam which were evolved were conducted upward through a

chimney. The metal had to be stirred carefully with wooden paddles to reach the highly heated core, so as to prevent loss caused by the spattering which would result if the metal came in contact with cooler water during washing in open tubs. "Taking the fire out of the gold" was the term the workers applied to this stage of the operations. It was finally washed by repeated decantations and filtration. After drying and melting, the gold was cast into bars assaying 996 to 999 in fineness.

The silver was recovered in two forms; 95% of it as granular metal from the precipitation-tanks where the silver sulphate had been reduced by copper. This was shoveled into the filter-cars, in which it was removed to the washing room. After thorough washing in hot water it became a mass of fine clear crystals. A pressure of 40 tons, exerted by a hydraulic cylinder, moulded the silver into cakes, which were melted as described. After boiling the gold a second day in the small pots, the remaining 5% of silver was removed and carried into a cast-iron receptacle on a truck to the 'sulphate tank.' The building of an overhead trolley in 1904 greatly facilitated the handling of this disagreeable liquid. Salt was added to the solution of silver sulphate, precipitating it as the chloride, which subsequently was reduced by zinc and sulphuric acid as previously described.

In 1901 more attention was paid to the recovery of copper, which hitherto had been largely wasted. The solution, free from silver, was siphoned from the precipitation-tanks in the refinery, down to a series of lead-lined vats in the interior court of the Mint. On the bottom of these, lead coils carried steam through four loops of pipe, which quickly brought the copper sulphate solution to the boiling point. This liquid averaged 26°B. at the beginning. Until 1901 this solution was boiled a few hours and siphoned into lead-lined crystallizing tanks at about 33°B. This insufficient concentration caused a meagre crop of crystals to form upon cooling, and most of the copper remained in the solution, which was then passed over iron. As this became coated with a little copper, action on the rest of the cupric sulphate ceased. In this way much of the copper was neither recovered as bluestone nor in the form of cement-copper, but was run down the sewer. This waste was almost entirely checked by changing the methods. The solutions were boiled until late in the afternoon, allowed to stand over night, warmed in the morning, and then siphoned off at gravity of 40°B. Large masses of crystals formed on the sides of the tanks and upon rows of sheet lead hung a foot apart on iron rods. After 8 or 10 days the mother-liquid was drawn down into several new tanks, where scrap iron readily precipitated the copper which had not crystallized. Baskets made of copper wire held this iron suspended in the solution, so that it did not pack on the bottom but presented a greater surface to the acid. The introduction of steam injectors heated the solutions so as to hasten the precipitation of the copper as well as causing the almost complete dissolving of the excess of iron. The first crop of crystals of copper sulphate were redissolved in a tank of boiling water, then drawn off at 30°B. into 7 finishing tanks, where the pure crystals formed. These were washed free of impurities, dried over a steam-heated lead floor, barreled, and sold as 'bluestone', $CuSO_4.5H_2O$; 4 lb. of this contains 1 lb. of copper and nearly ½ lb. of H_2SO_4. The average cost of materials and labor was 4 to 4½c. per pound, while the bluestone sold at a profit of about 1c. per pound. In six years nearly $25,000 was saved to the Government by the care taken in recovering this copper, which would have been wasted if the older methods had been continued. The sale of bluestone not only repaid the cost of the copper used in precipitating silver, but returned a considerable fraction of the amount paid for sulphuric acid. Frequent improvements had reduced the cost of refining the average grade of gold bullion received by the San Francisco Mint to less than 3c. per ounce, which was more than made up by the parting charges alone. There seemed to be no further progress possible in the development of this process, and the Government therefore decided to experiment with the electrolytic methods of separation.

Experimental Investigations

Toward the close of the nineteenth century, technical requirements necessitated purer grades of metals than the acid-parting plants could economically produce. The older methods of treating metallurgical products by smelting and refining had nearly reached their maximum efficiency. Accordingly, chemists who sought a more satisfactory system of separation turned their attention to electro-metallurgy. Although this science was developed early in the nineteenth century by the researches of Davy and his disciple, Faraday, its practical applications were limited to the deposition of metals from their solutions by feeble currents generated by galvanic batteries.

In 1867, when Siemens and Wheatstone invented the dynamo-electric machine, the new era of electrolytic separation began. The utilization of mechanical energy for the purpose of generating continuous currents at steadily decreasing cost facilitated the use of electricity in metallurgical work. Within the next few years, Elkington succeeded in separating silver from copper by suspending bars in a solution of copper sulphate, electrolyzing the solution, and depositing pure copper on cathodes of wrought copper; the silver settled to the bottom and was recovered in the form of slime. Further improvements by Kiliani in 1884-5 fully established this process of refining blister copper, which has become universal practice for all except copper from Lake Superior.

E. Wohlwill, manager of the North German refinery, began experimenting in 1871 with the electrolytic separation of doré bullion. During the next four years he employed Gramme electric machines to supply current for decomposing an electrolyte of silver sulphate dissolved in hot sulphuric acid. Anodes of crude silver, containing a small percentage of gold, were rapidly decomposed, the silver being deposited upon platinum cathodes and the gold settling to the bottom. Wohlwill experienced so much difficulty in preventing the silver from falling from the cathodes and in checking the mechanical inclusion of particles of finely divided gold in the deposited silver, that he was compelled to abandon his interesting experiment.

In 1884 the Moebius system of refining doré bullion by electrolytic dissociation was devised. This process consisted of suspending anodes of silver-gold alloy in a weak solution of HNO_3 and electrolyzing. The gold was recovered in bags encasing the anodes, while the silver deposited upon sheets of fine metal. Recently a slowly moving endless belt of sheet silver has been substituted for vertical cathodes. As the crystals of silver formed upon these belt cathodes they are conveyed out of the tank to brushes which remove the fine metal mechanically. The gold was further purified by boiling with nitric acid in porcelain pots. So successful did this process prove that a large Moebius installation at the American Smelting & Refining Co. plant at Perth Amboy, N. J., produced 24,000 oz. of fine silver per day in 1895. According to Mr. Borchers, the cost of refining, the actual materials, labor, fuel, and interest were reduced to ⅛c. per ounce. Overhead charges were not considered. The Moebius process was found to give excellent results at a number of plants where base metals such as antimony, arsenic, sulphur, selenium, tellurium, bismuth, copper, and lead had been largely eliminated by oxidation in cupelling the bullion.

Early in the nineties the melter and refiner of the Philadelphia Mint, D. K. Tuttle, introduced the Moebius system at that institution with gratifying results. Gold was inquarted with silver and melted into slabs 18 in. long and 10 in. wide. These were hung from copper bars in solutions containing 1% of HNO_3 and a little larger quantity of silver and copper nitrate. Twenty-one of these anodes were connected in multiple with 28 cathodes of sheet silver, and a current of 180 amperes at 90 volts passed through the electrodes. As the anodes decomposed during electrolysis the silver deposited upon the cathodes, while the gold, containing about one-tenth its weight of unparted

silver and insoluble base compounds, was held in muslin bags, and so removed when the operation was finished. A series of brushes moved by machinery scraped the depositing silver from the cathodes down to a submerged tray of cotton cloth which was removed at intervals. These operations were continuously conducted in 10 tanks of redwood, each being divided into 7 cells. The tanks were connected in series and the electrodes were wired in multiple. This plant produced 33,000 oz. of fine silver per day.

However well the Moebius process, and its modifications by Balbach and other electro-metallurgists, effected the economical and rapid refining of silver, the subsequent treatment of gold residue by boiling acids was deemed a drawback. A way of winning the gold directly by electrolysis had to be found. Wohlwill, who had first attempted to electrolyze doré bullion in a sulphuric acid solution of silver sulphate, turned his attention to the deposition of gold from the trichloride. He found that the fundamental principle of parting crude gold bullion electrolytically was the discriminating property of gold in uniting with nascent chlorine in the presence of free hydrochloric acid to form hydrogen gold chloride ($AuCl_3.HCl$) or $HAuCl_4$. This complex gold anion migrates to the cathode where the dissociating force of the current evolves hydrogen, reduces gold, and forms hydrochloric acid, as shown by the equation

$$HAuCl_4 + 3H = Au + 4HCl$$

Electrolytic deposition of gold from cyanide solution in the Siemens-Halske process led to the conclusion that it could also be recovered from chloride solution. During the nineties, Wohlwill evolved his process. He found that bullion containing 93 to 94% gold could be economically refined by passing a current of comparatively high density through anodes of this alloy suspended in a warm solution of gold trichloride, mixed with about 5% of free hydrochloric acid.

Several conditions were essential to the successful operation of this process. If the silver present exceeded 5%, its chloride formed a protective coating over the surface of the anode which retarded decomposition in proportion to its presence in the crude gold alloy. Porcelain tanks were used as the parting vessels, heated over a sand-bath to a temperature of about 65°C. Current densities of 80 to 140 amp. per sq. ft. were passed through the cathodes of sheet gold; the higher the current density, the more loose and spongy the deposit. With a high current this difficulty was diminished by the addition of more gold chloride and hydrochloric acid to the solution. From 25 to 60 gm. of gold per litre of electrolyte was maintained by periodic replenishment with auric chloride. When the current density was lowered, Wohlwill discovered that increasing proportions of monovalent gold chloride were detached from the anodes and dropped into the slime. Experiments showed that the percentage of gold which dissolved at the anode but failed to deposit upon the cathode varied inversely with the current density. This had to be regulated with care to prevent the simultaneous deposition of base metal from soluble chlorides or the mechanical loss of gold from the cathode by the sloughing off of a too spongy deposit. Fragments of gold and aurous chloride dropping from the anodes, together with the tops, which hung above the solution, aggregated from 10 to 15% of the original weight of each anode which had to be recovered, remelted, and again refined. Silver settled for the most part as chloride into the slime, which was treated with zinc and sulphuric acid in separate tanks. Lead and other soluble chlorides remained in solution, particularly the platinum metals whose ready recovery was an advantage of this process.

A Wohlwill plant was built at the Philadelphia Mint in 1902. The results proved highly satisfactory, and the refinery produced gold of 999.8 fineness and silver almost 1000 fine. Copper contained in the crude alloy was recovered as fine electrolytic metal and used for coinage, while a notable recovery of platinum, iridium, and palladium was effected. D. K. Tuttle, in 1902, in reporting his progress with this process, said: "The ideal refining plant would be one where two classes of bullion could be treated separately, blending to make up material for the anodes; one lot containing silver plus as much gold as could be worked by the Moebius process, the other being high-grade gold bullion for the gold trichloride system." After describing the low cost of generating the required current, he concluded: "Thus the energy of a few bushels of coal does the work of a dray of expensive acids." The deposition of 1 oz. of gold consumed but 10 watt-hours of electricity, and the equivalent weight of silver was carried to the cathode at a cost of 13.5 watt-hours. In the silver system a current density of from 20 to 25 amperes per square foot gave the best results.

(To be concluded.)

Analysis of White Metal

A systematic outline of procedure for the analysis of white metal containing copper, antimony, tin, lead, iron, and zinc is given by R. Kopenhague in *Ann. chim. anal.*, 17, 241-3. Two grams of alloy is treated with 30 c.c. of HNO_3 (800 c.c. HNO_3 plus water to make 1 litre) in a porcelain casserole, boiled and evaporated to dryness on sand bath; take up with 20 c.c. of HNO_3, letting stand in the cold for some time; add 25 c.c. NH_4NO_3 solution (120 gm. per litre) and boil for 10 minutes, cool, filter, and wash (wash solution: HNO_3 40 c.c., NH_4OH 30 c.c., water to make 1 litre). The precipitate contains stannic and antimonic acids with traces of Cu, Pb, and Fe; solution contains Cu, Pb, Fe, and Zn. Precipitate is washed into a conical 500 c.c. flask, a strong excess of NH_4OH added and H_2S passed through mixture. The $(NH_4)_2S$ formed dissolves the Sn and Sb; after standing, filter on paper used with SnO_2 and Sb_2O_5, wash with dilute solution of pale yellow $(NH_4)_2S$. The precipitate of CuS, PbS, and FeS on the filter is dissolved in a little HNO_3 + Br, Br expelled, and solution added to the first filtrate. The alkaline solution is evaporated to dryness on sand bath, taken up with 100 c.c. of $KClO_3$ solution (50 gm. per litre), 35 c.c. concentrated HCl added and evaporated to dryness on water bath. Take up with 8 c.c. HCl, 150 c.c. water, and 25 gm. $(NH_4)_2C_2O_4$, heat to boiling, transfer to conical flask, and pass H_2S into solution for 2 hours, keeping temperature at 95°. Sb_2S_5 precipitates with a small amount of CuX dissolved by the $(NH_4)_2S$, Sn remains in solution. To the almost boiling liquid add a little $(NH_4)_2SO_4$, shake, filter rapidly, and wash with a saturated solution of cold $C_2H_2O_4$ charged with H_2S and containing $(NH_4)_2SO_4$ and HCl; precipitate is put in beaker and treated with 20 c.c. of a 15% solution of KOH in alcohol; heat on water bath till sulphides blacken, and filter; all of Sb_2S_5 is in KOH solution; it is re-precipitated by HCl in very slight excess and filtered off; wash with hot air-free water; re-dissolve in HCl plus a little $KClO_3$, evaporate to dryness on water bath, take up with HCl and water; add 5 c.c. of 40% KI solution, 5 c.c. of CS_2, and titrate with $Na_2S_2O_3$ (41.33 gm. per litre − 1 c.c. = 0.01 gm. Sb). The Sn solution is boiled and electrolyzed. The solution containing Cu, Pb, etc., is heated to fumes with H_2SO_4 and Pb determined as $PbSO_4$. To the filtrate from the $PbSO_4$, add 20 c.c. concentrated HCl and dilute to 350 c.c., boil, and precipitate CuS with current of H_2S, filter, oxidize filtrate, and precipitate Fe with NH_4OH, filter, re-dissolve $Fe(OH)_3$, and determine iron volumetrically. Filtrate from $Fe(OH)_3$ is acidified with HCO.OH, made feebly alkaline with NH_4OH and the Zn precipitated with $(NH_4)_2S$; filter, ignite, and weigh as ZnO. To determine Cu, treat 2 gm. of alloy with 50 c.c. HNO_3 (1:1), heat to expel nitrous vapors, dilute to 300 c.c., and electrolyze; the Cu is re-dissolved in 10 c.c. H_2SO_4 + 20 c.c. HNO_3, diluted to 300 c.c. and electrolyzed; the Cu is re-dissolved in 10 c.c. H_2SO_4 + 20 c.c. HNO_3, diluted to 300 c.c. and again electrolyzed and weighed. Results on alloy made in laboratory showed excellent agreement.

Cerro de Pasco copper production for August passed the 3,600,000-lb. mark.

Wolframite in Portugal

By F. Bronckart

General Aspect of the Wolframite-Bearing Zone

*A granulite-schist massif occupies the northern region of Portgual which is bounded on the south by the Tagus, on the southwest by a tolerably straight line joining the confluence of the Rio Ocreza and the Tagus with Oporto and passing through Coimbra. In this region only are cassiterite and wolframite found in Portugal. The parent rock of tin is the granulite, and wolframite is one of the minerals associated with the cassiterite.

Generally speaking, the whole region is mountainous, but north of the Douro the country becomes more markedly broken. There a veritable labyrinth of mountains exists, the rounded tops of which attest their granitic formation and the action of long-continued erosion. On

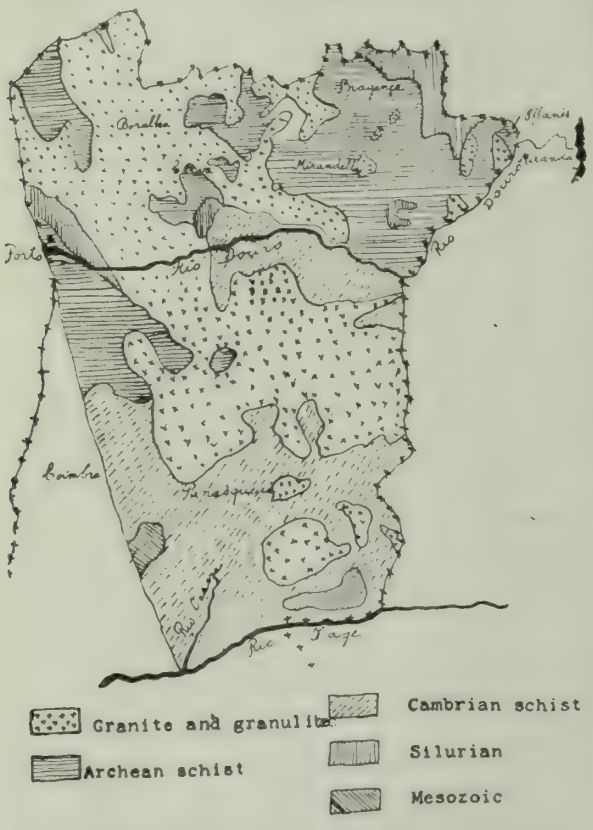


Fig. 1. Geological map, part of northern Portugal.

the west the mountains are cut by deep erosional valleys, but beyond the Rio Tamega, which separates Entre Minho and Douro from Tras os Montes, the county changes, the valleys become less deep, the schists, rare elsewhere, increase more and more, and beyond the peaks of Mogadouro the sad and monotonous, slightly undulating plain seems to stretch over the Spanish frontier into the plateau of Castille lying below, which was leveled in the Tertiary period.

Subdivisions of the Wolframite-Bearing Zone

The granulite-schist region may be divided in accordance with both its physical and geologic characteristics into three distinct zones:

The zone south of the Douro.—This fairly mountainous zone is formed by a granulitic massif almost completely surrounded by Cambrian schists. It includes deposits of cassiterite and wolframite, in some of which one mineral occurs alone, and in others they occur together. One of the wolframite deposits, that of Panasqueira, is worth mentioning here, because, situated in the schists and graywacke at a considerable distance from the granulites, it is unique in Portugal.

The zone northwest of the Douro.—This is an extremely mountainous zone. Almost everywhere the granulite outcrops, erosion having left only a few outliers of Archean schists. This zone is the richest of the three in wolframite-bearing veins. The latter are found everywhere in the contact of the schists and granulite, the mineralization seeming richer, however, in the granulite than in the schists. Cassiterite is found, either alone or accompanied by wolframite. The deposits of Boralha are by far the richest known in Portugal today. Those of Cerva, however, are also noteworthy and I shall have occasion to refer to them later.

The zone northeast of the Douro.—This zone, which is very hilly in the western part, develops toward the east into a plateau. Here the Archean schists cover the granulite almost everywhere, the latter showing only in a few outcrops. In the environs of Braganza, Mirandella, and Miranda do Douro, and in fact nearly everywhere, we find stanniferous veins with or without wolframite, at the contact of granulite and schist. Those in the environs of Miranda do Douro are well known as the Zamora deposits. In this zone few mines carry wolframite alone. There is one, however, at Iffanés, in which the wolframite shows a greasy lustre not common elsewhere, and which reminds one of the cassiterite of the region. The latter is found nearly everywhere in the vicinity.

Fig. 2. Shrinkage cracks and ore-shoots.

Minerals Accompanying Wolframite

In Portugal, as throughout the Iberian peninsula, wolframite is found in quartz veins either alone or accompanied by cassiterite and almost always by pyrite, chalcopyrite, mispickel, and galena, and in many places also by tourmaline and fluorite. In very rare cases scheelite and tungstic acid are associates. I have found scheelite and tungstic acid only in the extreme east of the country, in the region of the classic tin deposits of Zamora, on top of a plateau cut in the schists. I have never found them in the mountains, which tends to prove that tungstic acid and scheelite are products of the superficial alteration of wolframite. Under such conditions they cannot be formed in the mountains where the waters do not stagnate and where they erode too swiftly to allow decomposition products to accumulate. Tourmaline is found everywhere—in the granulite, in pegmatite veins, and in veins of greisen and quartz.

Trend and Mineralization of the Veins

The wolframite has crystallized in stockworks, in vertical veins, fractures which are tolerably regular and relatively continuous and deep—and sometimes in horizontal veins at times very variable in direction, which are called entokinetic cracks and are produced by the contraction due to the cooling of the granulite. These cracks have been given the names 'shrinkage' cracks in granulite and 'desiccation' cracks in schists. There is nothing more capricious than these shrinkage cracks; their direction and their inclination vary greatly; they are also much faulted. And, as if that were not enough to baffle all calculations, the distribution of the wolframite in the veins is ever more capricious than the strike of the veins containing it. In

*Translated by F. L. Hess from *Annales de la Société Géologique de Belgique,* 1908-1909, pp. B180-B191.

one place the wolframite appears as little brownish spots staining the quartz; in another there are rod-like crystals of varying size; but in most places the wolframite is not present, and one may dig long distances hoping in vain to see it reappear. Where the wolframite shows in spots there is likely to be continuity of mineralization, but this is a law to which there are as many exceptions as confirmations. With the rod-like form of fragments the wolframite is generally concentrated in pockets or shoots, but no law is known which governs the distributions of the pockets or shoots.

There is, in places, as in other mineral veins, an increase of mineralization where the thickness of the vein varies perceptibly, as at the faults, and at junctions with other veins; but in many places no variation of mineralization can be affirmed when the characteristics of the fissure varies. Inversely, it often happens that the mineralization decreases, increases, or even begins or ends without its being possible to affirm any variation in the character of the vein, either in the quartz which forms it or in the granulite which contains it. In fact, one can predict nothing as to the trend of the entokinetic fissures, nor as to the mineralization of the wolframite contained.

At other places in the Iberian peninsula, however, there are shrinkage cracks showing most beautiful mineralization and forming the richest wolframite-bearing veins. I hasten

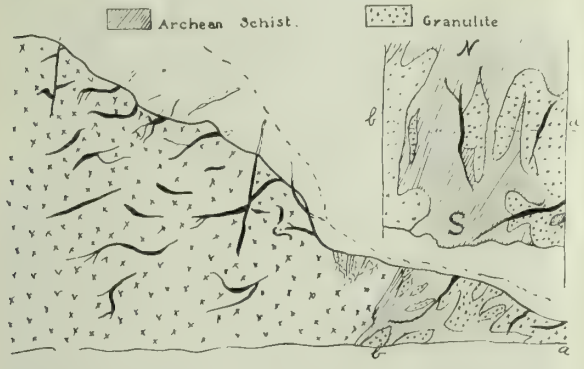


FIG. 3. IDEAL CROSS-SECTION OF A GRANITE SCHISTOSE MASS WITH FISSURE VEINS AND SHRINKAGE CRACKS. ABOVE IS A MAP OF THE GRANITE-SCHIST CONTACT.

to add that sometimes the miner has the good fortune to find shrinkage cracks which, though not very deep, are tolerably long. Some extend several hundred metres, and I know of one that is more than a kilometre long. It is well known that with vertical veins there usually exists a relation, evidently varying considerably, between the depth of the fracture and its length, and that veins extending long distances are apt to be deep. This law cannot be applied to 'entokinetic' cracks, as for these it is of no value. I have represented in 1-1′, 2-2′, 3-3′, 4-4′, and 5-5′ a few small lenticular cracks. (Fig. 2.) It is evident that their depth does not depend on their length.

The Cervà Deposits

The Cervà deposits are situated along the contact of the granulites and Archean schists in the eastern part of the zone northwest of the Douro, the general characteristics of which I have already described. All that I have said concerning the characteristics of entokinetic cracks and their mineralization is applicable here. I shall not, therefore, describe in detail these veins of Cerva, but I will cite among the different cases I have encountered those which seem to me particularly interesting, as well as some special characteristics of these veins.

Generally speaking, wolframite is found distributed almost everywhere in the mountains surrounding Cerva. Everywhere quartz lenses are found mineralized with wolframite, but their lack of continuity and their distance apart render them unprofitable. The north flank of Bentosellos, however, contains, in addition to such lenses, shrinkage cracks sufficiently important to admit of remunerative exploitation. Fissure veins and stockworks are also found.

As seen in Fig. 3, the granulite shows the characteristics of an intrusive. At their contact with the granulite the schists have been but little modified by metamorphism, but they contain much mica. Often, as in stanniferous deposits, the granulite is transformed into kaolin.

General Characteristics of the Veins

The general features of these deposits may be summarized as below:

1. The fissure veins are more recent than the entokinetic cracks which they fault. These entokinetic cracks are more recent than the Archean schists into which they sometimes extend. The difference in the ages of the veins is impossible to determine.

2. The fissure veins are not so well mineralized as the entokinetic cracks.

3. The entokinetic cracks which extend across the con-

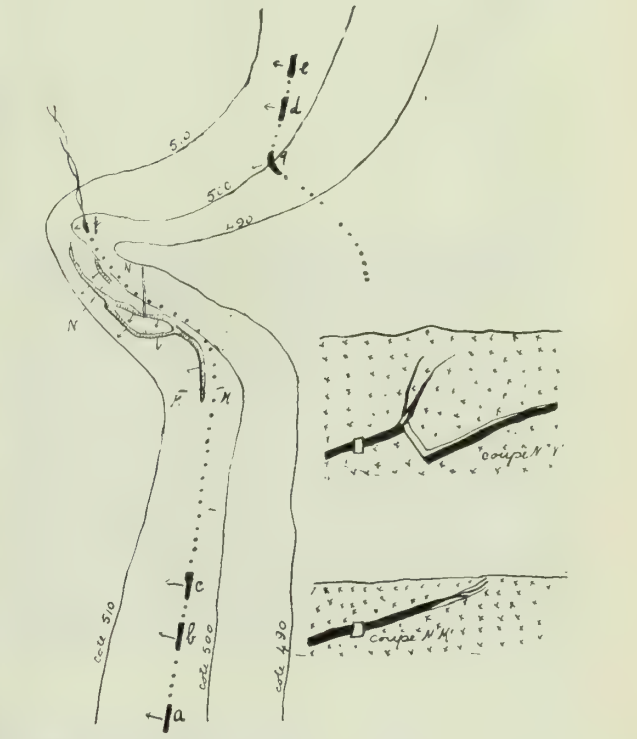


FIG. 4. RELATIONS OF VEIN TO OUTCROP.

tact seem to be less well mineralized in the schists than in the granulite.

4. The thickness of the entokinetic cracks is rather variable, but 0.30 m. (1 ft.) may be taken as the average. In some places it falls to 0.01 m. or 0.02 m. (0.4 of an inch, or 0.8 of an inch), and in numerous places it rises to 1.0 or 1.50 m. (3⅓ to 5 feet).

5. I encountered, but rarely, veins of 0.01 m. to 0.02 m. mineralized throughout their thickness. On the other hand, in a case of enlargement of a vein whose average thickness of 0.30 m. (1 ft.) rose rapidly to 1.50 m. (5 ft.) I was able to isolate a massif of 11 cubic metres of vein containing a pocket, the end of a shoot, of 7 metric tons of wolframite. From this it was possible to separate free from gangue a block of wolframite weighing 165 lb. Above this pocket all mineralization ceased.

6. The average dip of the exploitable veins is about 30°, but, as I have stated, the dip varies a good deal.

7. Certain fractures (generally the longest) seem to follow the trend of the lines of level of the mountain. This trend has also been affirmed in other deposits, notably in the Erzgebirge, and seems to be structural. Erosion has acted but little where the veins appear, which is but a short distance from the schists.

Blind Veins

A mineralized vein was followed a distance of 60 metres (200 ft.) until it disappeared. A cross-cut at a deeper point showed two thin veins, the second being the prolongation of that followed higher up by the drift. The first was unknown at the surface and in the drift. A little chipping done at the extremity of the gallery where the vein being followed had pinched, permitted the discovery and exploitation of another. Knowledge of the outcrops a, b, c, d, e, and f (see Fig. 4) led to the conclusion that the outcrops d and e were a prolongation of a, b, and c. Investigation showed that the fractures a, b, c, d, and e had throughout practically the same thickness and that wolframite absolutely free of pyrite, chalcopyrite, etc., had there crystallized into rich shoots.

On the contrary, fracture f, when followed about a hundred metres (325 ft.) showed a series of bunches where the wolframite, very rich in pyrite, cholcopyrite, etc., had crystallized into rich pockets. Everything seemed, therefore, to attest that d and e constituted a prolongation of a, b, and c, and that f was another vein without connection with a, b, c, d, and e. A cut made practically following N-N′ at 1 to 1.5 m. depth did not reveal a vein. The vein which cropped out at f could, however, hardly have disappeared in so short a distance. What had become of it? A cross-cut was made to prospect the granulite at a little greater depth; and local conditions forced a north-south direction. Soon two small veins carrying wolframite and running east-west were cut. Drifts were run both east and west, and the east drift connected with the workings along a, b, and c, but in the west split into two smaller veins which did not reach the surface. The main vein was found to have been faulted and was picked up by a short incline (see cross-section *coupe* N-N). The vein did not reach the surface (cross-section M-M). These workings showed that they were on the prolongation of a-b-c, and that e-d-q was a different vein, although in direct line with a-b-c.

I have cited this instance not only because it is an example of a vein not outcropping at the surface, but more particularly because it shows how circumspect the engineer must be in his statements regarding trends and mineralizations as capricious as those of wolframite-bearing veins in entokinetic cracks.

Continuity of Wolframite-Bearing Veins

An interesting point is the continuity at depth of the veins formed in entokinetic cracks. It is often claimed that such deposits are superficial, and in proof it is stated that the shrinkage cracks are not prolonged to a depth of more than a few metres—which is true—and that consequently wolframite does not occur at depths beyond—which is false. Certainly the shrinkage cracks do not extend to great depth, but neither do they extend necessarily to the surface; that is to say, the shrinkage cracks that we see crop out are those that erosion has laid bare. Therefore, if we penetrate deeply, we should, at the same time that we see the exposed cracks disappear, discover new ones that do not appear at the surface.[1] (See Fig. 3.) This point is hardly open to dispute; unfortunately, if it cannot demonstrate that wolframite disappears with depth, neither does it prove the inverse, for there is nothing to tell us whether the new cracks we shall meet will be mineralized.

In this connection it is to be noted that the situation of the Portuguese wolframite-bearing beds in the granulite-schist zone shows that they are very often formed at the contact of granulites and schists. Wolframite originates from the granulitic magma and appears to crystallize near the periphery of this massif in contact with the schists that cover it. When erosion has been sufficiently great to carry off the schists and the adjacent wolframite-bearing zone, no more deposits will be found. This would tend to prove, then, that the mineralization of wolframite is effected in contact with schists on a more or less thick zone; that is, that the wolframite-bearing veins are not prolonged into the granulites at great distance from contact with the schists. But this by no means proves that they are purely superficial deposits.

[1] Very often float wolframite is found on top of mountains, although no quartz veins appear higher. The veins have been eroded.

The Laws of Crushing

A series of investigations on rock-crushing has been carried on at McGill University, and the consumption of power has been accurately measured for several standard types of crusher, working on different kinds of rock and crushing to different degrees of fineness. The result of these experiments is finally to disprove the law of crushing originally enunciated by Rittinger and accepted by nearly all authorities since his day, and to show that the more recent theory advanced by Kick is either true or so nearly true that it affords a close working approximation to the truth. Kick's law was originally stated in 1885 as a general theorem in mechanics, and it is only within the last few years that it has been applied to ore dressing, first by H. Stadler in South Africa, and more recently at McGill. It may be stated as follows: The power necessary to crush a given quantity of any given rock from any known size to any other known size, will be directly proportional to the reduction in volume of the particles; in other words, it will take almost three times as much power to crush 1-in. cubes to ½-in. cubes as to ¾-in. cubes; or it will take twice as much power to crush from 1 in. to ¼ in. as from 1 in. to ½ in. The McGill experiments were first directed to settling the question of the truth of the theory, and the results of a long series of experiments agree with the law to within the reasonable limits of error of experiment on so variable material as broken rock. Next the efficiency of a single crusher, say a Gates breaker, was studied over different parts of its range to determine whether it gave as high an efficiency when working from 4 in. to 1 in. as from 4 in. to 2 in. or from 2 in. to 1 in. Other crushers, such as stamps, rolls, and tube-mills, were similarly studied with a view to finding the most efficient range of each machine and the comparative efficiencies of the different machines. Obviously the amount of ground to be covered is enormous, especially as the experiments have to be carried out on a large scale, yet with the utmost care to eliminate errors. Therefore, only a small part of the work has as yet been completed, but enough has been done to justify the preparation of a preliminary report which is now being prepared for publication. It is believed that it will soon be possible to state with a considerable degree of certainty what type of crusher is most suitable for a given degree of crushing, and to state what output may be expected for any rock for which the confines have been determined.

Mineral Production of China

There was no marked development of the coal-mining industry in China during 1911. The Chinese Engineering & Mining Co. mines produced 1,453,546 long tons compared with 1,174,312 tons in 1910; the Peking syndicate mines in Honan, 417,190 tons, compared with 357,209 tons in 1910; and the Hungshan and Fangtze mines in Shantung, 486,553 tons, compared with 482,880 tons in 1910. The Pinghsiang mines in Kiangsi, which produced 610,000 tons in 1910, closed down in October on account of the political disturbances. The Ching-hsing mines in Chihli are stated to have produced 600 tons per day during last year. The antimony refining works at Changsha purchased additional machinery, increasing the output of regulus from 100 to 390 tons per month, and further extensions are contemplated. The Chee Hsin Cement Co. plant at Tongshan, near Tientsin, installed new machinery last year. The capacity of the plant is now 500,000 bbl. per year.

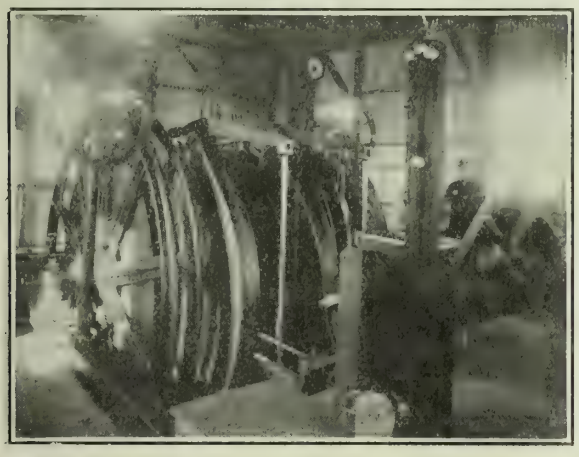
The present exact value of gold is $20.671834625323 per fine ounce, according to the computation tables of the United States Geological Survey and the Bureau of the Mint. The average commercial price of silver in 1911 was 53c. per fine ounce.

Fuel, Power, and Water Supply of Tonopah

By M. W. von Bernewitz

A regular and cheap supply of fuel, power, and water for any mining district is essential, and in this respect Tonopah, situated in a Nevada desert at an altitude of 6300 ft., may be said to be fairly well provided. This and other mining centres in Nevada are much indebted to California for its oil production and extensive water-power development. It may be said, in fact, that Nevada is generally benefited by its neighboring state.

The use of coal under boilers at Tonopah is out of the question, as it costs about $13 per ton, while coal for use in forges and private houses costs as much as $19 per ton. Oil from California is used everywhere, on locomotives, under steam boilers, in heating drills for sharpening, in assay offices, and in smelting the precipitate from presses or zinc-boxes. As at other places where it is used as fuel, all manner of burners are in use; air and steam are used as atomizers, as also a new system whereby the oil is heated by steam coils to 250°F., and then pumped into the

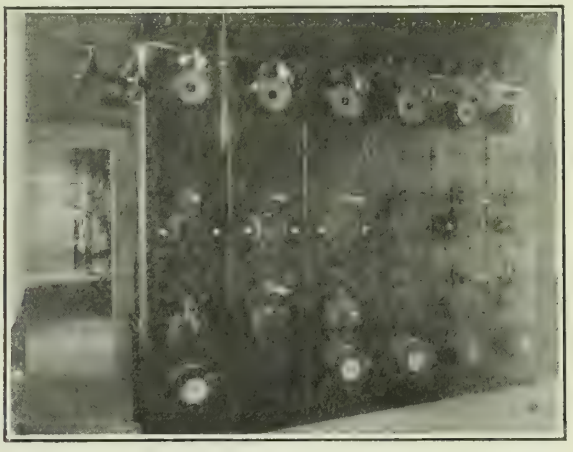


ELECTRIC HOIST, TONOPAH MINING CO.

burner at 150 lb. pressure by an ordinary duplex pump. At the Montana-Tonopah mine, the oil used is 18°B., supplied by the Associated company. It comes by rail, in 12,400-gal. tanks, and is pumped to tanks above the plant, from which it is drawn off as required, and fed into the boilers at 140 lb. pressure. The monthly consumption of oil is 20,000 to 25,000 gal., 4500 tons of ore being treated per month. It is found that but little additional oil is consumed in winter. One tank of oil costs $573, and the freight amounts to $442, making a total of $1015; the average cost to all mines at Tonopah being $1.59 per barrel.

The Nevada-California Power Co. has four power-plants on Bishop creek, Inyo county, California, and supplies Goldfield, Tonopah, Millers, Silver Peak, Blair, Rhyolite, Pioneer, Manhattan, and Round Mountain, in Nevada. At Bishop, there are 10 Pelton and Doble water-wheels, direct connected to electric generators, current being produced at 2200 volts and stepped up to 56,000 for transmission 110 miles to these places. The water at the power-stations is used several times, and the average pressure is 470 lb. per square inch. From Bishop to Tonopah there are duplicate lines of copper and aluminum wire, and also a private telephone line. At Millers and Tonopah there are sub-stations, the latter containing seven 500-kw. transformers, and the usual switchboards and accessories. Power comes in at about 52,000 volts, is stepped down to 6600 for transmission to the mines, which transform it to 440 volts for motors. The daily power consumption at Tonopah is 70,000 kw. The main sub-station has been unfortunate of late, as two fires have occurred which will require the expenditure of nearly $30,000 to replace the transformers and building. The Tonopah Mining Co. has an especially fine sub-station, which consists of transformers, rotary converter, storage battery, switchboard, and automatic telephone exchange, and takes care of the peak-load at the various shafts and the Belmont mine also. I happened to be inspecting this plant at the time the second fire broke out at the sub-station; and it was interesting to watch the rotary converter automatically take up its load from the storage battery, which is sufficient to run the hoists for a short time, and the lights for about eight hours. Power is supplied to the Tonopah companies at an average of 1½c. per kilowatt-hour, based on peak or total loads. Everything, from hoists to pumps discharging vacuum filter-tanks, is motor-driven. Use of electric power gives flexibility; motors can be bolted down in any corner, and give little or no trouble.

The Nevada-California Power Co. is erecting two more power-plants, and has over 400 men at work. It is already supplying Riverside and San Bernardino, in California, a distance of 250 miles. Trouble with the transmission lines across the Mojave desert has been experienced. In this region there are eight steel towers per mile, supporting a thick aluminum wire with steel core. The wind gradually increases in velocity to 75 miles per hour, and the towers lift slightly on one side, letting sand under the foundation. This is reversed from time to time, and gradually the towers are lifted to a position where they are likely to topple over.



SWITCHBOARD AT SUB-STATION OF TONOPAH MINING CO.

Three additional transformers are also being added to the sub-station at Tonopah.

Fifteen miles north of Tonopah the Water Company of Tonopah takes its supply from a sagebrush country underlaid by gravel and sand. Here there are four shafts 6 by 8 ft., and ten 8-in. cased driven wells, 35 to 165 ft. deep, having a daily capacity of about 400,000 gal. There are three 65-hp. motor-driven Worthington pumps lifting the water through an 8-in. pipe to a reservoir of 232,000 gal. capacity, three miles from Tonopah. There is also an auxiliary steam-pump service for use when electric power is cut off, and the town and mines are never without full supply. At Tonopah there is another reservoir of 116,000 gal. capacity and two wooden tanks holding 45,000 gal. The average supply pressure is 65 lb., and the monthly consumption over 8,000,000 gal. Prices range from 75c. per 1000 gal., for mines, to $1.25 for domestic use. Tonopah is, therefore, well provided for, and credit should be given to those who had enough faith in the district to provide the capital for the erection of plants for power and water supply.

Russian subjects have made 300 declarations for concessions to mine gold and asbestos in the Uriachaisk district of Siberia. Permits are being issued by both the Yenisei administration of state property and the district mining engineer. More than 2000 Russians already reside in this district, most of whom are engaged in the development of local mineral projects, and a general Russian colonization is rapidly taking place.

September copper production at Cerro de Pasco was over 4,000,000 pounds.

Amalgamation at the Homestake

By Allan J. Clark and W. J. Sharwood

*Inside amalgamation is practised at the Homestake mills, a copper plate ¼ in. thick and either 5 or 7 in. wide being attached to the chuck-block under the screen of each mortar. The wider plate with high chuck is used with new dies, and the other is substituted as the dies wear. The outside plates are ⅛-in. Lake Superior copper, in units 4 ft. 6 in. wide by 12 ft. long, though a few old plates of irregular length are still in use. One such unit of plain copper is placed immediately in front of each 5-stamp battery, and below it are two or three rows, usually wider, of silvered plates which are electroplated with 2 oz. of fine silver per square foot. At some of the mills, topography and other conditions have prevented the introduction of a plate system as complete as at the Amicus mill, and in others the grade and character of the ore treated have not warranted the addition of a fourth row. For instance, the Mineral Point equipment still consists of three rows of plates, each 4 ft. 6 in. wide by 12 ft. long for each five stamps. Wherever practicable the aim has been to increase the width of each successive row, and thus to thin the layer of pulp and facilitate contact of the finer particles of gold with the amalgamated surface. Mercury is fed to the battery hourly; the practice of inside amalgamation has been justified by assays of the tailing when using this system in comparison with outside feeding.

The loss of mercury per ton of ore varies in different mills from 0.06[1] troy oz. to 0.17 oz. The lower loss occurs in a mill crushing low-grade, thoroughly oxidized ore from near the surface, the higher loss prevailing in mills treating material containing more sulphides; a fair average is 0.13 oz. per ton crushed. If the loss of mercury in the different mills is compared with the corresponding weight of bullion obtained the variation is less, ranging between 0.6 and 1.1 oz. per ounce of bullion recovered, 780 fine in gold and 200 in silver. Attempts to correlate the loss of mercury per ton of ore with the area of plates per stamp led to no rational result.

The relation between the weights of mercury fed, total amalgam, and bullion for certain periods may be seen from the following table, the average ore representing that treated in the entire plant for a period of several months:

Mercury Fed and Lost in Mills per Ton Milled

	Average, oz.	Low-grade oxidized ore, oz.		Fairly high-grade unoxidized ore, oz.	
Mercury fed to mortars[2]	0.30	0.27[3]	0.20	0.33	0.364
Total amalgam obtained	0.55	0.30	...	...	0.80
Mercury lost in tailing.	0.132	0.085	0.09	0.17	....
Mercury found in precipitate:					
At slime plant	0.014	...	...	...	....
At sand plant No. 1.	0.001	...	...	...	....

The mercury finally lost, averaging 0.132 oz., amounts to about $0.005 per ton milled. Much of the loss is probably due to conversion into sulphide by contact with pyrrhotite and arsenopyrite. The loss in retorting and melting is extremely small. A little is recovered incidentally in various places, sumps, cones, and launders. The slime plant precipitate has sometimes contained as much as 12% of its weight of mercury, but it has not been found profitable to attempt its systematic recovery. This mercury must have been dissolved by an extremely weak cyanide solution.

A test in the Golden Star mill showed that an average of ¼ troy oz. of mercury is required per square foot to 'set' copper plates newly coated with 2 oz. silver per square foot before commencing amalgamation. If allowed to stand for any considerable time before using it is probable that more mercury would be necessary, as it is slowly absorbed and the surface hardens. The amount daily sprinkled on the plates varies with the condition of the plates and the character of the ore.

In using silvered plates the best results are obtained when the amalgam is kept moderately soft, and it is found that the best conditions are maintained when the temperature of the mill water is kept constant at about 50°F. The tendency of a higher temperature is to render the mercury more mobile, so that much of it separates and trickles down the plate, finally lodging in the traps at the foot of the tables. The amalgam left tends to become hard and is difficult to remove from the plates by the usual methods until cooler weather again prevails. When this occurs the plates resume their normal condition, and the yield may then be, for a few days, several times the amount ordinarily recovered. This condition is the only instance of 'accumulation' of amalgam noted here, and its temporary character is indicated by the abnormal recovery for a brief period after the return to regular conditions. The 'absorption' of amalgam by plates is almost negligible, as will be shown later. The following comparison shows the effects of dressing the silvered plates oftener than once in 24 hours:

Comparison of Recovery from Silvered Plates (three rows) when dressed once and twice daily.

	Twice daily.	Once daily.
Second row	$491	$451
Third row.....	240	248
Fourth row	120	128
Total recovered from silvered plates...	$851	$827
Relative value.....	100	97.2

The values given in this table are the totals for the amalgam obtained during several different periods. The differences from period to period were in some cases very small, and in some cases there was a slight difference in the opposite direction to the averages given above. The general tendency, however, as evident in the averages, is to catch rather less on the upper plate, when it is dressed too often, but a little more on the last two plates—presumably owing to the larger amount escaping from the upper one. During four months, May-August, of 1910, the general recovery by amalgamation was 72% of the total ore content; at the Lead mills during the same period it was 74%. It is noteworthy that the unoxidized ore from the lower levels yields about as high a percentage of its gold by amalgamation as the fully oxidized ore from the open cuts and shallower levels. On the other hand it must be remembered that the open cut ore now being worked is of low grade compared with that formerly mined near the surface, which is stated to have yielded a higher percentage, the tailing being of low value although no secondary treatment was practised.

A certain number of the chuck-blocks in each mill are changed every day, and the amalgam is then scraped from the inside plates, thus making the entire round of the mill in 15 or 16 days. The outside plates are cleaned up once a day, except those of the lowest row, which are cleaned up on alternate days. Amalgam is removed from the first row plates by brushing with a small whisk broom, that on the lower plates is swept up with a long-handled floor broom of stiff straw. No violent methods, such as steaming or scraping with steel tools, are used on these plates. In each mill the amalgam from the mortar, and from each outside plate, is separately cleaned and weighed daily. Warm water is generally employed before squeezing it. The skimmings are worked up every ten days by grinding in a barrel. At

*Excerpt from 'The Metallurgy of the Homestake Ore,' *Bulletin* 98, Institute of Mining and Metallurgy.

[1]Considerably lower losses are recorded for earlier times, when fully oxidized ores were treated, such as 0.04 oz. and less per ton. At these periods the plate area was considerably smaller than now.

[2]Additional mercury is sprinkled upon the outside plates, and a certain amount is also introduced during the cleaning of amalgam.

[3]In this case an additional 0.08 oz. of mercury was put on the outside plates.

the foot of certain row of plates are traps, from which the sands are daily removed. These 'trap sands' are run each day over a special silvered plate, and the amalgam thus obtained is cleaned up every ten days.

The amalgam traps are simple boxes or shallow troughs, placed at the lower end of certain plates and running completely across the tables. They contain no baffle plates or amalgamating devices, and are cleaned up by removing the accumulated heavy sand with a scoop and carrying it in buckets to a box, from which it is sluiced over a plate.

An experiment was made on two pieces of copper which had seen long service in catching amalgam, one a worn-out plate from the chuck-block of a mortar, the other a discarded plate from the first row, not silver plated. After being cleaned by the usual mill procedure, and without violent scraping, each was set in a planing machine and a series of the thinnest possible slices were planed off, each

HIGHLAND HOIST, HOMESTAKE MINE.

of which was weighed and separately assayed. The results may be briefly stated as follows:

SUMMARY OF ASSAYS OF LAYERS PLANED FROM OLD MILL PLATES.

	Chuck-block plate.	Outside plate.
Original thickness of copper, in.	0.250	0.125
Worn down to, in.	0.120	0.091
Percentage of total gold contents found in layers next surface, totaling about $^1/_{64}$ in.	98%	98%
Gold contained per sq. ft.:		
Value	$1.11	$0.31
Ounce	0.054	0.015
Area of entire plate, sq. ft.	2.5	54
Gold in entire plate:		
Value	$2.80	$16.75
Approximate ounce	0.135	0.81

In each case, beyond a depth of 0.005 in. from the face, nearly all the gold content was in dents and pinholes. In addition to the amalgam on the face, the outside plate showed on the back a few extremely thin patches of films and amalgam, which had evidently worked round the edges. Silver was not considered in the calculations, as the plates were both of old copper, not electrolytically refined, and the original silver content was unknown. It is evident that the accumulation of precious metal on plates does not go on here to anything like the extent reported from some other mills, where amalgam has been allowed to build up to a considerable thickness. Possibly this difference is due to the relatively low grade of Homestake ore. The fact that practically all the gold carried by an old amalgamation plate resides at the surface is also proved by the work of R. H. Richards on a plate from a Nova Scotia mill. Our experiments were made before reading his statement, and were prompted by the extreme differences of opinion prevailing among millmen with whom the subject was discussed, which ranged from the impression that no penetration whatever took place to the idea that a plate of Lake Superior copper would be converted, by a few years' use in a mill, into a literal pseudomorph of solid amalgam. An experiment made some years ago is perhaps worth recalling, although the exact data were unfortunately not all placed on record. A plate of sheet steel was coated with copper by electro-deposition, and then silver was deposited to the usual thickness—2 oz. per square foot. This was placed in the second row of one of the mills, where the coating lasted fully two years, and in behavior it could not be distinguished from the silvered copper plates running parallel with it.

In connection with the copper-plating of steel another departure may be noted. It is well known that when copper mill plates are fastened to the wood tables or sluices by steel nails or screws, the heads of the latter are rapidly attacked by electrolysis and rust off. In some mills, using relatively narrow tables, this difficulty is overcome by using wood cleats at the sides to retain the plates. With very wide tables this is impracticable, and in the Homestake

LEAD, SOUTH DAKOTA, SHOWING HOMESTAKE MILLS.

mills solid copper nails or spikes have been long in use, the heads becoming amalgamated at once, like the plate itself. These, however, are difficult to draw when re-plating becomes necessary, so that plates are often bent in the process of removal. Steel screws were therefore electro-plated with copper, starting with a cyanide solution and then using the sulphate as electrolyte. The heads of these become amalgamated in the mill, but the metal is protected, so that they can be unscrewed after over two years' use. They promise to be a cheap and effective substitute for the copper nails.

Three times per month the whole of the amalgam obtained during the preceding ten days is brought to the assay office, and the weight reported from each individual mill is verified by weighing to 0.1 oz. The amalgam is put into cast-iron trays, which are placed in horizontal cylindrical retorts, and covers are luted and keyed on. Each of the five retorts will hold 7000 oz. of amalgam. The fires, of pine wood, are started about 3 p. m.; about an hour later mercury begins to flow from the water-jacketed condensers, and the fires are kept up as long as this continues. About 8 a. m. next day the retorts are opened, the crude bullion is taken out, the product of each mill is weighed to the nearest ounce, and the whole is divided so as to give bars of about equal size, not exceeding 2000 oz. troy.

The bullion is melted in No. 50 graphite crucibles, in coke furnaces; 4 lb. of pulverized borax crystals is added to each pot. With four furnaces, four bars, worth nearly $130,000, can be thus melted at once, but if the amount exceeds this it is necessary to use one or more No. 100 crucibles, from which two bars can be poured at one heat. As soon as the metal is set, a little water is poured on the top to partly chill the slag, which is then pulled or scraped off with a hook. The bar is then turned out, picked up with grip tongs, and plunged into a bath of very dilute nitric acid, then in cold water, and scoured with wet sand. It is then rinsed, dried, sampled by drilling two opposite corners, stamped with a consecutive number, weighed to 0.1 oz., and stampe with its weight and, finally, sacked, and delivered to the United States Assay Office. The loss in melting the crude bullion is about 0.66%; in re-melting the finished bars at the United States Assay Office there is a further loss of about 0.04%.

California Miners' Association Meeting

The sixteenth annual convention of the California Miners' Association was held in Native Sons' hall, San Francisco, December 9, 10, and 11. Though nominally the sixteenth session it is not so in fact, since no meeting has been held since 1906. The convention was called to order on the morning of December 9 by W. C. Ralston, the president, who outlined the topics for consideration. In the afternoon session A. J. Wallace, lieutenant-governor of California, spoke on behalf of the state and urged the appointment of a committee to confer with federal and state authorities. A. A. d'Ancona made a brief address of welcome on behalf of the Mayor of San Francisco and M. H. De Young, on behalf of the Directors of the Panama-Pacific International Exposition requested the coöperation of the Association in securing exhibits for the exposition. C. F. Curry, congressman-elect, spoke of legislation and the mining industry; J. A. Britton discussed hydro-electric power as a factor in mining; Whitman Symmes described the work in progress on the Comstock Lode; and Tirey L. Ford briefly reviewed the history of the Association. The chairman then announced the following appointments on committees:

Order of business—B. M. Newcomb, chairman; S. W. Cheyney, H. L. Slosson, Jr., Ed. H. Benjamin, J. R. Tregloan, E. J. Rector, Frank W. Street, S. B. Christy, J. J. Hamlyn, H. C. Cameron, M. B. Kerr, B. C. Clark, W J. Graham, Elgin Stoddard, A. B. Ruggles.

Resolutions—Charles M. Belshaw, chairman; A. H. Ricketts, F. R. Wehe, Frank A. Leach, W. F. Englebright, A. E. Boynton, Frank H. Short, A. J. Pillsbury, Russell L. Dunn, S. B. Christy, H. Foster Bain, F. T. Nilon, Louis Rosenfeld, E. C. Voorheis, Clarence M. Oddie, J. H. Miller, George B. Finnigan, C. C. Derby, George Scarfe, Robert J. Strang, Charles Grimes.

Mining exhibit at Panama-Pacific International Exposition—N. Cleaveland, chairman; E. B. Braden, W. H. Storms, Thomas T. Read, Henry Gould, J. N. Nevius, J. Schwarzchild, E. H. Franklin, W. W. Waggoner, W. W. Coe, James F. Farraher, A. C. Hoofer, Adna Lamson, L. L. James, M. Blumenkrantz, E. C. Hutchinson.

The session on Tuesday was opened by the reading of a paper on public land administration, prepared by W. C. Mendenhall and read by C. G. Yale, in the absence of the author, which will appear in our issue of January 4. To this presentation of the matter from the viewpoint of the federal authorities, A. H. Ricketts replied from the standpoint of the mining industry, in part as follows:

Previous to congressional legislation relative to conservation the federal statutes affecting the disposal of public lands provided for the divestiture of the government's title to the public domain as, for instance, to a state for educational purposes, to a transcontinental railroad in aid of its construction, as bounty to those who have been its defenders in times of war, to the settler upon such lands, and to the mineral claimant.

The basis of the conservation policy of the government is to retain the title to public land in the United States, permitting its use under a lease or permit, when the bureaus choose to issue one, except that, as in the case of forest reservations, the mineral claimant may still locate and patent mineral claims therein under the federal laws and appropriate water rights under the state law.

The vesting of administrative authorities in relation to governmental reservations tends to render vested property rights therein commercially valueless by depriving the miner of the means of its exploitation and the reduction of his ores by denying him access to water within or necessarily conducted across reserved land, and to take away an essential use of property is to take the property itself. This unsatisfactory condition arises from the manner in which the laws are administered by the federal departments, which are persistently exceeding their limited lawful power over the public domain.

At the afternoon session A. J. Pillsbury, chairman of the State Industrial Accident Board, presented an especially able and interesting discussion of the theory of employers' liability and workmen's compensation, and outlined the legislation necessary to bring the law now in force in California into such shape as to be less oppressive to the employer and more serviceable to the workman. The legislation on this topic which has been enacted in other states and territories was then reviewed by F. T. Nilon.

At the morning session on Wednesday, addresses were made on conservation and workmen's compensation. F. N. Short opposed federal control of natural resources, and A. C. Baker, director of exhibits of the Panama-Pacific International Exposition, outlined the considerations which should govern the preparation of a mining exhibit and asked the coöperation of the members of the Miners' Association in securing an adequate exhibit for 1915. At the afternoon session, W. W. Waggoner discussed the conservation of flood waters in hydraulic mining and suggested that hydraulic areas might be used as storage reservoirs, since good sites in the Sierras are scarce, at high altitudes, and are usually inadequate. F. E. Brooks recited a stirring poem on California, which has been accepted by the Exposition authorities. A number of papers on interesting topics, which had been arranged for, were not presented for lack of time, the discussions on workmen's compensation and conservation having been unduly protracted.

The present officers, William C. Ralston, president; Charles H. Dunton, vice-president; John Henry, treasurer; and John R. Tyrell, secretary, were reëlected for the ensuing year. Resolutions were then adopted providing:

That the Association meet in San Francisco during October, 1915.

That the state undertake accident and liability insurance.

That the Los Angeles Chamber of Commerce be commended for its efforts to prevent fraud in the flotation of mining ventures.

That permanent headquarters for the California Miners' Association be secured in San Francisco, with a paid officer constantly in attendance to give information to visiting mining men in regard to the purchase of equipment, and the securing of competent employees.

That the state legislature be asked to appropriate $25,000 "to examine any fake or wild cat organization" and to bring it to the attention of the attorney-general, or the post-office authorities.

That increased appropriations should be made by the state for the work of the State Mining Bureau.

That the Association coöperate with the officials of the Panama-Pacific International Exposition in securing an adequate mining exhibit, and that a committee consisting of one representative from each county be appointed for that purpose.

The following resolutions concerning the public land question were also passed:

Resolved, That the attention of Congress is called to the persistent and harmful interference of federal bureau officials with the operations of prospectors and miners who go on the public land to mine under and by virtue of the unrepealed and unmodified grants heretofore made by Congress to citizens, of free minerals, free timber for mining, free mining, and free occupancy of the public land containing minerals, and Congress is hereby asked by its appropriate action to abate this harmful interference of administration officials of the Federal Government with citizens engaged in peaceably and lawfully mining on the common public land of all the citizens of the United States.

Resolved, That the president and secretary of this association be, and they are hereby, directed to transmit copies of the foregoing resolution to senators and representatives of the state of California in Congress and to the governors of the several states of the union.

Whereas, The public lands were ceded by the original states of the Union to the Federal Government, to be held in trust and to be disposed of to actual settlers as soon as could be done and at reasonable prices; and

Whereas, The later states admitted to the Union have been

admitted upon the same understanding and upon an equality with the original 13 states; and

Whereas, This rule is embodied in the early acts of Congress and in many decisions of the Supreme Court of the United States; we therefore believe that the remaining public lands in all of the states should be disposed of consistent with this policy and to actual settlers, where suitable for settlement, and where unsuitable for settlement that the same should be disposed of or devoted to the most beneficial use of mining or other uses to which they are suited, to the end that all of the public lands shall be, as soon as practicable, devoted to actual settlement or to the most useful available purposes, that the states may be fully settled and their resources fully developed as soon as can be done for the benefit of the people of the several states, and therefore for the benefit of the whole people of the United States. And we are opposed to any policy in any direction inconsistent with this equitable rule and the understanding in connection with which the United States holds and administers the public lands. We call upon the governors and the legislatures of the several interested states to see to it that the rights and interests of such states and of the people shall be properly guarded and fully protected.

Resolved, That the attention of the governor and legislature is hereby called to the persistent interference of Federal bureau officials with the use of the water of the streams of the state by miners, and the appropriate action of the governor and legislature is hereby asked to abate this Federal bureau interference with the free and full enjoyment by the miners of their property rights in the use of the water of the streams under indefeasible grants of proprietary title by the primary owner thereof, the state of California.

Resolved, That the law committee of the California State Miners' Association prepare and transmit to the governor and legislature its report on the primary title to the water of the streams in California and on the incidents or property rights attached to such primary title.

Resolved, That the president and secretary of this Association be, and they are hereby, directed to transmit copies of the foregoing resolutions and the report of the laws committee of the governors of the other states of the Union.

The Association then adjourned to meet in October 1913.

The annual dinner of the Broken Hill section of the Australasian Institute of Mining Engineers was held at Broken Hill on October 22, there being 100 members present. Mr. George Weir, of the North mine, stated the following with regard to silver, lead, and zinc production of that important centre: "During the past few years the greatest metallurgical development has been in the extraction of zinc. In 1904 the value of zinc concentrate produced amounted to $275,000. In 1911 the production had increased to 516,000 tons, valued at $5,610,000, making the value of the total production from all the Broken Hill mining and treatment companies of silver, lead, and zinc for the past year approximately $24,000,000. The total value of Broken Hill mineral production to the end of 1912 may be estimated at $340,800,000, which is practically equal to one-third of the total value of the entire mineral production of New South Wales from its foundation in 1788 to the present day. In addition, the value of Broken Hill current production represents more than 50% of the entire mineral production of the state. Therefore, Broken Hill takes premier place in the mineral industry in New South Wales. Within the state one person out of every 43 is directly employed at mining, and if allowance is made for other industries and businesses dependent on mining, together with wives and families, there is probably one person in every 15, or, say, 7% of the population of the state engaged or dependent on the mineral industry. In regard to the extent of mineral wealth, the large production of gold, silver, copper, lead, zinc, and tin, the extent of the coal deposits, the presence of large quantities of iron ore, and the great variety of minerals found in appreciable quantities, suggest that the future history of mining will in all probability be more remarkable than that of the past."

Bureau of Mines and Western Mining

By J. A. Holmes

*The people of the country are coming slowly to recognize the fact that, of its two great foundation industries, mining, no less than agriculture, is entitled to the recognition and aid of the Federal government. And it is to be hoped that they will also soon come to recognize the fact that the mining industry of the Western or public-land states is entitled to special recognition and aid, because of the fact that these lands belong so largely to the Federal government, and are, therefore, not taxable by the states for the support of local expenditures.

Under modern conditions no country can become great or can maintain its greatness without the aid of a mining industry, which furnishes its supply of coal and oil and iron and steel and other essential mineral materials. And it should be kept in mind that while a country may increase its agricultural resources by the improvement of its soil through the addition of fertilizer and water, of mineral resources it has but the one supply, which it cannot increase but must decrease in proportion to both as this supply is used and as it is wasted or destroyed. It is true, therefore, that the benefits which a country may receive from its mineral resources will depend not only upon the nature and extent of those resources, but also upon the intelligence and wisdom with which they are developed and used.

With the opening up of the Panama canal, the United States will enter upon a new era of commercial development which will call for far larger export of coal than we have ever estimated in the past. And we should see to it that this export of raw materials develops also large imports of mineral as well as of agricultural products; so that the ultimate results may be thoroughly beneficial to American industry. In this connection, as well as in other connections, we may realize the fact that the most important function of a national Bureau of Mines is not simply to facilitate or hurry up the development of mineral resources, but to aid in bringing about the most efficient and the wisest development of these resources.

Both the Secretary of the Interior and the Director of the Bureau of Mines have been yearly urging Congress to provide the Bureau with appropriations for mining investigations in the Western states, and on a scale commensurate with the importance of the mining industry in these states. The investigations of the mine disasters in the coalfields of the Middle and Eastern states have required a large part of the energies and the appropriations of the Bureau of Mines during the first two years of its existence. But Congress has recently granted an appropriation of $50,000 for the inauguration of special investigations in behalf of the Western mining industries, and the Department has recommended that for the next fiscal year this appropriation be increased to $250,000. The Bureau now has under way an investigation into the California petroleum industry; an investigation looking to the use of crude petroleum as a means of facilitating the electric smelting of iron ores; and an investigation looking to the improvement of smelter conditions. If Congress grants the larger appropriation which the Department has asked for, it is expected that the Bureau's investigations will be considerably enlarged. As to the work to be done, and as to the manner in which these investigations may be carried on to the best advantage, the Directors of the Bureau of Mines will welcome suggestions.

Nagaoka dispatches to the *Nichi Nichi* state that No. 1 well of the Nippon Kerosene Co. at Nishiyama, Japan, suddenly gushed oil on September 19, 450 koku (1 koku = 39.70 imperial gallons) being blown out in 15 hours, which is a record quantity in Japan. The kerosene market in Echigo has since acquired an unusual activity.

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*Abstract of letter sent to Sixteenth session of the California Miners' Association.

An Internal-Combustion Oil-Engine

By W. S. Noyes

The Presidio Mining Co., operating a silver pan-amalgamation mill at Shafter, Texas, recently installed an internal-combustion oil engine with the following actual results in operating economy.

The engine formerly used is a 16 by 36-in. Reynolds-Corliss heavy-duty pattern of 115 bhp.; the oil-engine replacing it is a 20 by 34½-in. De La Vergne Machine Co. type 'F.H.', of 130 bhp. The oil used is Texas crude, 0.927 specific gravity, or 324.66 lb. per barrel.

Comparison of Fuel Consumption

Engine.	Lb. Oil per Bhp.-hr.	Ratio.
De La Vergne	0.425	1.0
Corliss	2.882	6.8

The De La Vergne engine was guaranteed to consume not over 0.6 lb. oil per bhp.-hr.; but, as shown by the above, its fuel consumption is practically 30% less than the amount called for by the guaranty.

Commercial Economy

The process in use at the mill requires heating of the amalgamating pans by steam through their steam cones. This was formerly done by the exhaust from the steam-engine. After the installation of the oil-engine, live steam was required for this purpose; hence the oil consumption of the new plant is as follows:

	Lb. Oil per Bhp.-hr.	Ratio.
De La Vergne engine.....	0.425	...
Heating pans referred to bhp-hr.....	0.325	...
Total	0.725	1.00
Corliss engine	2.882	3.85

At the present cost of oil, the saving effected by the oil-engine is $44 per day if running full time.

The De La Vergne engine is of substantial and heavy design, and of the highest grade of material and workmanship. It runs without any difficulty from 98 to 99% of the possible time, and such delays as have occurred were not from any defects in the machine itself, but rather from small troubles with the auxiliary, or oil-feeding, mechanism. The spray valve is easily stopped up by the carbonizing of oil or any slight sediment in the oil if the latter is not very carefully strained. The delays at Shafter were from the above-mentioned spray valve and little defects with the air-compressor and its valves. All these causes are difficult of detection except by experienced men, and men with such experience are difficult to obtain, particularly in the frontier districts. A short statement of the condition is that such engines have developed much more rapidly than men to operate them.

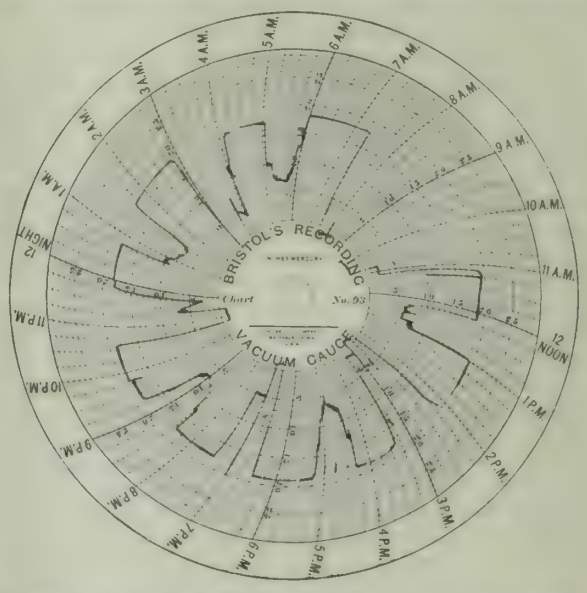
A Chinese syndicate with headquarters in Ipoh, Federated Malay States, and ramifications throughout Malaysia, is reported to have obtained a mining concession to prospect for all kinds of minerals over the entire province of Fukien, China, for the space of two years. The capital is $1,000,000. The prospectors sent up to China some years ago have, it is stated, returned with rich samples of silver ore, and others are now proceeding to Fukien to verify the reports.

The world's production of gold in 1911 is estimated at $467,449,600 by the U. S. Geological Survey. Africa was by far the greatest producer, with $192,972,100; the United States came second, with $96,233,500; Australasia third, $59,187,900; and Mexico fourth, $29,196,000. Other large producers were Russia and Finland, $24,865,000; China, $10,000,000; British India, $10,463,200; and Canada, $9,762,100. South America as a whole produced nearly $17,000,000.

Recording Gauge for Filter Operation

Staff Correspondence

The scheme of treatment at the Montana-Tonopah filter plant involves dumping 150 tons of ore per day into a steel ore-bin, from which it is drawn out, crushed by a No. 5 type K Gates, elevated to a revolving trommel, and the oversize reduced to 1¼ in. by two No. 3 type D Gates machines. A 14-in. belt conveys the broken ore to the mill-bin, from which it is fed to forty 1100-lb. stamps, crushing through 20 to 25-mesh screens in hot cyanide solution. There is about 3% of pyrite in the ore, and nearly one ton of concentrate is caught daily on 8 Wilfley tables. This is dried to 5% moisture and shipped to smelters. Pulp from the concentrators is lifted by two bucket elevators to two Dorr classifiers, which work in the closed-circuit system with two 5 by 22-ft. tube-mills. The classifier overflow goes to three settlers or dewaterers. Thickened slime is then pumped to six Hendryx and one Trent agitators for



52 hours' agitation in a 5-lb. cyanide solution. Live steam is introduced here and the temperature kept to 110° Fahrenheit.

The vacuum filter plant consists of two filters with 100 leaves in operation, each 5 by 10 ft. The chart reproduced is a complete record and check on the work done in this department. The Montana-Tonopah mill is at an altitude of about 6500 ft., and the possible vacuum is 22 in., while from 18 to 20 in. is maintained during filtration. A study of the recording gauge shows, for instance: At 7 p. m. the filter tank was filled with slime, and formation of cake started, the vacuum keeping at 5 in. for about 25 minutes, then rising to 18 in., remaining steady at this for 60 minutes, when the cake was formed, and excess slime pumped out by a centrifugal pump to the stock tank. From 9 p. m., when the tank was filled with weak solution for washing, the vacuum averaged 18.5 in., dropping momentarily to 16.5 in. at 9:50 p. m., until at 10:35 p. m., when treatment was finished, suction ceased, and the cake was blown off and discharged. The complete cycle, therefore, was 3 hours and 35 minutes. Silver and gold are precipitated by zinc-dust, supplied by an adjustable feeder, which also has an arrangement to prevent the dust from setting hard during feeding. An extraction of 93% is obtained at a total cost of $2.99 per ton.

Bulawayo is about to have a new producer. This is the Redrup's Kop mine, situated 12 miles from Bulawayo and controlled by the Forbes Rhodesia Syndicate. The property has been equipped with a 5-stamp mill and a 5-ft. Chilean mill, with sand and slime plants of a minimum capacity of 25,000 tons per year.

Discussion

Readers of the MINING AND SCIENTIFIC PRESS are invited to use this department for the discussion of technical and other matters pertaining to mining and metallurgy. The Editor welcomes the expression of views contrary to his own, believing that careful criticism is more valuable than casual compliment. Insertion of any contribution is determined by its probable interest to the readers of this journal.

A Treatment Problem

The Editor:

Sir—In your issue of November 16, Henry Vogel makes inquiry regarding cost of treatment of accumulated silver-bearing tailing derived from patio or other processes, and carrying about 8 oz. silver per ton. He refers to dumps of such material, aggregating 600,000 tons, scattered over the province of Junin, Peru. Presumably the physical condition of the tailing as to cleanness, location, size of individual dumps, accessibility, questions of water and power will have important bearing on costs, aside from metallurgical considerations. The conditions assigned by Mr. Vogel, namely 80% passing through a 200 mesh, silver content 8 oz., SiO_2 80%, Al_2O_3 1.7%, FeO 7.7%, and a fairly large amount of mercury present, do not, therefore, present the problem fully enough to prevent a comprehensive and categorical reply.

I spent about three years in the testing and treatment of a large old dump of silver-bearing tailing at Cortez, Nevada, containing 100,000 tons of material and carrying about 8 oz. of silver, with a little gold. The ore had previously been roasted and treated by thiosulphate. Owing to faulty lixiviation washing methods, about half of the metal content of the tailing was readily soluble in weak cyanide solution, enough more to make up an 80% recovery, which seemed to be the maximum possible, was extremely difficult to get into solution with a reasonable cyanide loss. Finally, no attempt for a high recovery was made and attention was concentrated on operating methods, to reduce the cost to the minimum. Owing to the cost and uncertainty of labor in districts away from the railroad, and numerous other resulting factors, our costs were excessive, but inasmuch as these still permitted a profit, operations were fairly satisfactory. Much preliminary testing was done by the California Ore Testing Co., and the results attained in treatment of about 30,000 tons were closely anticipated by these tests. The general scheme of treatment was by rapid leaching, using a large total volume, as much as 5 to 1 of solution, of low strength, 0.2 to 1 lb. per ton. Excessive alkalinity aided solution and precipitation results, and about 15 lb. CaO per ton tailing was added. The extraction ranged from 45% to 55%, averaging 50% and the costs on about 15,000 tons treated, at the rate of 80 tons per day, were very closely as follows:

	Per ton.
Labor	$0.34
Solution men	0.14
Superintendence	0.08
Cyanide, ½ lb. at 22c	0.22
Zinc shaving, 0.4 lb. at 15c	0.06
CaO, 15 lb. at 1c	0.15
Gasoline power	0.06
Marketing bullion	0.05
Depreciation and amortization	0.20
Supplies and petty cash	0.05
	$1.35

Many physical difficulties, owing to adverse operating condition, were encountered in the treatment of the tailing. It was found most essential to change the stock solution completely every month or two, owing to fouling by soluble impurities in the tailing. On using fresh solution, good results were always obtained with little trouble, but after use for several weeks the fouled solution gave much trouble, in precipitating principally. This was the only important metallurgical difficulty.

A. W. GEIGER.

San Francisco, December 3.

Mexican Conditions

The Editor:

Sir—With reference to certain remarks and opinions of G. L. Sheldon regarding the Monroe Doctrine—which opinions seem to be shared by many—appearing under the heading 'Mexican Conditions' in your discussion column of November 23, permit me to express myself somewhat emphatically on a subject so greatly misunderstood by both North and South Americans alike.

In order to make it clear that I treat this subject from an international point of view and that I speak in the interests of all, I may mention that I am a *porteño* of Argentina; in other words, I was born in Buenos Aires, where my late father was for half a century one of the leading German merchants and where we still have large interests. My cousin conducts a similar house in Montevideo and an uncle was equally active as an international merchant in Rio de Janeiro, where I spent some time, as likewise in the West Indies and all over Mexico. I may also mention that I spent twelve years in France and Germany before taking up my studies in the United States and becoming an American citizen by choice. All our mining operations in Mexico, in the interest of French, English, and German capital, had to be abandoned with considerable loss and a 10,000-acre cocoanut *hacienda* near Acapulco, owned and operated by several members of my family, was completely destroyed by 80 bandits, one of our nephews murdered by them in cold blood, and everything movable carried away. Indeed I might feel justified in condemning the American policy, but such is not the case. There is a great difference between selfish pocketbook patriotism and true regard for the welfare of your neighbors. I can find no fault with the Monroe Doctrine with regard to South America, but I do find fault with the Americans who go to South America.

When President Monroe established the doctrine of foreign non-interference on the American continents, he proved himself a far-sighted statesman. If it were not for this doctrine, South and Central America would long ago have been partitioned between the nations of Europe, very much like Africa. This would have brought endless dangers to the political and commercial development of the United States, nor would the Panama canal be an American enterprise today. The American manufacturer who is now beginning to enter these most valuable markets may still see his already very difficult undertaking fail completely, because, though his government has insisted upon political integrity of the Latin Americans, she has allowed complete foreign commercial supremacy there. The great trouble is that the South American knows as little about the North American and the United States as a country, about our customs, language, trade, commerce, and politics, as the average American knows about South America. As a consequence, the South American regards the Monroe Doctrine merely as an American 'bluff,' a menace and a political *bete noire*. He cannot bear the mention of it and imagines the United States uses this doctrine merely as a shield and pretext for the purpose of ultimately securing political supremacy from the Rio Grande to Cape Horn.

Unfortunately, and this is the crux of the whole difficulty, the very behavior and utterances of most North Americans in South American countries encourage this view. So firmly is this idea rooted in the South American's mind, that the giving of independence to Cuba, and Mr. Taft's strict adherence to the neutrality laws, almost to a point of censure, have availed absolutely nothing to change it. I regret to state that North Americans are most disliked in Latin America where they are present in great numbers, and herein nothing is at fault but his own personal behavior and disregard for the feelings and sentiments of the people among whom he is living and doing business. In traveling through Latin America I found that I was welcome everywhere and treated with the greatest cordiality and frankness so long as I traveled as a German, but when compelled to go as an American I found many a door closed and was treated with a reserved civility.

Pan-American conferences are being held, and diplomatic

visits are being exchanged, but even the tour of Mr. Root through South America a few years ago, and the visit of Mr. Knox to Central America did not tend to change South American views and in some instances did more harm than good. The true sentiment of political and commercial delegates is never expressed in the carefully worded speeches delivered over the cup of sparkling wine. American envoys and delegates would not feel flattered could they have heard many frank confessions that were made to me, as a German, regarding them, the 'Yankees' and their ways, and for reasons already pointed out, the Latin American has a great aversion to anything that savors of Washington, D. C., or that has any connection therewith. Possibly Latin America might have developed faster if left to the mercy of European aggrandizement, though this is open to argument, but one thing is certain and that is, if the United States had not upheld this doctrine the American flag would not fly over 48 states. It cannot be denied that this doctrine is also an irritant to other nations, who, despite the fact that the United States cannot possibly do police duty in every place, are fond of holding the Unites States responsible for everything that goes contrary to their own interests anywhere south of us. Only recently England tried to hold the United States responsible for the atrocities committed in the Putamayo rubber district because she did not do police duty along the Amazon basin, and only a few days ago a member of Parliament stated in an interview that, if it were not for the Monroe Doctrine, England 'might do something,' whereas, as a matter of fact, these atrocities can be charged directly to the greed and incompetence of the English directors of the great rubber companies, who now under the cloak of humanity, while purposely and greatly exaggerating these scandals, blame the Monroe Doctrine for not being able to 'do something.' When these scandals began to leak out, thanks to the successful wireless establishments (belonging to the German *Telefunker Gesellschaft*) between the Amazon district and Lima, the English commissioners hastened to explain that 30,000 Putamayo Indians had been murdered or lost their lives. As a matter of fact, the whole Putamayo district has never contained more than 30,000 Indians, most of whom are still alive.

It is often said that the caliber and capacity of a man can be gauged by the number and character of his enemies—the same can be said of the Monroe Doctrine. John Barrett, the director-general of the Pan-American Union in Washington, has recently voiced the true sentiment when he said that we must stop shouting about the Monroe Doctrine and make every effort to replace the same by the spirit and doctrine of Pan-American trade. Nothing is truer and more correct. How is this to be brought about? I might suggest an easy solution, but a discussion of such a commercial problem would fall entirely outside the scope of this paper.

In my opinion the Germans and French will always be the leaders in Latin America in the handling of certain goods and commodities and England will always be the leader in the field of transportation, but it will be left to the American to do the really big things there—it will be the American engineer and American banker who will accomplish the greatest achievements and win the greatest prizes. Goethal's work in Panama and E. L. Corthell's great work in Brazil are good illustrations of what may be done. There is absolutely no reason why the United States should not secure the entire trade in engines and heavy machinery, belting, and agricultural implements through Latin America. The great benefits of the Monroe Doctrine to the American nation are only beginning to be felt and will in due course be appreciated alike by North and South America. The Panama canal will do much to replace the political with the commercial doctrine of trade.

The disturbances in Mexico have indeed been exasperating and the United States has been lenient to her neighbor, but it must be understood that Mexico is undergoing more a constructive than a destructive period and that she is only now obtaining the experience that Argentina, Brazil, Chile, and Peru went through years ago, countries which stand today on firm political and commercial foundations. Mexico is destined to become a great country, as great as Brazil and Argentina. After she has fought out her own battles she will settle down to greater peace and prosperity than she ever had before. I am quite sure that when the smoke of battle has cleared she will not forget her friend in need, the United States, and will make full restitution to those who suffered on her account. We must not forget that not so very long ago a much more bloody, much longer, and much more destructive war was fought at home, that millions of dollars of foreign investments were wiped out, property was ruined, pledges were disregarded, and that this country would have tolerated no outside interference. The very fact that the United States has not interfered in Mexico will in due course of time be appreciated more than anything we could have done, and the gain this will bring to the nation at large in prestige, in trade, and in commerce all over Latin America will be infinitely greater than all individual losses sustained.

The United States has absolutely no cause to change her policy regarding Latin America, but the individual American has much to learn with regard to these immensely rich countries and their peoples. If he would indeed 'get off the fence' he would find the Western hemisphere a safer place to live and in which to transact business. I do not believe he need worry much, as whether or not foreign nations like the American policy in Latin America, the important fact is that they are keeping their hands off. The Monroe Doctrine never was a police doctrine. Framed more in the spirit of self-protection, it has stood the test and has answered its purpose. It is now up to the Americans of this generation to reap the benefits and to establish the doctrine of Pan-American trade. The engineer, the exporter, the importer, the rancher, the farmer, the banker, the capitalist, the promoter, will each find a field for his labor in South America that is today unexcelled anywhere in the world, and each would do well to carefully study those countries. Do not hesitate to go there, but when you do go, leave your shouting American eagles to roost at home, watch the Germans, French, and English, and remember that in many things the peoples of South America can teach you more than you can teach them. If this be done, there will be less cause for misunderstanding, friction, and hard feeling.

JUAN FELIX BRANDES.

San Diego, California, November 25.

Copper Producers' Association Report

The Copper Producers' Association statement, December 9, shows an increase during the preceding month in accumulation in this country of 9,419,095 lb. The details are as follows:

	Pounds.
Stocks of marketable copper of all kinds on hand at all points in the United States, Nov. 1, 1912	76,744,967
Production of marketable copper in the United States from all domestic and foreign sources during November	134,695,440
Deliveries for consumption, November	69,369,795
Deliveries for export, November	55,906,550
Stock of marketable copper of all kinds on hand at all points in the United States, December 1.	86,164,062

The changes in surplus since December 1, 1911, have been as follows, in pounds.

	Increase.	Decrease.
December 1911	.....	22,330,493
January 1912	.....	22,173,252
February	.....	3,301,944
March	.....	572,431
April	2,927,829	.....
May	.....	15,450,386
June	.....	5,280,639
July	5,945,416	.....
August	.....	3,579,046
September	16,364,213	.....
October	13,679,380	.....
November	9,419,095	.....

Special Correspondence

MANILA, P. I.

DREDGING PROGRESS.—RESOURCEFUL PROSPECTORS.—COAL, IRON, AND OIL.

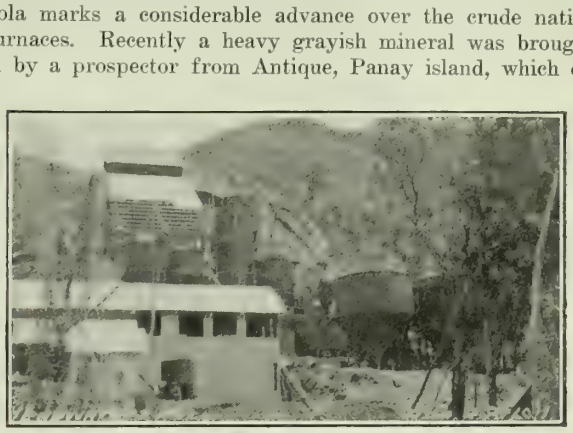
During the past year the Benguet district has been unable to recover from the backset which it suffered in the latter part of 1909. The Benguet Consolidated is no longer milling; the Major mines have shut down indefinitely; and the Headwaters mine has been having more or less trouble, though it still runs. Development work continues on the Kelleys. In Masbate the Colorado mine and mill is doing well under the superintendence of H. C. Wilmot, and is sending up a good sized gold bar regularly. Throughout the rest of the district there is nothing more than the usual assessment work and some development.

The most encouraging news comes from the Paracale district, which has had so many vicissitudes in the past. There are four dredges now at work. The Risdon is on the Malaguit river. The Paracale dredge is on the Paracale river. This dredge has been entirely overhauled and now belongs to the Paracale Bucket Dredging Proprietary Co. (controlled largely by Australian capital). Two new pontoons belonging to this company are in the water and part of the superstructure built. The Stanley dredge, which has been idle off and on due to litigation, has been working lately in the upper part of the Paracale basin. On the Gumaus river, in the same district, the Philippine Exploration Co. has begun operating its new dredge, built by the New York Engineering Co. This dredge has had only one clean-up and returned 275 oz. with the ladder on the bottom only three days. This has 5½ ft. close-connected buckets, passing 22 to the minute over the tumbler. Mr. Kane, the pioneer dredgemaster of the Philippines, is in charge of this dredge. Messrs. LeDuc and Hanlon have been doing some placer work in the cocoanut grove in the neighborhood of Paracale. Their method is to sink a caisson through the saturated upper loose material and when the hard bottom ground is reached, drive a drift as in lode mining. In the early stages of the work, Mr. LeDuc went down in a prospecting shaft which had filled with water, using an oil can for a diving helmet, into which air was pumped by the natives at the surface. Such is the resourcefulness of the American prospector, as well as the usefulness of the ubiquitous oil can. Mr. LeDuc reports rich gravel.

Of quartz mining little can be said to be going on in this district. A new drainage adit to the San Mauricio mine from the mine to Mambulao bay is being driven, and it is hoped by those interested to be able to resume operations here shortly. At Cansuran, Surigao peninsula, Mindanao, the Surigao Gold Mining Co. has about 4000 acres of placer ground which it is sluicing. Some of this carries $2.50 per yard, though the average would be doubtless much less. Many engineers have made estimates of the probable total yield of this ground and one of the most conservative engineers who has been in the field has made an estimate of $4,500,000 upon the ground. The gold is usually about 790 fine. Mr. Parker, one of those interested, has several ½-pint bottles full of fair-sized nuggets in his house at Surigao.

In the coal basin it is regrettable to have to report the shutting down and sale at auction of the East Batan mine, on Batan island, which has been in operation since 1907. This is not the end of the coal business in the Islands, however, for there are other and better deposits which will be developed sooner or later. The experience of the East Batan mine will be of great benefit to future operators. When all the conditions are known, allowance will be made for the mistakes of this pioneer company. Philippine mines are not alone in their tribulations, as the Labuan (Borneo) coal mine has already caused five companies to fail. The quality of this coal and its principal characteristics were known long ago and pointed out in the bulletin issued in 1906 by the Philippine Mining Bureau.

There are no new developments to be recorded at this time in the Tayabas oilfield. The Government Bureau of Lands is making a topographic survey of a part of the peninsula. In the iron industry the only new development has been made by Charles Wilson, who has built a cupola 36 ft. high, 40 in. diameter, 12 ft. from charging door to tuyeres. In one week's run he turned out 2000 sets of plow points and shares which sold at 55c. each. This cupola marks a considerable advance over the crude native furnaces. Recently a heavy grayish mineral was brought in by a prospector from Antique, Panay island, which on examination proved to be wolframite. If this can be definitely established as having been found in the Philippines, it will be a great stimulus for mineral industries here.



HEADWATERS 10-STAMP MILL.

HOUGHTON, MICHIGAN

LOW WORKING COSTS IN COPPER MINES.—HIGH CRUSHING EFFICIENCY.

J. R. Finlay has stated that it is highly doubtful if the average cost of copper produced by the so-called Western porphyry mines will be as low as that of the deep mines of Michigan. In general the cost of producing copper in the Lake Superior district is being materially lessened. In 1908 the cost per ton of mining, transportation, stamping, and taxes at the Calumet & Hecla was $2.15; in 1909 it was $1.93; in 1910 it was $1.92; in 1911 it was $1.84. That is, a reduction of $0.31 per ton was obtained in three years. The Calumet & Hecla ore, including amygdaloid and conglomerate, averaged 31.22 lb. of refined copper per ton of ore stamped in 1908; 28.18 lb. in 1909; 25.77 lb. in 1910; 25.47 lb. in 1911. The U. S. Geological Survey reports that for the total Michigan production in 1908, the average output of refined copper per ton of ore stamped was 21.2 lb.; 20.5 lb. in 1909; 25.5 lb. in 1910; and 20.0 lb. in 1911, or 1 per cent.

A few years ago certain seers in the Lake Superior district began to have visions of 'dollar rock.' But on account of the depth of the mines and the excellence of the mining practice then in vogue, these prophets were ridiculed. In view of the costs submitted for 1911, the prophecies do not now seem so absurd. The Osceola company in 1911 was mining, transporting, and stamping ore, and paying taxes, at a cost of $1.14 per ton; Ahmeek is doing it at $1.42; Mohawk at $1.406; Isle Royal at $1.42. The last mine has reduced the cost from $2.33 in 1908 to $1.42 in 1911, a difference of $0.91 in three years.

The reductions in cost are due to increased efficiency underground, where lighter rock-drills have supplanted the old 'slugger' types, and to improvements in mill practice. The stamp-mills have introduced steeple compound heads, regrinding apparatus, and pebble-mills. It is interesting to note in passing that there are less than 100 stamps in the entire Michigan district. In 1910 there were milled 10,869,561 tons, and a number of stamps were idle. Ordinarily the Lake Superior steam stamp has a capacity of 320 to 700 tons per day, according to type of stamp, size of screen, and kind of ore. Several stamps have been improved to such a degree that they crush 800 tons per day.

Most of the mines do not report the cost of milling the

ore. It probably averages in most cases over 20c. per ton of ore stamped. The Osceola company reported a cost of 17.47c. for 1907, and 15.78c. for 1908. During 1911 there were eight mines which paid dividends; the same was true in 1907. In 1908, 1909, and 1910, there were seven mines which paid dividends. There are usually between thirty and forty copper mines operating or exploring, the stock of practically all of them is traded in on the stock market. The eight mines which paid dividends in 1911 are controlled by four different mining companies.

MELBOURNE, AUSTRALIA

FLUXING ORE FROM PAPUA.—A QUARTER CENTURY'S PROSPECTING.—NEW SOUTH WALES MINING MEASURES.

The Great Fitzroy Mines, Ltd., in Queensland, a Bewick, Moreing & Co. flotation, has acquired an option over the Laloki mine on the Astrolabe field, in Papua (British New Guinea). The mine is only 17 miles from Port Moresby, with which, it is understood, the Government intends to connect it by rail. The mine, which is held by a small syndicate, was worked by the British New Guinea Development Co. on option, and abandoned, owing to the high cost of transportation by road. The Great Fitzroy is taking it over in the belief that it will provide suitable fluxing ores. Down to a depth of about 20 ft. the ore is gossan; for the next 30 ft. there is a secondary enrichment with chalcocite, covellite, etc., containing about 20 or 25% copper, below which the copper content decreases to 3 or 4%. The content of the ore is given as 2.8 to 4% copper, 43.8 to 50% iron, 4.1 to 9.6% insoluble matter, about 45% sulphur, 2 to 3.1 dwt. gold, and 0.35 to 4.3 oz. silver per ton. For profitable working it will be necessary to handle between 500 and 600 tons of ore per week and G. C. Klug, the Bewick, Moreing & Co.'s representative, estimates that at least 200,000 tons will have to be proved by development before the company will be justified in equipping the mine. The development recommended will cost $25,000 or $30,000. For the option a sum of $25,000 is being paid, and there is to be a royalty of 50c. per ton payable on all ore treated during the time of the option. The harbor at Fort Moresby is to be deepened to allow of the berthing of bigger ships than it can accommodate at present. If the enterprise proves successful it will be a great thing for the mineral industry of Papua.

Twenty-five years is a fair length of time for the driving of an adit to be carried on, but that is the period over which the Bright District Prospecting Co., a Victorian concern, has been driving to intersect at depth certain veins which have been worked above. Not until this month had any success been met with; but now, in a drift some 260 ft. from the main cross-cut, a highly mineralized auriferous vein has been found. Assay values, according to daily samples, are from 5 dwt. to 1 oz.; but daily samples can be made to prove anything, and it is necessary to wait for systematic sampling or, better still, for mill results, before pronouncing an opinion in regard to the value of the find. The vein where cut has a width of only 12 in., but there is 1560 ft. of backs, so it may be that the company has a good thing. Certainly such remarkable perseverance deserves some reward.

In the New South Wales Parliament, the Mines Inspection bill and the Miners' Accident Relief Fund Amendment bill have both been withdrawn, through the pressure at the close of a session when it becomes necessary to lighten the load of legislation. The wages award in the coke-making industry of New South Wales may give Americans some idea of the happy conditions of the Australian laboring classes. A week's work is to consist of 48 hours (in most industries it consists of not more than 44), and Sunday and holiday work is fixed at double rates. Preference of employment is given to members of the Coke Workers' Association. An employee must be allowed time off to attend delegate meetings which he is appointed to attend, provided his employer is given 24 hours' notice. These terms must not be supposed to be unusually favorable to the workers. They are, in fact, unusually moderate. Whether, however, the excellent terms the workers can now demand will be maintained through periods of depression remains to be seen. At present, anyway, the working man is master of the situation. He is exacting his full pound of flesh and giving in return for it as little as he can.

JOHANNESBURG, TRANSVAAL

SEPTEMBER OUTPUT.—HIGHER YIELDS AND COSTS.—THE FAR EAST RAND.

During the month of September the average recovery per ton milled on the Rand is given by the Chamber of Mines as 28s. 7d. as compared with 28s. 9d. for the month of August. Throughout the whole of the year since January there has been a steady improvement in the average yield, but in September a slight setback in recovery is to be noticed. It is difficult to trace the cause of this improved yield, but it may be due to the tendency which has been shown lately to send a higher grade of ore to the mill by restricting mining to the richest parts of the property, of which several instances might be quoted.

There is for instance, the East Rand Proprietary mines, where the grade of the ore sent to the mills has appreciably improved. Considering the large output from this property such a changed policy is calculated to make itself felt on the whole output. Several other large producers have been adopting a similar practice, so that there is every appearance that, coupled with the more satisfactory results obtained in the Far East Rand, the changed working policy may account for the higher grade of ore sent to the mill. Another factor in support of this view is the higher level attained by the working costs. While the grade has been going up, the working costs have also, until at one time it seemed doubtful whether there was any benefit to be derived by sending a better grade of ore to the mill. Such consequences are just what may be expected as a result of selective mining. Whether it pays to improve the grade to obtain such a small increase of profits at the expense of the working costs must all depend upon the surrounding circumstances.

Another month has passed without the results of the reduction in railway rates being made apparent in the Rand working costs. Last month the cost was 18s. 8d. per ton, just the same as in July, the month before the reduction in railway rates took effect. Undoubtedly considerable effort is apparently made to reduce the working costs on the Rand and operators are loth to believe that this steady increase in working costs is due to the growing depth from which the ore is being mined, regarding it as more likely due to the practice of selective mining in the attempt to increase the profits. Last month the profits averaged 10s. per ton milled; the total working profits made on the Rand being in September, £1,040,820.

Since the discovery in the Modder Deep, which exceeded all anticipations, more attention has been devoted to the Far East Rand, where several important shafts are being sunk. Perhaps the least important is the circular shaft of the New Modderfontein, which has just proved the reef, and accompanying partings, to be 48 in. wide, with an assay value of 13 dwt. per ton. To the New Modderfontein company, however, the find is of immense importance, as also to the Modderfontein Deep, as it proves that probably the well developed and satisfactory vein discovered in the Modderfontein Deep is no patch, but covers an extensive area. This would also appear to be the case by other discoveries in the neighborhood of the original one on the property.

It is to be regretted that better finds were not made in the two westerly shafts of the Government Areas, as the position of the shafts is such that more favorable results might perhaps have been expected. But the other two shafts going down to the east of the Brakpan mine are situated in interesting ground, and may possibly make up for the disappointment resulting from the only ordinary ore found in the western part of the property. Farther to the east the Springs mines are making good progress, with

the shafts in what has all the appearance of being a promising area. But seeing that so far its value has only been indicated by bore-holes, not much reliance can be placed upon the results until the reef has been intersected by a shaft and driven upon some distance. The Far East Rand is the only area where shaft-sinking is now carried on to any extent and it is not difficult to see that, providing the Rand continues to increase its output of gold, it will be from this area that most of the increased output will be obtained. There is not much scope for further extension on the central Rand, while on the western Rand the reefs are covered by great thicknesses of overlying dolomite, making prospecting an almost impossible task.

NEW YORK

SOUTHERN PACIFIC DECISION.—NEW GRANBY PLANT.—A NEW DISTRICT.

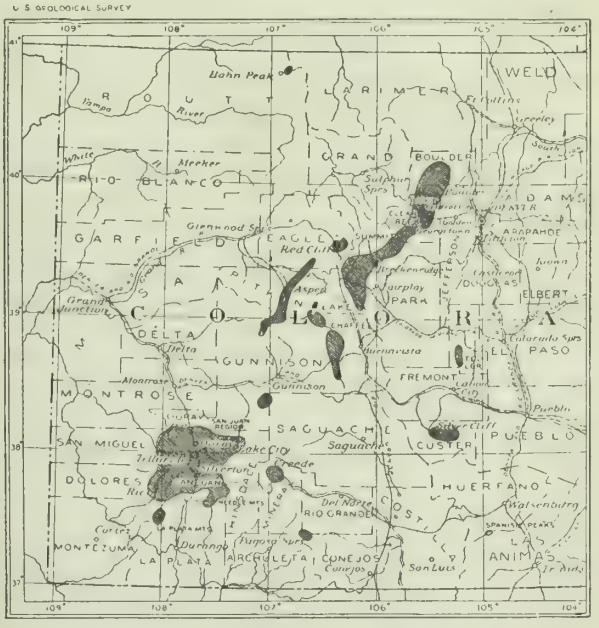
Following the handing down by the Supreme Court of the United States of the decision in the Union Pacific-Southern Pacific merger suit, there has ensued a period of depressed bewilderment that has apparently involved all of Wall Street. That part of the Street which has not developed as acutely bearish is hesitating, much befogged, and is seeking for new points of the compass. Prices have suffered generally, and as yet there has been no evidence of a strengthening of the situation or a stiffening of prices. To point to any one particular cause as responsible for the present slump and unsettlement is impossible. It would be presumptuous to declare that the foreign situation has ceased to be an active market factor. It is generally believed by the Street that peace is to be restored in Europe, and that a general conflict will be averted. There remains, however, the bill to pay, and the nations realize as never before the cost of warfare, even when such operations are of no greater magnitude than those recently conducted in European Turkey.

The economic issues that constitute the gravest problems confronting the country are taking shape in the developments from day to day, and, as important underlying factors, are not without market influence. As the Pacific Coast has wrestled with the Union Pacific-Southern Pacific combination, so New England is making heroic efforts to overcome the domination of the New York, New Haven & Hartford Railway Co. The Federal Grand Jury is now investigating the recent squelching of a competitor of the New York, New Haven & Hartford, and the possibility of criminal proceedings against some of the best known men in the financial world is not one to reassure market operators. The banking situation in New York, which very directly affects the whole country, is receiving its due share of attention, while the 'money trust' investigation is about to recommence, and an important statement has just been made by the Secretary of the Treasury. Undoubtedly the most important suggestion that is made, among others, is his insistence upon the great necessity "for independent banking units—so independent that no one bank can be owned, controlled, or shared in any degree directly or indirectly by any other bank."

In the face of the general success of such bear attacks as have been organized, Braden Copper has made a most striking advance. The shares registered a high mark of $10.62 at a moment when listed shares on the New York Stock Exchange were in precipitate retreat. Just how successful a campaign of distribution is being made in Braden is hard to estimate. From the reports given to the press it is evident that the property is expected to develop into one of the most important copper producers of the world, with a tremendous ore reserve and a very low copper cost. J. P. Graves, general manager for the Granby Consolidated Mining, Smelting & Power Co., is about to call for bids for the construction of the new 2000-ton smelter for the Hidden Creek property.

The passing of the quarterly dividend by the Goldfield Consolidated subjected the Nevada precious-metal stocks to considerable pressure. The Tonopah issues were sold freely, and this part of the market very noticeably felt the effects of the prevailing gloomy atmosphere, an atmosphere by no means dispelled by the various dividend declarations. The distribution of an extra payment of 50c. per share by the Nevada Consolidated was largely without effect, owing to the majority of the issued stock being held in the treasury of the Utah Copper Co. It is worthy of note that the Nevada Copper Co. declares this extra 50c. from accumulated surplus, and the distribution is therefore to be considered as a part return of principal invested rather than a distribution of earnings. The shareholders are counting upon an increase in the quarterly distribution of the Utah Copper Co. for the first quarter in 1913 as a result of the increased receipts from Nevada Consolidated. The possibilities of a big consolidation or merger in Ely, Nevada, were not received as a good omen market-wise by the holders of Giroux, this issue having been one of the weak spots in the mining-share list for the past several days. There is hardly a copper property in which the public is interested, with the standing exception of Trinity Copper, which is as much of a mystery as Giroux.

Followers of mining markets throughout the East are hoping that new interest in the mining-share list will come through the discovery of new areas, an encouraging report



COLORADO.

having been received from Colorado to the effect that a new district has been discovered in that state near Monte Vista in Conejos county. The thorough exploration of the mineral-bearing possibilities of the world has been mentioned heretofore in this correspondence. Along this line it is interesting to note that the present Government of Panama is just passing a bill for the policing of the San Blas country, a part of the territory of Panama which is believed to be rich in minerals, but which has never been thoroughly explored on account of the inability of the Government to protect prospectors against Indians.

As a part of the Eastern campaign being made to distribute the stock of the El Paso Consolidated Gold Mining Co. of Cripple Creek, the company has had placed on exhibition a large glass model of the El Paso mine showing the various levels and shafts, and also showing the Roosevelt drainage adit, upon which the recent movement in El Paso is based. In the state capitol at Albany there has been for many years a complete model of the old Valenciana mine at Guanajuato, Mexico, a property which is credited in history with being the greatest precious-metal producer of the world, but which has been filled with water for many years.

The Ahmeek Copper Co. still retains its premiership as a dividend payer among the newer copper companies of the Lake country. Its recent declaration of $7 is for the

quarter just closed. The last quarterly dividend was $6 per share. Six months ago $5 was paid, nine months ago $4, and one year ago $3. The coming back of various leading copper companies into the dividend ranks is very gratifying, but at the same time it is a little discouraging to note that Nevada Consolidated has sold down to $19 just after the declaration of its extra payment.

Copper circles have anticipated a somewhat unfavorable statement. Estimates of the decrease range from 15,000,000 to 30,000,000 lb. [The increase was actually 9,420,000 lb.] The situation is due to restricted exports partly because foreign consumers have drawn more freely than usual upon reserves abroad (the last fortnightly figures showed a decrease of 6,000,000 lb. in visible supply) and partly due to a lack of bottoms for loading. The Hamburg-American Line has leased quite a number of new vessels that will be used principally to handle export copper, but this betterment will not be noticeable until the February report appears. The copper metal market is a rather dull affair. Foreign trade has not been in evidence during the week, and the majority of the business has been that of supplying smaller domestic consumers. As in most other lines, manufacturers consuming copper are disposed to proceed with great caution.

AUSTIN, TEXAS

HAZEL DRY CONCENTRATOR.—SHAFTER OUTPUT.—THE QUICKSILVER INDUSTRY.

The new dry concentrator of the Hazel Mining Co., about 15 miles northwest of Van Horn, was recently started to treat the old dumps, which contain about 100,000 tons of ore, said to average $15 in copper and silver per ton. This mine has a good producing record, but has been inactive for several years. The new plant has a capacity of 100 tons per day. Charles Culter, of Dallas, and associates, comprise the company that now owns the property. During a period of about ten years that this mine was worked by A. C. Schriver, of San Antonio, and associates it is said to have produced ore to the value of about $500,000. The ore averaged about 10% copper and 50 oz. silver per ton, and one carload shipment was made that netted $5000 per ton.

Preparations are being made to open up several old prospects in the territory around Van Horn and Sierra Blanca. Some of these old claims are known to be very promising in copper and silver ore as well as some gold. The Maltlay mine in the Van Horn district, which was worked by Jacob Hahn about 25 years ago and produced considerable quantities of copper and silver ore that averaged about $40 per ton, is being investigated with a view to operations being resumed. In the Shafter district of Presidio county the old Shafter silver mine is keeping up its splendid record of production. The present year will show an increase over the output of any previous year, it is said. Considerable prospecting is being done in that district and arrangements are being made to develop several new claims.

Reports from the Terlingua quicksilver district, 90 miles south of Alpine, are not altogether encouraging. It is stated that there is a falling off in production of cinnabar ore and that the opening up of new properties which was proposed a few months ago, has been postponed. The plans for the construction of a railroad into the Terlingua district have also been abandoned, it is now reported. The receivership of the Kansas City, Mexico & Orient railroad which is now being constructed into Alpine from the north, will greatly delay if not entirely cancel the plans for building the branch line of that road to Terlingua. While a railroad is not essential to the operation of the quicksilver mines except that it enables the bringing in of supplies at a low cost the remoteness of the Terlingua district at present places it out of touch with investors and prospectors, and in this way the development of the well known riches of that section is seriously hampered. If the road should be constructed, local men confidently expect steady growth of the mineral industry to follow.

TORONTO, CANADA

THE PORCUPINE STRIKE.—ARRESTING STRIKERS.—NICKEL AND THE WAR.

The Porcupine strike shows no signs of coming to an end and has resulted in numerous disturbances, one of them of a decidedly serious character. The leading mines have been bringing in strike-breakers, but most of these have yielded to the more or less forcible persuasions of the strikers and their sympathizers, and have refused to go to work. However, the forces of the Dome and Hollinger are being hourly augmented and operations at both mines are going on steadily. On December 2 the detectives employed by the mine owners fired into a crowd of strikers congregated in front of the hotel at Timmins with a view to conferring with a recently arrived party of strike-breakers. A number of shots were fired and four of the strikers wounded. There are, of course, the usual conflicting statements as to who is to blame, and whether there was any necessity for the shooting. Several of the detectives were arrested, and one of them, Ferdinand D. Luke, who was identified as having fired on the crowd, was committed for trial. The local magistrate has been kept busy hearing charges of assault, intimidation, etc., preferred by both sides, and numerous heavy fines have been inflicted, with apparent impartiality.

One result of the shooting affray has been to place the duty of preserving the peace in the hands of a large detachment of Provincial Police, as the local feeling against the detectives and special constables is bitter and likely at any time to result in bloodshed. This week the Hollinger company is trying a new tack, and has sworn out warrants against some 300 of its former employees for a breach of the Lemieux act in going out on strike without first giving notice. Under the provisions of the law this renders them liable to a fine of $10 per day. It is the first time that a case of the kind has been brought, and it will be made a test case, as most of the other mines affected could take similar action. The strike has affected the stock market adversely and there has been little demand lately for Porcupine issues.

Cobalt stocks have attracted more attention, among the most active being Cobalt Lake, which has at last reached the dividend-paying stage, having declared its initial distribuion of 2½%. The output for the mine for the current year is estimated at approximately 1,000,000 oz. of silver and the net profits will be about $450,000. Early next year 20 more stamps will be added to the mill, at a cost of about $50,000. The statement of La Rose for October showed a net profit of $97,002. During the first ten months of 1912, 2,272,584 oz. of silver was produced, and net profits of $777,296 realized. The surplus on hand, including outstanding shipments, etc., was $1,658,881. The company has renewed for five years its contract with the Northern Customs concentrator for the treatment of its low-grade ore, calling for a delivery of 100 tons per day. The Preston-East Dome, which, since the closing down of its Porcupine holdings, has been operating the Silver Bar of Cobalt as a forlorn hope, has uncovered a 6-in. vein of good ore on the 50-ft. level. The Buffalo, in addition to its regular 5% dividend, has declared an 18% bonus payable January 1, and an additional 3% bonus to be paid in February.

The European war situation and the increased demand for battleships has greatly stimulated the Sudbury nickel industry. Existing companies are extending their operations and new enterprises are being organized. The Canadian Copper Co. has acquired part of the northern range from the Lake Superior Power Co., and is opening up the Fronde mine and other workings which have for some time been closed. The Mond Nickel Co., which has been operating on a small scale and shipping its output to England, is putting up a large smelter for the production of nickel matte. The Dominion Nickel Co., which owns the Whistle and the Murray properties, but was deterred by former market conditions from entering into competition with the companies already in the field, will build a new smelter and operate on a large scale.

General Mining News

ALASKA

Fairbanks

There are now 16 mills in the Fairbanks recording precinct, 12 of which are built or are being built at the mines themselves, and all will be at work in December. In nearly every case the mine-owner has taken out enough ore from the property to pay for the mill. The mills are situated as follows: One on Ester, that of the Hudson brothers; two on Dome creek, owned by Mr. Spalding; two on Cleary proper at the Newsboy and the Newsboy Extension; one on Willow creek at the Tolovana claims; one on Bedrock creek at the Rhoads-Hall vein; one on Twin creek at the Rainbow; one on Wolf creek at the Rexall; two on Chatham creek at the North Star and the Chatham Creek Mining Co., and one on Fairbanks creek for the McCarty and Fursteneau claim.

Seward

S. Silverman is authority for the statement that the gold produced in the interior and taken through Seward during the past season, has been nearly $200,000, coming from about six different properties. W. Martin has recovered $45,000 from 60 days' work near Knik; the Gold Bullion, in 80 days, produced gold worth $74,000, and concentrate valued at $20,000; M. Kelly took out $35,000 from claims on Willow creek in 60 days; Hayden cleaned up $15,000 in 21 days on Falls creek; the Primrose produced $8000 during the season, and has good prospects; in 30 days $400 was won with a 2-stamp mill at the Skeen Litchner claims, and $45,000 has been spent on development; and over $40,000 passed through Seward from the Cache creek country.

ARIZONA

Cochise County

The Calumet & Arizona smelter in November yielded 4,918,000 lb. of copper, compared with 4,404,000 in October. The Copper Queen mine produced 7,951,746 lb. of copper, while the total output of the Phelps-Dodge mines was 12,888,937 pounds.

The State Supreme Court has handed down a decision in the case of Bowman *v.* Warnekros, which involves the payment of 10% commission on the sale of certain claims to the Great Western Mining Co., of Courtland. Bowman claimed 10% from Warnekros for completing the sale, but the latter denies that the former made a sale, although Warnekros admitted he authorized Bowman to make the sale; but the latter was not in authority when it was actually completed. The District Court held for Bowman, and Warnekros appealed. The last decision remands the case to the Superior Court at Tombstone with instructions to grant the Warnekros demurrer.

In the Federal court, hearing of the appeal of the bondholders of the Tombstone Consolidated Mines Co., bankrupt, will be heard on December 23. When this is settled, some definite policy will be announced regarding these properties.

Gila County

(Special Correspondence.)—The Cole Development Co.'s present activity is one of the most potent indices of the recurrence of mining activity of the western portion of the Globe-Miami mining district. The Cole Development Co. was organized under the laws of Arizona in 1909 with a capital stock of 300,000 shares, par value $1 per share, the amount of stock issued being 112,000 shares, and the amount left in the treasury 188,000. The company will now sell 12,000 shares of stock for 40c. per share, and the money received from the sale of this stock will be used to further equip this already well equipped property. Under the new arrangement, development work will be continued at an accelerated rate, and the ore already developed will be extracted as rapidly as possible. Ore shipments will be begun at once. The property is marked on the U. S. Geological Survey maps as the Cole & Goodwin mine and is too well known to need any elaborate description. The group includes 17 claims on the faulted zone where the ore occurs, and has a length of 6000 ft. along the fault. The present improvements consist of a 400-ft. inclined shaft, 22-hp. gasoline hoist, heavy head-frame, skips, cars, and tools. From the creek level, below the shaft, a 480-ft. cross-cut adit is now within 50 ft. of the fault. The property lies about three miles east of Gibson, or 15 miles west of Miami, and has a good wagon-road to the latter copper centre.

At the Miami plant extensive improvements are in progress in the way of erection of buildings and installation of equipment and the usual progress in development is being maintained. The new mine machine-shops are completed, and the engineering force has entered the new and well equipped offices. The same building contains the mine offices. The concrete foundation for the miners' change-room near No. 4 shaft has also been finished, and the new hospital building is well on in course of construction. Two churn-drills are being operated on the property, and two diamond-drills are being used in the sinking of a perpendicular hole from the lowest level of the mine. Another 600-hp. boiler, the fourth, has been installed at the power-plant, and is now generating power. Production for October reached 2,789,000 lb. of copper, the amount of ore mined being 95,439 tons.

At the Old Dominion, at Globe, there are no new underground developments to record. On the surface, the new crusher-plant excavation work is progressing well, and should be complete by the middle of December. A new 750-kw. turbine has been recently installed at the smelter power-plant, and a new geared hoist will be shipped from the factory early in December for erection at 'A' shaft. The management hopes to have its new basic converters running in January 1913.

Mr. Henderson, the general manager, expects to take out six carloads of about 16% copper ore from the Summit this month, as against seven carloads in November. The lessees also will ship two carloads as they did last month. There are two parties of lessees extracting ore at the Gibson, one party on the Pasquale vein, and the other on the Summit vein. The ore now being taken from the property by the company is on No. 4 level, but as soon as a chute has been finished to the No. 6 level, the ore from the No. 4 level will be dropped through to the No. 6, and the intervening ground between those two levels will be worked from the No. 4 to the bottom.

The ore recently discovered in the Superior & Boston continues as the driving and other exploration work along the vein progresses. The east drift of the No. 8 level continues in this ore and the raise started from the point on that level where the ore first was found has been driven 20 ft. toward the No. 6 level, and is all in ore. As there is nearly 4000 ft. of unexplored ground in the eastward direction in which the No. 8 level drift is following the ore, the prospects for development of ore of good grade seem unusually good.

Globe, December 5.

The Ray Consolidated Copper Co. has completed arrangements to work the Ray Central property, and production will start during December. It is stated that the Magma Copper Co. will obtain control of the Queen company's leases early in 1913. The Calumet & Arizona company has put on more men to work on the roads. The Douglas Copper Co. will develop its property next year by churn-drilling. Eastern capital is interested, and engineers have been examining it during the past six weeks.

Graham County

In November the Shannon Copper Co. produced 1,436,000 lb. of copper, against 1,210,000 lb. in October.

Pima County

The Oceanic mine in the Arivaca district has been bonded for $60,000 to C. T. Tryon and associates, who are well known at Tucson. The ore is free milling, and the mine has produced a fair amount of gold.

Santa Cruz County

The Copper Queen company has discontinued work at the World's Fair mine, in the Patagonia district, which would have involved a deal of $800,000. Work on other options in this district is being continued by the company.

CALIFORNIA

Calaveras County

(Special Correspondence.)—The 10-stamp mill at the South Carolina, near Carson Hill, is about to go into commission. Development at the mine is advancing steadily, and considerable ore is ready for treatment. The mine was recently acquired by Joseph A. Peirage & Co. The Finnegan Extension is keeping the 10-stamp mill at work. Ore lately uncovered is stated to be of good grade. The Hardy-McCreight mine, on Chaparral Hill, is rapidly being prepared for production. The old workings have been cleaned up and repaired and considerable ore opened. The owners are planning the erection of a 5-stamp mill. The property is situated three miles south of Angels Camp. James G. Maltman is superintendent. An 8-ft. vein of $14 ore is reported from Fazzi mine, north of Altaville. The strike was made at a depth of 50 ft., and the ore is said to carry rich pyrite in addition to the free gold content. The vein is supposed to be the continuation of the Sultana-Keystone lode. Andrew Fazzi is managing owner. The Angels branch of the Calaveras Chamber of Commerce is preparing to collect a high-class exhibit of Calaveras minerals for display at the Panama-Pacific Exposition. Lack of water continues to handicap mining operations in this district. The dry season has been exceptionally prolonged. The Calaveras Copper Co. is maintaining a fair extraction from its Copperopolis mines, and shipping to the Mammoth smelter at Kennett. The company will make a heavy production early in the coming year. Boston and New York people are largely interested.

Angels Camp, Nevember 30.

A fire, believed to be the work of an incendiary, destroyed property valued at $75,000 at the Reiner gravel mine, situated a half-mile north of Altaville, on December 7. The damage is partly covered by insurance.

Inyo County

The Saline Valley Salt Co. continues to work steadily. All the towers are finished from Saline across the summit, and work is under way at the Saline loading terminal. Methods of collecting the salt have been improved, and a double track railroad will run from the terminal out on the field. Cars will be moved by cable traction and stationary engine. By next spring, it is expected that the buckets will be dumping salt at the Swansea terminal.

Kern County

The production of oil during November was over 8,000,000 bbl., and the total for 1912 is estimated to be nearly 90,000,000 barrels.

Mariposa County

A two-drill air-compressor has been installed at the Whim shaft lease, near the Mariposa mine, and development will proceed faster. This shaft is down 200 ft., and a vein 24 in. wide has been opened at the bottom.

Modoc County

(Special Correspondence.)—The Sunshine company has on view in San Francisco, a large sample of ore which is part of a shipment of 6¾ tons sent to smelters, and averaged 8.38 oz. of gold, and 16.76 oz. of silver per ton; the net return being $159.24 per ton, and total of $1020. An adit is in 300 ft., and three shoots of ore are being worked on the property. At 175 ft. in, a drift has been driven 40 ft. north on a vein. Two shafts are down 42 and 27 ft., with 6 to 12 in. of hard ore. The installation of a hoist and compressor is contemplated. At the Modoc mine, the shaft is down 150 ft. Two shifts are being worked. From a lease of the Sunshine company, five tons of ore sent to the Big Four mill yielded $11 from the plates, and the average value was $21.40 per ton. The Lucky Dutchman lease shaft is down 40 ft. The Sunset-Hummer claims, owned by Williams & Wall, situated at the south end of the High Grade district, shows 3 to 5 ft. of ore worth over $20 per ton.

San Francisco, December 6.

Nevada County

The new 14-stamp circular Straub mill at the Birchville mine, near Graniteville is in operation. It is of new design, and will crush 30 tons of quartz ore in 24 hours. Water-power is used for driving the machinery; also for generating electricity for compressors and lighting. A fine orebody was uncovered at the Birchville some time ago, and profitable returns are expected.

Work has been started on the new cyanide plant at the Champion mine, on Deer creek; and when it is ready, the North Star company will be able to treat the Champion tailing in this plant. Development in the Champion property is encouraging.

Plumas County

Reports from the Seneca district state that the California-Nevada Mining Co. is installing a 30-ton mill of the arrastre type, one of the improved mills popular as a prospect mill. Development next summer will depend on

mill tests from Pezzoni's claim, in the vicinity of Old Diggings, at Butt Valley.

Shasta County

(Special Correspondence.)—It is rumored that the Bully Hill Copper Co. may commercially test its new process for treating copper ore in the near future. It is understood that negotiations are pending with the Federal Government for permission to blow in the furnaces. The mines and plant are situated near Delamar. Representatives of the Oro Water, Light & Power Co. are vigorously prospecting the placer deposits along Clear creek. The Peterson ranch is being given particular attention, and options are said to have been taken on the Saeltzer, Jones, Mullen, and other tracts. The Clear Creek dredge is operating on adjacent territory, and is understood to be earning good profits. A new furnace is being completed at Heroult by the Noble Electric Steel Co. The last run of the old plant is understood to have satisfactorily demonstrated the practical application of the improved method of electric pig-iron smelting. A new process for the elimination of fume in smelting ores is being tested, and the inventors claim results are highly encouraging.

Redding, December 2.

Two 350-hp. motors formerly used in the Cottrell

plant, at the Balaklala Copper Co.'s smelter at Coram, are being sent to Tacoma. The $30,000 brick stack is crumbling away, and will damage the Cottrell plant if it falls.

The bag-house equipment of the Mammoth smelter at Kennett suffered damage on December 3, through the concrete foundations supporting the fans in the steel flue, leading from the flue-chambers to the cooling-pipes, collapsing. The fans are used in the fan house, midway between the flue chambers of the furnaces and the cooling pipes to reduce the temperature of the fume before being admitted to the bags. They are 16 ft. diam., and are driven by two 250-hp. motors. Repairs are being made with all speed, but it may take a week or more to complete the work.

Sierra County

(Special Correspondence.)—Among recent finds of real importance is that of high-grade ore in the Chispas mine of the Swastika M. Co. This concern has been working for two years opening the mine, and while details are not available, it seems clear that a discovery of real value has been made. The Tightner, too, is now working in excellent ore and the good judgment of A. D. Foote and his associates of the North Star company, in taking hold of this property, seems to have been amply confirmed. Another of the old properties being reopened is the Gold Cañon, which is being handled on bond and lease by C. C. Derby and associates. The mine, which has a recorded production of $750,000, had been idle several years when Mr. Derby took charge. Water under 1200-ft. head is available and pipe-lines and a power-plant have been put in preparatory to the active underground work that is now beginning. The shaft is down 400 ft., but only a small area in the plane of the vein has been mined.

Nevada City, December 6.

There are 50 men taking out gravel at the Bellevue mine, in the north part of this county. The gravel averaged $90 per carload. Work is being done by an incline, 15 ft. vertical depth. F. and W. Bosch have their property in order for winter work, and will work underground as long as there is no water to sluice with.

A rock-crusher weighing 12,000 lb. has arrived at the Sierra Buttes mine, at Sierra City. It was hauled on a wagon from the Western Pacific railroad at Beckwith.

COLORADO

Huerfano County

The Colorado Fuel & Iron Co., Denver, is installing additional apparatus for equipping its mine at Picton, Colorado, with electric drive. The installation includes a 500-kw. rotary converter, two motors of 235 hp. each, four motors of 200, 150, 100, and 65 hp., respectively, and switchboard apparatus. For operating its Coal Creek mine at Canon City, Colorado, new electrical hoist apparatus consisting of a 125-hp. motor-generator set, 250-hp. motor, air-compressor, and switchboard is being added to the power-house equipment. All the apparatus is of the General Electric Co. manufacture.

Lake County (Leadville)

The output of the district for November was slightly below that of preceding months on account of car shortage, which is improving. The Ibex property retains its position as a heavy producer, and several lots of ore were settled at the Arkansas Valley plant at 70 oz. of gold per ton. Besides the iron ore from Fryer hill, a fair tonnage of carbonate of zinc is being shipped. The Cosmopolitan adit is in about 900 ft., in the direction of Corinne mountain. In the face there is a mineralized formation with a strong flow of water through soft porphyry, and the acid water is causing bad air. In the spring it is intended to overhaul the adit and drive it about 500 ft. farther. Several cars of good sulphide ore has been shipped from the old R. A. M. dump.

Teller County (Cripple Creek)

According to local figures, November was a banner month for dividends in this district, no less than $106,500 being distributed in dividends, while large amounts also went to the stockholders in the several close corporations that are operating profitably in the district. The dividends announced were: Elkton, $50,000; Golden Cycle, $30,000; Granite, $16,500; Gold King, $10,000.

The output for the month amounted to 76,697 tons, of a gross value of $1,167,235, and an average value of $15.21 for all ore treated. This is an increase in tonnage and a slight decrease in total value as compared with October, the change being due to the increased activity of the various local mills in handling the lowest grades of mine and dump ore. The figures as reported from the various plants follow:

	Tons.	Av. Val.	Gross Val.
Smelters	3,855	$65.00	$ 250,575
Golden Cycle	30,000	20.00	600,000
Portland (Colorado City)	9,570	22.00	210,540
Portland (Victor)	15,350	3.15	48,352
Stratton's Independence	11,222	3.12	35,013
Gaylord (Dante)	1,800	3.00	5,400
Kavanaugh	1,500	2.15	3,255
Wild Horse	900	4.00	3,600
Blue Flag	1,500	6.00	9,000
Isabella (tailing)	1,000	1.50	1,500
Totals	76,697	$15.21	$1,167,235

Production from El Paso mine during November was 144 cars of ore, of which the company sent out 100 cars averaging $30 per ton, and lessees 44 cars of $18 per ton. The former ore was mined from No. 5, 6, and 10 levels. The Isabella shipped 101 cars, of which 29 lessees owned 97 cars. The company mined four carloads from the new orebody on the 1275-ft. level. Twelve machines are working from a compressor at Lee shaft, and lessees in the Empire State are buying air from the Western Investment Co. for four machines. The Colburn mill is treating 78 tons per day. The 4-in. pipe from a spring at Union Park to El Paso mine, two miles long and costing $5000, has been completed, and is now supplying good water for the mine. Shortage of water has been a drawback to living on Beacon hill. Twelve sets of lessees are working at the Gold Dollar mine. The quarterly report states that revenue from ore shipped and royalties totaled $15,988, while cash on hand amounted to $18,573. During November the Vindicator company shipped 60, and lessees 40 cars of ore, worth $35 and $25 per ton, respectively. The Elkton company sent out 2500 tons of ore in November. About 1300 ft. of driving has been done on No. 11 level. Between 5 and 6 ft. per day has been sunk in hard granite at the Maid of Orleans mine, working two shifts. The shaft is nearly 900 ft. deep.

On December 1 the flow of water from the Roosevelt tunnel was 8650 gal. per minute. So far, the electric pumps at the Golden Cycle shaft have not been entirely satisfactory. A severe storm has been raging over Colorado, accompanied by cold winds and much snow. At Cripple Creek the blizzard was particularly strong, and the wires of the street lighting system were blown down. Power wires have kept up all right.

IDAHO

Latah County

There will be a winter short course of instruction for miners and prospectors at the School of Mines of the University of Idaho, which opens on January 5 at Moscow. Courses offered are: elementary surveying, assaying, mineralogy, mining geology, chemistry, mining machinery, gold milling, placer mining, the cyanide process, concentration and smelting of ores, and mine bookkeeping. There are no entrance requirements and no charge for tuition. The only cost is board and room at Moscow, from $6 to $8 per week.

Shoshone County

The Bunker Hill & Sullivan company paid dividend No. 183, amounting to $65,400 on December 4, making a total to date of $13,911,750. Construction of the Washington

Power Co.'s line to the Nabob mine on the east fork of Pine creek is being pushed ahead, and 50 men are employed on the four miles of country through which it will pass. Twenty men are working at the mine, and development is to be started at once. The Blue Star company operates a group of claims one mile up Little Pine creek, and development consists of an adit 600 ft. long and several open-cuts. A compressor will be installed and more men employed.

MONTANA

Silverbow County

To satisfy a judgment of $200,000 obtained by the Lincoln Trust Co. of New York, as trustee December 15, 1906, the holdings of La France Copper Co., in Butte, organized by F. A. Heinze, were sold on December 3 to T. S. Crotey, of New York, for $100,000. The buyer represented a newly organized La France Copper Co. The November production from all mines was 418,260 tons of ore and 27,937,680 lb. of copper, of which the Anaconda yielded 9,882,000 lb. from 162,000 tons, and Boston & Montana 6,944,600 lb. from 106,840 tons.

NEVADA

Esmeralda County

The principal mining companies of Goldfield and Esmeralda county united in an action last week against the state and county to prevent the attempt to collect taxes on patented mining property. The amount involved in taxes is $3700 on claims assessed for $91,000. From the law it appears that an assessment has been levied on all patented claims at $500 each in the county. This case was argued before P. J. Sowers, judge of the District Court, who, in an opinion that was closely followed by the Supreme Court, ruled that the claims were non-assessable, and issued a perpetual restraining order against the County Clerk and ex-officio tax collector stopping him from collecting taxes on any patented mining claims in Esmeralda county or from advertising the same as delinquent.

Lincoln County

The Prince Consolidated company has resumed shipments of tailing from the Bullionville dump, and is also sending out 400 tons of ore per day; while the Day-Bristol is shipping 100; Mendha, 100; and the Highland Mary, Home Run Copper, and others bring the average to about 700 tons per day. The Day-Bristol will build an aerial tramway from the mines at Bristol to the ore-bins of the railroad at the Day mine, slightly over two miles.

Storey County

The Monte Cristo mine, owned by the Mexican company, has enough ore in sight to pay for the erection of the aerial tramway now being constructed from there to the Mexican mill, through Seven-Mile canyon. During the week ended December 7 the Mexican mill treated 492 tons of ore averaging $26.52 per ton, with 92% extraction. At the Sierra Nevada the new air-pipe is in place, and work was resumed at the 2500-ft. level. From the raise four mine-cars, worth $133 per ton, and 12 worth $14, was saved. At the Consolidated Virginia a new drift has been started. The southwest drift on the 2500-ft. level of the Ophir is now being driven south into the Consolidated Virginia, the face being in porphyry. The Crown Point mined 529 cars of ore worth a total of $5700. At the C. & C. pumping shaft all is in good order. There are fears in Nevada that the assay office at Carson City may be closed, as the United States Congress made no appropriation for it and other offices.

White Pine County

Eight shovels are working on day shift and three at night at Copper Flat, from which the daily output is about 9000 tons. The Nevada Northern is operating eight or nine trains per day, and has four hauling and one unloading crew in the service. At the concentrating plant at McGill, eight sections are working. The Giroux company has several hundred men at work again, but has not resumed ore shipments.

NEW MEXICO

Grant County

The copper output of the Chino mine in November was 4,117,020 lb., making 25,174,000 lb. for the eleven months of the current year.

What is thought to be an extension of the Queen lode has been uncovered by D. L. Cresswell in his claim 7 miles south of Steins. This lies about 200 ft. west of and across

CHINO MILL.

the gulch from the Queen shaft. A force of Mexican miners is at work, and good oxidized copper ore has been opened.

Luna County

W. L. Bradley, an El Paso mining man, who has been working in the old Victoria district west of Deming, has acquired the Rambler mine, adjoining the Excess, which has produced over 1000 tons of lead carbonate ore. These properties are part of the old Hearst group, worked in 1882 and later, and have yielded over $200,000. Pumping and hoisting machinery is to be installed, and the mines prospected at depth.

UTAH

Juab County

At the Centennial-Eureka, owned by the United States Smelting company, the orebody on the 1800-ft. level has flattened, and this is being followed and a large tonnage mined. The Midvale concentrating plant of the company has been closed down, the first time for three years, so it will be overhauled. Within a few weeks the usual tonnage of silver-lead ore will be coming from Bingham.

The Eagle & Blue Bell has a large quantity of good ore opened on the 1350-ft. level, which has been followed 116 ft. below. The weekly output is 600 tons of ore from the mine. New machinery at No. 1 workings of the Iron Blossom has been started. It consists of a Nordberg hoist driven by a 300-hp. direct-connected motor. Good copper ore is being mined on the 2200 and 2300-ft. levels of the Grand Central. The Swansea has closed down indefinitely.

Salt Lake County

Fourteen of the largest water-power electric plants in Utah, Idaho, and Colorado have been merged in a $40,000,000 corporation, which will supply railroads, mines, mills, and smelters with power. D. C. Jackling is president of the new company, whose headquarters will be at Salt Lake City. The new company includes the Telluride Power Co. and Ames & Ilium hydro-electric plants in San Miguel county, Colorado; Durango Gas & Electric Co., Colorado; the Grace plant, Bannock county, Idaho, and the Knight Consolidated Power Co., Utah. In all there are 17 hydro-electric plants with a total of 60,000 hp. and 997 miles of transmission lines.

The miners' strike at Bingham is practically a thing of the past, as previous to it starting the Utah Copper Co. had 1900 men and now has 1500 men employed, while the tonnage handled is equal to that formerly treated. The Bingham Amalgamated adit is now in 1400 ft.

At a trial of the 12-in. Karns tunneling machine at Salt Lake during the latter part of November, it was turned full

speed against a hard, tough rock, and drove 11 inches in 13 minutes, equal to 51 inches per hour. A large crowd watched the performance, and were surprised. Representatives of the machine company say that it will reduce tunneling costs 50 per cent.

CANADA

British Columbia

The mines of the Kootenay district are said to be in better order than ever, which also applies to the Slocan district. The Eureka and Slocan Star mines are opening well. With the Standard dividend of $50,000, the total paid this year by five companies in the Kootenay and Boundary districts is $1,032,512. Spokane capitalists have offered $100,000 for the Rio Tinto group of mines, but the owner has refused it.

During October La Rose income totaled $161,399, expenses $64,307, and net profit $97,092. The surplus now stands at $1,658,881. The Beaver Consolidated shaft is down 700 ft., and is the deepest at Cobalt. A large station is to be cut out, and cross-cutting started.

Ontario

Conditions at the mines have changed little. The union has published a scale of wages for millmen, which is as follows: Shift-bosses, $4.75; amalgamators, $4.25; helpers, $3.75; batterymen, $4; helpers, $3.75; concentrator men, $3.75; filtermen and helpers, $3.50; crushermen, $3.75; solution-men, $4; repairmen, $3.75; mill sweepers, and all other classes of unskilled labor, $3.50 per 8 hours, and includes the regular provisions regarding board. It is stated that the backbone of the strike has been broken by the strike-breakers sticking to their work at the Hollinger. A special train brought in about 50 men for the Dome mine, while other mines are adding to their working forces daily.

MEXICO

Chihuahua

(Special Correspondence.)—At El Rayo Mining & Development Co., construction work has been started on the new aerial cord-wood tramline, and all material is on the property. It should be in operation in February and will cut the cost of wood by one-half. The line will be of the Otto friction-grip type, 11,770 ft. long, made by A. Leschen & Sons. Wood will be transported from the Provedencia valley to Los Azules, crossing a high range of mountains. Nothwithstanding the fact that many mines are shut down in the Parral district, labor is scarce, especially peon labor. Cold weather also interferes with this camp, there having been two snow storms this year. Peons prefer Parral to spend the winter in as it is 2000 ft. lower than Santa Barbara.

Santa Barbara, November 27.

Guadalajara

During October, El Favor Mining Co., one of the Makeever enterprises in the Hostotipaquillo district, shipped 298 tons of high-grade ore to smelters, and milled 637 tons at the mine. Estimated value of the former was ₱30,717, and the latter ₱12,510, and the net profit ₱24,023. The mill also crushed a total of 1765 tons of mixed ore from the El Favor, Mololoa, and Mirador mines, all Makeever properties, the value being ₱44,205. These mines are in charge of Walter Neal.

The Mexican Mines Co. owning the old Bolanos mines, in the Bolanos district, is resumming operations. This company is controlled by the Bradbury interests of Los Angeles, California. Power for the company's plants may be supplied by the Chapala Hydro-Electric & Irrigation Co. of Guadalajara.

Oaxaca

Not less than 25 villages have been destroyed in this state during the latter part of November by government troops. The administration believes that the rebellion in this locality has been cowed by the warfare waged, and sanctioned orders for the retirement of the greater part of the Federals from the state. Over 500 Indians have surrendered. Generally there is little improvement in the situation, in spite of the summary powers allowed the Federals.

Sonora

During October the El Tigre old mill crushed 2804 tons of ore; the stamp-mill crushed 3710 tons; while the cyanide plant treated 6291 tons of current and 1583 of dump tailing, with a total yield worth $157,332. Mining and development cost $16,372; treatment, $31,736; and the estimated profit for the month was $77,840.

The Victor and Guerrero mines have been reported on by A. T. Bird of Nogales, Arizona. They are situated about 12 miles west of Cananea, in the Cerro Jorota, a prominent elevation at the north end of the Sioux mountains, the Victor being at an altitude of over 5000 ft. The Guerrero lies at the foothills, about one mile east of the Victor. The general country rock is andesite, and through each property is a well defined lode, over 20 ft. wide, and highly mineralized. Not much work has been done on the properties, the total being about 2000 ft. There is plenty of timber and water available.

NICARAGUA

Revolutionary disturbances have prevented the Oroya Leonesa mine having a fair trial. It has not been possible to proceed with development, so that the ore reserves remain as stated in the preceding annual report, namely, 94,358 tons, averaging $9.52 per ton, less the tonnage crushed since. A cross-cut has been driven from the main shaft to open up and develop the orebody at a depth of 105 ft. below the No. 1 adit. In a cross-cut from the winze, the Leonesa shoot, at 120-ft. depth below No. 1 adit, assayed $16.40 per ton over 54 in. To carry on development, the company has borrowed $170,000 from the Lake View & Oroya Exploration Company.

QUEENSLAND

At Charters Towers the mills crushed 11,517 tons of ore: cyanide plants treated 12,897 tons of tailing; ore smelted amounted to 298 tons; copper ore produced was 110 tons; and black tin. 11 tons, the combined output for October being worth $207,000.

WESTERN AUSTRALIA

(Special Correspondence.)—The wages question at Kalgoorlie has been the important topic for many weeks past. The members of the various unions are to withdraw from the arbitration agreement at the end of November. There has been a good deal of talk about striking, but it may not eventuate. The opinion of local men is that, before any strike occurs, J. E. Dodd, Member of Parliament, who has always been useful in helping to settle disputes, will go to Kalgoorlie and get the unions to waive their claims for increases in wages if the minimum is adjusted, and that the Chamber of Mines will then probably increase the minimum to $2.64 per shift. Crushings from the new mill of the Associated Northern at Ora Banda have so far shown fair costs and extraction; but the Ridgway 'turnover' filters will not treat the tonnage estimated. Four Huntington mills and three Ridgway machines were designed to treat 12,000 tons per month of kaolin ore containing veins of quartz and iron. The second run of the mill resulted in 5007 tons treated by two mills and two filters yielding $26,000, at a cost of $12,000 for mining and treatment, and $3000 for development, leaving $11,000 profit. Sampling of the Great Victoria mine at Nevoria, in the Southern Cross district is finished, by R. Hamilton of the Great Boulder Co. The price asked is $240,000, which is high for ore averaging $4.80 per ton. The Chaffers company is still trying to find the extension of the Horse-Shoe lodes in the Main Reef property. The New North Boulder mine, worked by a local company, has got the Rutter ore-shoot from the Oroya north block, of the Oroyo Links Co. At 127 ft. in a shaft, the lode was found to be 48 in. wide worth $25 per ton. This shoot gave five leases $170,000 from 4742 tons, less royalty and treatment. Sulphide ore from the North Boulder is treated at the Associated Northern mill, and recent returns total 155 tons worth $8500.

Kalgoorlie, October 25.

Personal

Professional men are invited to send news of their engagements and travels. Such news is interesting to friends.

H. F. Davis is in St. Louis.

Key Pitman is in San Francisco.

James Farraher is at the Palace.

W. D. Wilson is here from Los Angeles.

Arthur W. Stevens, of Boise, Idaho, is here.

Harley A. Sill is at Tumco, California, examining mines.

C. S. Green, of Maricopa, California, is in San Francisco.

James G. Berryhill was in San Francisco during the week.

C. T. Nicolson left for the East last Wednesday, on business.

H. C. Miller, of Saginaw, Michigan, is now at Berkeley, California.

John G. Kirchen, manager for the Tonopah Extension company, is in San Francisco.

Frank M. Estes has returned to Mexico City, with headquarters at 525 Mutual building.

George E. Farish was married to Miss Ellen Douglas, at St. Joseph, Missouri, on November 28.

W. W. Cole, of Roanoke, Virginia, is here to attend the California Miners' Association convention.

F. H. Pettingell, of Colorado Springs, will make his headquarters at Los Angeles during the winter.

B. F. Noehl has returned to Los Angeles after making examinations in the Kingman district, Arizona.

Fred Hellmann will go, early next year, to Chile, where his address will be Chuquicamata via Autofogasta.

John M. Brooks, Jr., formerly of Guanajuato, is with the Cinco Minas Co., at Magdalena, Jalisco, Mexico.

Z. Cushing was operated on for appendicitis at Honolulu recently and is recovering nicely. His return has been delayed about two weeks.

A. Hulshoff Pol left San Francisco for the Dutch East Indies on December 7, and will visit the mining districts of Sumatra and Celebes.

M. N. Colman has returned from Costa Rica, where he has been constructing a cyanide plant for the Panama & Costa Rica Mining Company.

A. F. Flynt, of Tepic, Mexico, has returned to the Zopilote and Purisima mines in the territory of Tepic, Mexico, after an extended absence in the United States.

Morril B. Spaulding is now manager in the Pittsburg district for the Crocker-Wheeler company, with headquarters in the Henry W. Oliver building, Pittsburg, Pennsylvania.

Henry H. Armstead is leaving New York by steamer for Veracruz, Mexico, December 19, to make an inspection of his companies' properties in Guanajuato, Jalisco, and Tepic.

George W. Metcalfe, James Sallee, H. L. Waste, W. L. Cole, M. E. Dittmar, S. E. Bretherton, I. O. Jillson, J. B. Keating, E. V. D. Johnson, and W. H Roberts were Shasta county delegates to the California Miners' Association meeting at San Francisco.

J. Nelson Nevius, after attending the meeting of the California Miners' Association at San Francisco, left for Kennett to study the bag-house system of fume control at the plant of the Mammoth Copper M. Co., in the interest of the Los Angeles Chamber of Mines and Oil.

Obituary

William O. Madden, a pioneer in the development of Goldfield, died at that place early last week, at the age of 61. In the boom days of the Comstock he was employed on the Consolidated Virginia, and later went to Grass Valley, California, where he was superintendent of the Brunswick. At Goldfield he was superintendent of the Florence and Little Florence. Several years ago he retired from active work on account of failing health. He leaves a widow and five children.

Market Reports

LOCAL METAL PRICES

San Francisco December 12.

Antimony	12—12½c	Quicksilver (flask)	.40
Electrolytic Copper	18—18½c	Tin	.52—53½c
Pig Lead	4.60—5.55c	Spelter	8¼—8½c

Zinc dust, 1400 lb. casks, per 100 lb., small lots $9.50—9.75; large $7.50—8.50

METAL PRICES

(By wire from New York.)

NEW YORK, December 12.—Copper remains quiet and buyers, though their wants are poorly covered, continue to hold off for better terms. Lead and spelter are also quiet and business dull. Average daily prices for the past week, in cents per pound, based on wholesale transactions, standard brands, are given below.

Date.	Electrolytic Copper.	Lead.	Spelter.	Silver, per oz.
Dec. 5	17.38	4.35	7.10	64
" 6	17.38	4.35	7.10	63⅞
" 7	17.38	4.35	7.10	64⅛
" 8	Sunday.	No market.		
" 9	17.38	4.16	7.08	64⅛
" 10	17.38	4.16	7.08	64⅛
" 11	17.38	4.16	7.08	64

LONDON QUOTATIONS

(By cable, through the courtesy of C. S. Burton & Co., New York.)

	December
Camp Bird Ltd	$ 5½
El Oro	4
Esperanza	9⅜
Oroville Dredging	1⅛
Santa Gertrudis	6⅜
Tomboy	6⅜

COPPER SHARES—BOSTON

(By courtesy of J. C. Wilson, Mills Building.)

	Closing prices, December 12.		Closing Prices December 12.
Adventure	$ 5	Mohawk	$ 57
Allouez	37	North Butte	31⅜
Calumet & Arizona	66½	Old Dominion	51⅜
Calumet & Hecla	525	Osceola	102
Centennial	16⅜	Quincy	76
Copper Range	49⅜	Shannon	11⅞
Daly West	3½	Superior & Boston	1¼
Franklin	8	Tamarack	34
Granby	62	Trinity	4½
Greene Cananea, ctf.	8½	Utah Con	10
Isle-Royale	30½	Victoria	1⅛
La Salle	5	Winona	3½
Mass Copper	4⅜	Wolverine	67

NEVADA STOCKS

(By courtesy of San Francisco Stock Exchange.)

San Francisco, December 12.

Atlanta	$ .16	Montana-Tonopah	$1.65
Belmont	7.95	Nevada Hills	1.40
Big Four	.51	North Star	.16
Buckhorn	.70	Ophir	.31
Con. Virginia	.31	Pittsburg Silver Peak	.60
Crown Point	.40	Round Mountain	.33
Florence	.56	Sierra Nevada	.31
Goldfield Con.	1.75	Tonopah Extension	2.27
Halifax	1.00	Tonopah Merger	.76
Jim Butler	.55	Tonopah of Nevada	6.40
Jumbo Extension	.26	Union	.20
MacNamara	.17	Vernal	.08
Mexican	1.60	West End	1.05
Midway	.28	Yellow Jacket	.35

MINING STOCK QUOTATIONS—NEW YORK

(By wire from C. S. Burton & Co., New York.)

	Closing Prices. December 12.		Closing Prices. December 12.
Alaska Mexican	$ 13½	McKinley-Darragh.	$ 2⅜
Alaska Treadwell	40	Miami Copper	25
Alaska United	23	Mines Co. of America	2⅜
Amalgamated Copper	74⅞	Nevada Con	18⅛
A. S. & R. Co.	70⅜	Nipissing	8⅜
Braden Copper	9½	Ohio Copper	1⅞
B. C. Copper Co.	4	Ray Con	19⅛
Chino	40½	Tenn. Copper	36⅜
First National	1⅞	Tonopah Belmont	8
Giroux	3½	Tonopah Ex.	2⅜
Goldfield Con.	1⅞	Tonopah Mining	6⅜
Greene-Cananea	8⅛	Trinity	5⅞
Hollinger	15	Tuolumne Copper	2⅜
Inspiration	17⅛	Utah Copper	55⅛
Kerr Lake	2½	West End	1
La Rose	2½	Yukon Gold	3½
Mason Valley	12		

Company Reports

CAUCASUS COPPER CO., LTD.

This company was formed in 1900 to acquire six properties in the Murgal Gorge district of Arlvin, Government of Kutais, near Dzanzul, in the Caucasus. The authorized capital is £500,000. After years of difficulty, the company appears now to be emerging into a period of prosperity. The report covering the year ended May 31 last (Russian style) shows that the production was equivalent to 3030 metric tons of refined copper. The sales brought an income of £256,195, and the working cost was £166,019. Out of the profit, £70,044 was paid as debenture interest, and £23,779 was allowed for depreciation. James Colquhoun, formerly manager of the Arizona Copper Co., is the chairman of the board of directors, and spends a large part of his time at the mine. At the meeting of shareholders he gave many details of the operations. The concentration plant is at present treating 500 tons of ore per day. A third unit of 250 tons capacity is being erected and should be at work early in 1913, while the order has been given for further plant that will bring the output to 1000 tons. A new aerial ropeway is being built, having a capacity of 2000 tons per day. The methods of mining have been altered. In the first place, the overburden, consisting of loose soil varying in thickness from 10 to 100 ft., is now removed by hydraulicking; second, the ore is mined from the great open-cut by the 'mill-hole' system, thus eliminating all shoveling. A new reverberatory furnace has been built, measuring 89 by 19 ft., and the waste gases are used for steam-raising. As regards ore reserve, the estimate seven years ago was 3,600,000 tons, and since then the development has about kept pace with the extraction. The finances have recently been rearranged. The whole of the outstanding profit-certificates, amounting to £500,000, together with £299,900 in options, have been surrendered and canceled. The £579,000 6% second debentures have been scaled down to 5%; and £440,000 loans have been satisfied by 5% second debentures. The issued capital of the company consists now of £500,000 ordinary shares, and there are £45,280 5% first debentures, £500,000 convertible 5% second debentures, and £745,900 non-convertible 5% second debentures. The position of the ordinary shares is therefore greatly improved. It will be remembered that the company has the advantage of the higher price of copper ruling in Russia.

BURMA MINES, LTD.

This company was formed by Bewick, Moreing & Co. in 1906 for the purpose of acquiring ancient silver-lead mines and slag heaps at Bawdwin, near Lashio, in Upper Burma, not far from the frontier of China. The mines were in former times worked by the Chinese for the silver content of the ore, and the lead was an unconsidered item, to judge by the fact that the slag averages 45% lead. These workers confined their attention to the oxidized zone, and the sulphides disclosed by the development work done by the present company contain a large proportion of zinc. The company had to be organized in 1910 on a new basis by reducing the nominal capital, and at the same time assessing the shareholders. The issued capital now consists of 312,046 shares of 4s. each, on which £33,737 has been called up, and there are also £213,685 debentures. The report for the year 1911 shows that the affairs of the company are still being rearranged with the object of putting it on a sounder basis. The smelter has been removed from Mandalay to the vicinity of the property in order to save the expense of transport; a refinery is being built so as to extract the silver and sell the lead in the Eastern markets; while the prospecting and development work has been carried on so as to give the company a source of ore instead of being entirely dependent on the old slag heaps. The ore disclosed by development consists of mixed sulphides running high in lead and zinc, with some iron and copper, and containing much silver. The ore varies greatly in content, but taking an average of the samples quoted in the report, it may be said to contain 8 to 20% lead, 10 to 33% zinc, 1 to 10% iron, 0 to 5% copper, and 5 to 25 oz. silver per ton. The gangue is mostly quartz. In view of the changed conditions due to the nature of the sulphide, shipments of ore have been sent to London for the purpose of determining the best method of treatment. During the year the smelting plant at Mandalay treated 34,340 tons of slag averaging 45½% lead and 2.62 oz. silver, also 2589 tons of Bawdwin ore, and 816 tons of purchased ore. After the removal of the smelter to the mine, 1019 tons of slag and 600 tons of ore was smelted. The total bullion produced amounted to 13,756 tons. The receipts from its sale were £181,296, and the cost of mining, smelting, and administration was £148,804. Out of this £5658 was allowed for depreciation, and £12,821 was paid as debenture interest. The net profit was £15,126, which was carried forward.

TOMBOY GOLD MINES CO., LTD.

The report of the general manager, D. A. Herron, gives details of work for the year ended June 30, 1912. At the Argentine group of claims there has been no advance in development, not due to lack of promising prospecting ground, but owing to the desire of getting the newly acquired Montana property on a producing basis. Development will be resumed on the ore-shoot of the former near 119 manway below the 2100-ft. level, and a block of ground above this level. A year's work at the Montana has confirmed the original estimate that no extra equipment, other than an air-compressor, would be required. Montana ore is transported over the covered surface tramway connecting the portal of the Ophir tunnel with the portal of the 1750-ft. level of the Argentine mine, hoisted through the Cincinnati shaft 90 ft. to the 1650-ft. level, and then trammed to the 60-stamp mill. The Ophir level of the Montana has been equipped with a new track and extended north 300 ft. and sidetrack 250 ft. long constructed near the present face. A large amount of dead work had also to be done before ore could be mined. Owing to the variable metal content of the ore, as well as the size of the vein, it has been difficult to estimate reserves in the Montana mine, but the original tonnage has been increased and the mine is supplying 30 stamps with ore, and 21,702 tons averaging $10.50 per ton in gold and silver was treated. Montana ore assays: gold, 0.42 oz. per ton; silver 4.3 oz.; lead, 1.68%; zinc, 2.21%; iron, 4.52%; and copper, 0.43%. In the Argentine mine ore reserves are estimated at 340,000 tons, there being 230,000 broken in stopes. The mill has been altered and improved by Gelasio Caetania with good results, details of which will be published in another issue of the *Mining and Scientific Press*. The year's operations may be summarized as follows:

Ore treated, tons	107,577
Yield from—	
Ore	$401,432
Concentrate	520,688
Pulsator classifier	32,861
Total production	$954,981
Average per ton	$8.87
Costs:	
Mining and development	$2.20
Milling	1.90
General	0.59
Total per ton	$4.69
Profit for year	$450,941
Dividends paid	$148,800
Carried forward	$54,600

SOUTHERN RHODESIA is in need of a thoroughly comprehensive geological survey by skilled field observers. So far, prospecting has been conducted on haphazard lines and there has been little really systematic exploration along mineralized belts.

Concentrates

Most of these are in reply to questions received by mail. Our readers are invited to ask questions and give information dealing with the practice of mining, milling, and smelting.

MARBLE valued at $6,992,779 was produced in the United States in 1911.

THE value of all the gold produced in the United States from 1792 to the end of 1911 is estimated at $3,358,463,500; and value of silver at $1,629,972,000.

POTASH deposits may not be located under the law governing salines, as erroneously stated in this column recently, but fall instead under the general placer law.

CARBORUNDUM is more effective than emery in polishing sections of metal, or in grinding thin sections, as a lessened pressure is required and the time necessary is greatly shortened.

EROSION in bronze propeller blades has been found to be greatest where the change of rate of flow is greatest, such as in bends or curves where the water suddenly changes its direction of flow, or notches in the blades where the current is converted into a jet-like stream.

THE known coalfields of the United States embrace an area of 310,296 square miles, the estimated supply of coal before mining began was 3,076,204,000,000 short tons, of which 1,922,979,000,000 tons were easily accessible, and 1,153,225,000,000 accessible with much difficulty.

HAIR silver frequently occurs in nature, and its formation is supposed to be due to the fact that Ag_2S is capable of existing as gas to some extent. The metal, as it separates from the gas, is in a condition intermediate between the gaseous and solid, resulting in the formation of fine threads of the metal.

CORROSION of track fastenings on zinc-treated railroad ties is apparently caused by evaporation around the spike head of water containing zinc salts from the unseasoned ties. Steel spikes are more affected than wrought iron, and corrosion is prevented by seasoning the ties by zinc-tanning treatment, or by crude oil.

ALLOYS, as a rule, do not solidify at a definite temperature, but over an interval, sometimes of quite wide range, in which the mass consists of solid grains in a fluid melt. Expelling this liquid by means of a centrifuge, by an inert gas, or by liquid such as oil, yields a porous metal. Thus from an alloy of 90% lead and 10% tin, porous lead can be obtained.

WATER has been a source of expense and loss to many a mining company, but the Bullion Coalition company, in the Stockholm district of Utah, finds profit in it. Below the Honerine drainage adit, owned by this company, is a fertile valley in which the mining company is now raising fine crops on a ranch of 1250 acres irrigated with waste water from the mine.

FATAL accidents in coal mines of the United States in 1911 totaled 2719, of which 1321 were due to falls of roof, 'slate,' or coal; mine cars and locomotives, 438; gas and dust explosions, 362; powder and other explosions, except gas or dust, 134; electrical, 94; mine fires, 80; and all others, 290, showing that the first mentioned causes more deaths than do explosions.

LEAD objects in museums sometimes gradually decompose, leaving a powder chiefly of $PbCO_3$, while other objects do not change. Investigation has showed that more or less chloride was present in the 'sick' lead. To test the matter, lead foil was allowed to remain in neutral 30% NaCl solution and then kept dry. After 3 years the metal was whitish and had gained 0.0517 gr. in weight. Painting the objects with a collodion varnish did not prevent further destruction and long washing with water proved useless.

SUBLIMED WHITE LEAD contains 75% of lead sulphate, 20% of lead oxide, and 5% zinc oxide. Blue lead contains 50 to 53% of lead sulphate, 38 to 41% of lead oxide, with small proportions of lead sulphide and sulphite, and zinc oxide. Zinc-lead oxide contains from 46 to 50% of lead sulphate, 46 to 52% of zinc oxide, and a small amount of zinc sulphate. Leaded zinc oxide may vary from 4 to 20% in lead sulphate, the remainder being zinc oxide, with a little zinc sulphate. Sublimed white lead and sublimed blue lead are produced directly from ore.

EXPLOSION-PROOF as applied to a motor refers to one inclosed in a casing so constructed that an explosion of mine gas (methane), and air within the casing will not ignite a mixture of the same gas surrounding the motor. Out of 248 tests made by the Bureau of Mines at Pittsburg with a motor at rest, a 'puncture' occurred four times. By the term 'puncture' is meant the ignition of the gaseous mixture surrounding a motor casing by flames discharged from it. Twenty tests with a motor running showed no 'puncture.'

MINING property can be protected from liens when under option. Section 1192 of the California Civil Code provides that every building or other improvement or work (including labor and materials furnished for or upon mining claims or in milling or reducing the ores from the same), constructed, altered, repaired, performed, or furnished upon any land with the knowledge of the owner shall be held to have been constructed, altered, repaired, performed, or furnished at the owner's instance and the owner's interest in such land shall be subject to a lien for the same, unless he, within ten days after having obtained knowledge of such construction, alteration, repairs or work or labor, gives notice that he will not be responsible for the same by posting a notice in writing to that effect in some conspicuous place on the property, and within the same period recording with the court recorder a verified copy of said notice. Such notice of non-responsibility should contain a description of the property affected sufficient for identification, with the name and nature of the title or interest of the person giving the same. The copy to be recorded may be verified by anyone having a knowledge of the facts, on behalf of the owner or person for whose protection the notice is given.

SCUM floating upon the surface of stagnant water is commonly regarded as an indication of the presence of petroleum, but is usually only an evidence of the presence of soluble iron salts. Iron in the form of oxides is contained in most rocks and soils. Percolating waters which are charged with CO_2 have the power of dissolving one of these oxides, FeO. The water containing ferrous carbonate in solution oozes from the rocks and collects in pools or swamps, where it absorbs oxygen from the atmosphere. By this process the ferrous carbonate is converted into an insoluble peroxide ($2Fe_2O_3.3H_2O$). The peroxide is deposited in an excessively fine form as a scum on the surface of the water. This has a beautiful play of color and reflected light, and much resembles a film of oil, for which it is often mistaken. The precipitate later sinks to the bottom because of its heavy specific gravity, and there collects as a reddish mud, thus allowing a fresh supply of oxygen to produce another scum on the surface. If some of the scum is inspected under the microscope it will be noticed to contain a number of iron-secreting vegetable organisms called *Gallinea*. A simple way to decide whether a scum on water is oil or precipitated oxide of iron is to place a little of it in a tube and add a few drops of acid. If it is iron oxide it will readily dissolve.

Book Reviews

Any of the books noticed in this column are for sale by, or can be procured from, the MINING AND SCIENTIFIC PRESS.

CYANIDE PRACTICE IN MEXICO. By Ferdinand McCann. 194 pp. Ill., tables, plans, index. Mining and Scientific Press, San Francisco, 1912. For sale by the *Mining and Scientific Press.* Price, $2.

If it were not for the cyanide process, mills in the great Waihi, Mexico, Tonopah, and Cobalt districts which produce silver ores, would probably be still using the old Washoe or patio process. Results from cyaniding these ores surprise many millmen, and in the volume under review there is a comprehensive review of metallurgy in Mexico, including the districts of El Oro, El Tigre, Guanajuato, Parral, and Pachuca. In part this book consists of extracts from one written and published by the author in Spanish and hitherto not accessible to those who do not read that language. To this has been added new matter to bring the practice in various Mexican mills up to date.

Every work on cyanide practice has a more or less detailed summary of the process, and this one has an historical outline to 1906 in readable form. Chapter II discusses shortly what systems of treatment are suitable for different classes of ore, from crushing to filtering the final slime. Eleven chapters are devoted entire to descriptions of the principal plants in Mexico, including a large valuable table prepared by W. E. Hendy, giving details of plant, equipment, and metallurgical practice at five mills in Mexico, and eleven in South Dakota. This particular table practically makes a full description and flow-sheet combined, and is useful for reference. Several of the descriptions mentioned in chapters III to XII are greatly condensed and are to that extent better than those drawn-out in many journals, tending to make reading tiresome. Mexican practice may be summarized as follows: The ores are mainly valuable for the silver which they contain. This ranges from 10 to 180 oz. to 1 of gold, save at the El Oro mine, where the contents are gold $8.06 and silver 3 oz. per ton. Stamps vary from 1100 to 1250 lb. weight, and nowhere has the heavy stamp craze influenced local practice. Crushing is done in weak cyanide solution in all cases, and while on this subject it might be as well to note that the use of hot solutions as used profitably at Tonopah, where the ores carry 100 of silver to 1 of gold, is not mentioned. Crushing in 60 to 80°F. solution and raising it to from 95 to 120° in the agitator is the scheme at Tonopah. Is this of no benefit in Mexico? Concentration is necessary on some ores in Mexico, and this product is shipped away for treatment. Several mills make a sand and slime, treating the former by percolation for about 9 days and the latter by agitation, decantation, and filtration in Burt, Butters, Moore, Kelly, or Merrill filters. The practice of adding hard rough ore to tube-mills for grinding pulp obtains at two plants; but the efficiency of this procedure has been questioned. Mechanical agitators are often used, as well as the Pachuca vat. Precipitation is in the majority of cases by zinc-shavings, while clean-up procedure varies according to experience, acid treatment of precipitate not being general. Extraction varies from 94.18% of gold and 78.56% of silver at the El Oro mill, to 95 and 90% respectively at the Guerrero mill of the Real del Monte y Pachuca Co., Hidalgo; while costs are from $1.14 to $4.04 per ton; and consumption of chemicals at the latter being 2.75 lb. of cyanide, 9.9 lb. of lime, 0.4 lb. of lead acetate, and 1.1 lb. of zinc per ton treated.

The account of the new mill at the Esperanza mine is accompanied by an elaborate yet simple flow-sheet. Two classes of ore are treated, sulphide and hard oxidized, the former being crushed to ¼-in. size and fed to 15 Huntington mills, which crush 15 tons per day each through 60-mesh slot screen, giving 60.7% through 200 mesh, at a consumption of 13 hp. The 1½-in. oxidized ore is crushed by 120 stamps of 900 lb. each, with a daily average of 3.4 tons each. Sulphide ore is concentrated, while all pulp is ground in tube-mills, agitated in Pachuca tanks, and the flocculent slime from primary classifiers, and granular slime from re-ground sand is treated in Merrill filter-presses. An interesting comparison between Chilean mills and stamps is to be found in chapeer VIII, the Loreto mill of the Real del Monte company having both at work, while at its new Guerrero mill there are stamps crushing through 4-mesh screens, followed by Chilean and tube-mills, similar to the work at the Goldfield Consolidated. This is of interest, as this type of mill is being much discussed of late for primary crushing or regrinding from stamps, etc. The first place that the Pachuca vat was tried on the American continent was at the San Francisco mill at Pachuca, and full details are given in chapter X. The Lucky Tiger-Combination mills treating a complex ore are to be improved early in 1913, and their present work is described, showing the work of Kelly filters. Some discussion has appeard in technical journals on the Pachuca and Parral systems of agitation, and Bernard MacDonald gives a comparison of results at Parral. Chapters XIV to XVIII deal with 'Cyanide Practice in Small Plants'; Continuous Cyanide Treatment, in Connection with Pachuca Tanks'; 'Cyanide in Pan-Amalgamation Mills'; 'Precipitation on Metallic Zinc'; and 'Treatment of Cyanide Precipitates,' all of which are thoroughly detailed in a useful manner. Altogether, 'Cyanide Practice in Mexico' is undoubtedly a useful addition to the existing literature on cyaniding. Many works attempt too much in this line; but this one has not covered too wide a scope, and as a result is worth while. It is especially valuable in that it gives in condensed form the actual practice and actual results in a large number of modern mills. The book is well printed and illustrated and forms an excellent companion volume to 'Recent Cyanide Practice' and 'More Recent Cyanide Practice' published by the same firm. M. v. B.

MODERN MINE VALUATION. By M. H. Burnham. 160 pp., tables, and diagrams. Charles Griffin & Co., London. For sale by the *Mining and Scientific Press.* Price $3.75.

Much of the material in this book was previously published in *The Mining Magazine* in a series of articles entitled 'The Finance of a Mine,' and provoked interesting discussion by H. S. Denny, W. H. Goodchild, Ross B. Hoffmann, S. J. Truscott, and others who took exception to some of the author's contentions. The author has evidently profited by the discussion to amplify or clarify some of the principles advanced. While there is much in the book that will commend itself to the more advanced engineer and investor, and will be a welcome addition to what has been published on mining finance, there are a number of engineers who will not agree with the author and who do not believe that the valuation of future possibilities of a mine can be expressed by any general mathematical formula, however ingenious. In most cases of uncertainty of persistence of metal content and tonnage in depth, such practice, in my opinion, attempts to introduce a refinement of calculation that is not warranted by the speculative conditions. In a mine, for instance, where the greater part of the value is speculative and dependent upon extension beyond present openings, any refinement of valuation methods is absurd. It is for the engineer clearly to state the facts and the risks of the enterprise, and his conclusion regarding possibilities and advisability of taking hold. It is for the investor to judge if the reward in case of success is large enough in proportion to the amount risked to make it an attractive venture; in other words, if the game is worth the candle. While the more careful engineer of today applies the principles, if not the formulæ, of valuation advocated by Mr. Burnham, there are a number of engineers who occupy more or less prominent places that might benefit by a careful reading of the book, though their clients might object to these methods being applied to their next flotation. As the author says, the practice and principles of valuation generally observed leave much to be desired, and his demand that a clear and full presentation of data and deductions therefrom be embodied in a report cannot fail to meet with approval. Engineers following this method and with a clear idea of mining finance are "too few in number, unknown to many, and have a status only as special advisers

to the larger and more reputable concerns. Their light often has a bushel kept carefully over it lest the public, learning of their existence, should demand favorable reports from them on new ventures."

A number of pages are devoted to explain the author's system of sampling. This was devised to meet the needs of systematically sampling certain veins on the Rand, and is more particularly intended for large veins of banded structure. Careless work in sampling is always to be deplored, but for ordinary examinations and with small veins it is hardly necessary to go to such extremes; such procedure would seem an unjustifiable affectation of accuracy. But to do Mr. Burnham justice, one must quote: "A sense of economic proportion should be preserved even in examination work." What the author means is fortunately explained in a footnote as follows: "This is a more euphonious way of stating that common-sense on the ground as well as in the choice of sampling and calculating systems is a useful adjunct to accuracy." A number of tables that show considerable thought and labor in their preparation will prove interesting, though many of them are, as the author says, "old friends," and there is much in the book that is commendable. It is well worth reading by engineers, though promoters in general and those engaged in questionable and top-heavy flotations are not likely to recommend the book to investors. C. J.

Catalogues Received

McKiernan-Terry Drill Co., 115 Broadway, New York. Bulletin on Pile Hammers. 28 pages. Illustrated. 6 by 9 inches.

Central Foundry Co., 90 West street, New York. Booklets showing advantages of Universal Pipe. Illustrated. 3½ by 6 inches.

Snow Steam Pump Works, Buffalo, New York. Bulletin S-110, 'Snow Crude Oil Engine.' 8 pages. Illustrated. 6 by 9 inches.

Hinman Hydraulic Mfg. Co., Denver, Colorado. Catalogue No. 12-A, 'Canal and Reservoir Appliances.' 36 pages. Illustrated. 10 by 7 inches.

The Hayward Co., 50 Church street, New York. Pamphlet No. 596, 'Hayward Buckets and Digging Machinery.' 8 pages. Illustrated. 6 by 9 inches.

Allis-Chalmers Co., Milwaukee, Wisconsin. Bulletin No. 1804, 'McDougall Roasting Furnaces.' 12 pages. Also Bulletin No. 1628, 'Hydraulic Turbines.' 16 pages. Illustrated. 8 by 10 inches.

Nonpareil High Pressure Coverings. 71 pp., ill. The Armstrong Cork Co., Insulation Department, Pittsburgh, 1912. An interesting booklet describing losses in steam pipes; how to cover pipes with Nonpareil compound; and general results from properly insulated pipes. This is an important subject in all steam plants, and is well treated in this publication.

Commercial Paragraphs

The Alberger Pump & Condenser Co., of 140 Cedar street, New York, announces that it now owns the exclusive right to manufacture and sell the Hammond meter. This meter has been largely used in power-stations for keeping an accurate record of boiler feed. It is also adaptable for measuring other fluids, and is ideal for use in modern industrial plants.

The H. W. Johns-Manville Co. has recently opened a new Southern warehouse at 31½ South Broad street, Atlanta, Georgia. The entire building, embracing three floors and a basement, with a total floor area of about 10,000 sq. ft., will be utilized exclusively as a warehouse for a stock of such J.-M. products as roofing, boiler and pipe coverings, cements, packings, fire extinguishers, electrical, railway, and automobile supplies.

Decisions Relating to Mining

Specially reported for the Mining and Scientific Press.

Oil and Gas Lease—Rights of Surface Owners

The lessee under an oil and gas mining lease cannot select a place and there drill an oil or gas well if the particular place selected will endanger the property and lives of other people who are lawfully using the surface, when the lessee can drill his well at another place equally convenient to him, and equally advantageous to him, which will not endanger the property and lives of those lawfully upon the surface.

Gulf Pipe Line Co. *v.* Pawnee-Tulsa Petroleum Co., (Oklahoma) 127 Pacific, 252. October 15, 1912.

Agricultural Lease Does Not Give Mineral Rights

Where a lease contained the operative words, "demise, set and to farmlet," without any words in any part of the lease referring to minerals on the premises, it was held to be a lease for agricultural purposes only, and not to convey any mineral rights. Where the lessee in possession under such a lease mines coal and makes passageways, he cannot be permitted to continue trespass on plaintiff's premises by having such passageways to mine coal from other lands.

Trustees of Proprietors of Kensington *v.* Lehigh Valley Coal Co., (Pennsylvania), 84 Atlantic, 820. May 6, 1912.

Extralateral Rights

Held as a matter of fact that the so-called 'fault vein' of the National Mines Company was a continuation of its principal vein, and that the principal vein and its continuation as aforesaid crossed both end lines of the National company's claims, and did not turn and cross the side lines of the Charleston Hill claims as had been unsuccessfully contended by defendants. Hence the National Mines Company was entitled to an extralateral right on its vein beneath the Charleston Hill Syndicate claims.

National Mines Co. *v.* Charleston Hill National Mining Syndicate *et al.*, (Nevada) United States District Court. November 1912 (not yet reported).

Placer Claims in Alaska—New Regulations

To meet with the requirements of the new Alaska placer law (in effect August 1, 1912), the Land Department has issued the following instructions:

(a) Where location is made by agent or attorney, the power of attorney must be in writing, executed and acknowledged in accordance with the laws of Alaska or of the state in which it is executed, and recorded in the proper recorder's office. The application for patent must be accompanied by a certified copy of such power of attorney, showing its recordation.

(b) An agent or attorney cannot at one time represent more than two individuals or one association, and he may make not exceeding two placer locations for each of his principals during any one calendar month. The application for patent should accordingly be accompanied by a sworn statement of the agent setting forth specifically the names of all placer locations and locators thereof, made by him under his powers of attorney during the month in which the claim for which patent is sought was located.

(c) No person can through an agent or for himself locate more than two placers in any calendar month. Accordingly the application for patent should be accompanied by a specific statement of each principal locator showing all locations made by him in person or through agent or attorney during the calendar month in which the claim for which patent is sought was located. This showing must be made in addition to that hereinabove required of the agent himself.

(d) No survey of any claim will be approved which shows an area in excess of forty acres or a length of more than three times its greatest width. These instructions apply only to placers located in Alaska subsequent to August 1, 1912.

Land Department Circular. October 29, 1912.

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EDITORIAL

BULLETS and dollar diplomacy are not always the most important factors in international relations. Germany is reported to have halted its attack on the Standard Oil Company because the naval department urges the desirability of keeping on good terms with American producers of crude.

MONTANA is seldom thought of as a gold-producing state, since the precious metal content of its enormous output of copper has no visible existence until reaching the refinery at Perth Amboy. But the yield of small producers is also considerable, as our Butte correspondent elsewhere notes.

ANONYMOUS contributions will not be printed in this journal, and it seems necessary periodically to repeat this statement. When for any satisfactory reason an author does not care to have his name known, a pen name may be substituted, provided always that the real name be given the editor as evidence of good faith. If 'One of the Great Unwashed,' an anonymous correspondent of ours, will send us his name and address, we shall be glad to print his contribution.

FURTHER correspondence between Mr. F. W. Mondell and the Secretary of the Interior relative to sales of coal land in Wyoming by the Federal Government, recently made public, emphasizes the fact that the prices now charged do not prevent sales for development and are materially less than those that form the basis of transfer of privately owned lands. Allowing ordinary interest and taxes and a reasonable rate of production, the heaviest charge made is equivalent to a royalty of two cents per ton, whereas the courts found in the Owl Creek case that 6½ cents was a fair average for Wyoming royalties.

AGITATION concerning smelter fume has been the direct source of much loss in California. The decreased output of copper last year as compared with two years ago, corresponding to a decrease of nearly $3,500,000 in value of the mineral output of the state, is in large part attributable to this factor. It is interesting to note that the total value of the real estate in Shasta county is but little more than twice this sum, and the single company now in operation there annually expends a greater sum upon the removal of solid particles and neutralization of its fume than would cover the total damage done to agriculture by all the plants since the beginning of smelting operations in the district. The Los Angeles Chamber of Mines and Oil, with characteristic and commendable energy, has sent Mr. J. N. Nevius to study the conditions in Shasta county, with a view to proposing legislation at the next session of the state legislature which will do away with the present continual unrest. Such action is extremely wise. The smelting companies have so far confined their efforts to resisting unjustifiable attacks upon them, and it is high time to take the attitude that smelting is a necessary and well established art which must, for the general good, be permitted to flourish under no more than reasonable restrictions. At present, farms yielding a few thousand dollars per year can shut down a smelter yield-

ing millions. The smelters make every reasonable effort to prevent damage; some have moved their plants to points remote from possible damage and others have gone to great expense in the use of methods of prevention, yet every tree that dies in the county forms a possible basis for a damage suit. The smelters recognize the principle that every industry should bear all the damage incident to its conduct, and are willing to pay reasonable compensation for every authenticated case of injury. Let us have legislation providing for the determination of damage by capable non-partisan men, award upon a reasonable basis, and opportunity to carry on in security an industry which is almost as ancient and no less necessary than the agriculture with which it sometimes interferes.

CHRISTMAS, according to commentators on the obvious, comes but once a year. There can be no successful contradiction of this dictum, if attention be centred on the day rather than the spirit. There is but one twenty-fifth of December in each year, save for those who cross the date line opportunely, but Christmas is more than a particular day. It, like the City of the Hub, is a state of mind. More than that it is a spirit—a spirit of joy, of kindliness, of hope. Not the calendar, the Christmas tree, the hung stocking, or the deluge of gifts, makes Christmas. Like salvation, if you do not feel it, it exists not for you. If, however, you have the wish and the will to widen a little the limits of happiness, if you pause a bit to think of others, if you realize that the *mozo* who serves you or the 'hunkie' in the bunk-house is after all a brother human—one who has feelings, hopes, ambitions mayhap, that differ from your own but are dear to him—if you are touched with the feeling of brotherhood, then Christmas has come to you, and we could wish for you nothing better than that it come not once a year only, but to sweeten and hallow the whole of the twelve-month.

UNPREPAREDNESS has again resulted in loss of life. The account of the fire at Mount Lyell given by our Melbourne correspondent is but a repetition of what has happened many times elsewhere. The management had all the usual safeguards, but had not planned for the unusual. A little fire is a dangerous thing, and nowhere more so than underground. Metal miners, free from the dangers of dust and gas explosions that menace coal miners, forget that the burning of a small amount of wood in the limited space open in a drift or stope, will exhaust the oxygen of the air in a surprisingly short time. Men are suffocated before they are aware there is danger. The confined spaces also make fire-fighting difficult even when apparatus is at hand. Constant watchfulness and a liberal supply of fire extinguishers is the best protection. It is peculiarly true of underground fires that the proverbial ounce of prevention overbalances the pound of cure. A number of the large companies now maintain a regular fire patrol through their mines. At the Tonopah Belmont mine these firemen have, in the past year, found and extinguished a half dozen or more burning candle ends left in such a position as to have possibly caused a fire. Good apparatus and constant vigilance is needed. We would call attention, however, to the fact that a plan for fighting fire should also be matured. Just as the firemen in the cities make in advance plans for fighting a fire starting in any quarter, so a mine superintendent should work out plans for notifying his men, for controlling ventilation, using water lines, and for organizing rescue and fire-fighting parties. Above all else, every man around the mine should know exactly what to do when the fire signal is given. Apparatus without trained men, equipment without educated generalship, is not only useless but may increase the danger.

OIL-FIRING for smelting furnaces is becoming popular, and following its successful application for reverberatory furnaces at the Cananea and Steptoe plants it has been adopted at several other plants in the Southwest. Attempts at blast-furnace smelting using oil as fuel have frequently been made, those at Van Anda, British Columbia, last year being the most extensive. More recently the Pioneer Smelting Company has built a plant for full-scale work at Corwin, Arizona, but no report of the results secured in operation over any considerable period has yet appeared. Like the Irishman who believed he could get his tight boots on after having worn them awhile, new processes are more likely to be successful if tried at large plants; where they are not at all welcome, as they cause too much interference with regular work. At a small property a great variety of business and mechanical troubles not necessarily incident to a new process often seriously interfere with its success, while the difficulties of the process similarly affect the business success of the enterprise. There would seem to be a possible field for oil-fired blast-furnaces, though not a large one. Throughout a large area adjacent to California the substitution of oil for coke would greatly decrease the cost of the heat units necessary. It must not be overlooked that in the blast furnace the purely physical rôle of the coke is often no less important than the heat which it furnishes, and at several plants where the sulphur content of the charge is high enough to permit smelting without the addition of coke, it is nevertheless added in order to give a more porous and faster smelting charge. A considerable increase in the tonnage smelted per day is cheaply secured at the cost of a few tons of coke. On the other hand, in a high sulphur charge the object of the smelting operation is to burn off the sulphur and oxidize and slag the iron present, operations which are not facilitated by the presence of the glowing coke necessary to furnish the additional heat that may be required. Supplying this heat through complete combustion of liquid fuel offers a considerable advantage if a satisfactory degree of porosity of the smelting mixture can be maintained. Unfortunately, the smelter is continually called upon to handle a larger and larger proportion of fine material, and it is only in rare cases that lump ore is available in abundance. The use of oil in blast-furnace smelting has to meet the inexorable conditions of low cost and high capacity; upon the degree in which it is able to meet them its success will depend.

Geological Survey Building

Elsewhere we print an abstract from the report of the Director of the United States Geological Survey, bearing on the need of a suitable building for housing that bureau. We are glad to see the matter made prominent in his report, for we consider it one of first importance. As Mr. Smith points out, there is, aside from the constant danger of loss by fire of documents that can not be duplicated, an equally constant loss of efficiency and serious danger to health under present working conditions. No one who has wandered down the dark halls of the present building and stumbled over boxes and specimen cases while hunting for the author of some famous geological report, has failed to feel that the Government takes but little care of employees in this branch of the public service. Contrasting the cubby-hole occupied by the chief geologist with the private office of a postmaster in a town that has a political pull, emphasizes the need of change. 'Pork barrel' legislation gives beautiful public buildings to small frontier towns in Wyoming, at the expense of efficiency and health among regular employees at Washington. Mining men often complain, and justly, of the delay in writing and printing Geological Survey reports. Much of the delay may be traced

directly to the poor quarters and the crowded conditions under which the geologists and their assistants must work, and prompt issuance of reports need never be expected until suitable quarters are provided. At various times attempts have been made to obtain an appropriation for such a building, but these have always been defeated by some technicality. In 1909 plans were ordered for "a fireproof building of modern office-building type" and an unexpended balance of $96,506 was made available for preparing the plans. It is interesting to note that this money was available because one Western senator, Mr. F. G. Newlands, refused to receive from the Government more than he had paid for his part of a certain city block purchased as site for a Hall of Records. The clamor for this particular building died down after the site was purchased, and now the Government has the land and an unexpended balance. Plans submitted to Congress last May provide for erecting a building for the use of the Geological Survey and closely related bureaus of the Department of the Interior. These call for expenditure of $1,950,000 for a three-story brick or $4,900,000 for a seven-story stone building. The latter amount, as the Director pertinently remarks, just equals the value of the public property now exposed to serious fire risk in the present unsafe, crowded, and unhealthy quarters. Details as to the style of building are of minor import. A structure suitable to its intended use rather than monument is needed, but most of all Congress should be urged to end the present disgrace of expecting gentlemen and scholars to prepare scientific reports under sweatshop conditions.

Public Lands and the States

State control of the remaining public lands is being widely urged. The California Miners' Association, after active debate, pronounced unequivocally in favor of this plan, and in doing so gave voice to a sentiment widely held throughout the West. There can be no question that, wearied with the constant friction with representatives of the Forest Service and the Land Office, those who live in the West are in large numbers coming to demand that the public lands be passed over to the states. In part this movement is based upon considerations of principle, and in part on expediency. It is maintained upon the one hand that the lands were originally ceded to the general Government in trust only, and with the purpose of having them pass as promptly as possible into the hands of actual settlers. The first public lands were given by the states to the Federal Government to be sold to pay the public debt. The states at the same time persistently refused to cede those lands that lay within their respective borders. It is argued that while the right of the United States in the public lands is on all hands admitted to be that of owner rather than sovereign, it is practically impossible for the general Government permanently to hold and administer lands which together constitute a large fraction of the area of a state, without impairing the sovereignty of the latter. Since the equality of the states is a fundamental tenet of Americans, ground is laid for strong demand that the lands be turned over to the individual states. The second argument, that of expediency, rests on the admitted fact that it is always difficult and often impossible to obtain from Congress, a majority of the members of which live outside the affected states, prompt and adequate legislation. If the matter be left to the discretion of a bureau chief or a department secretary, the result is good or bad according as the individual who administers is honest, diligent, courageous, informed, and efficient, or the contrary. In any event the action is "arbitrary"—a much abused term—and practically even the best officials are rarely free to do the best that the situation demands. That this is true is as freely admitted in Washington as in the mountains. No one could condemn the present situation as regards power development, for example, more severely than has Mr. Walter L. Fisher, the present Secretary of Interior. "The present law," he states in a recent report, "neither promotes development nor protects the public interest in an effective manner," and he attributes this principally to the fact that a permit is revokable at any time without specific reason. He calls it "a serious and unjustifiable obstacle to the development and utilization of one of the Nation's greatest natural resources." He declares that conditions and limitations should be defined by statute on which permits should be issued, and only for breach of which they should be canceled. In the meantime, and pending formulation of adequate regulations or legislation, all permits are for a time at least refused. This effectually stops development, and in the West, development is the supreme good.

As against state control, two lines of argument worthy of careful consideration are advanced. In the first place many of the problems involved are interstate in character. Power used in the Goldfield and Tonopah districts of Nevada is generated in California. Granting that a measure of regulation of power companies is necessary, which state is to control? Again, use of the streams for power development and for irrigation is interwoven with the whole problem of stream control. The rights of the Federal Government in matters of navigation are admitted, and yet to regulate the streams so as to fit them for maximum use as navigable channels requires a measure, at least, of supervision over the tributaries and the sources. Admitting that forests do not influence rainfall, forest cover, using the term comprehensively, does influence stream control. In the East the problem has proved too big for the individual states, and the United States is now engaged in buying back lands at the heads of the rivers in the interest of stream control. With this teaching from experience, it seems folly to make haste in giving away similar lands in the West already owned by the Nation. The second argument is also founded on experience. At one time the general Government gave to the various states all the swamp lands within their borders on condition that they be reclaimed before passing to individual ownership. The great bulk of these lands are now privately owned and are still unreclaimed, and as part of its work of river improvement the United States Government is annually spending large sums necessary to reclaim the lands. At the same time even larger appropriations will be necessary before the work is complete. It is also within the experience of practically everyone living in the West that at various times the different states have fallen under the dominion of corporations or cliques which, under promise of development, have practically robbed the state. It is historically true that it has been easier to corrupt a state legislature than Congress, and that in the past municipal government, that nearest the people, has been the poorest in America. It is hoped that conditions have improved; that in the future all branches of the public service from City Council to Congress will be conducted on a high plane, but facts are stubborn and recruits should not be trusted oversoon. There are many, who realizing the force of the argument in favor of state ownership as a final policy, contend that the time is not ripe. There is still too prevalent a notion that it would afford but an easy way to escape regulation and compensation. State ownership may afford the only final solution, but in our judgment this, even if it be desirable, is not likely soon to be brought about, and we are therefore much more interested in securing legislation from Congress that will permit development and clearly define rights through the period, long or short, during which title continues in the United States.

The Benguet Mining District, Philippine Islands

By Arthur W. Geiger

The Benguet mining district in the Philippine Islands is one of great scenic beauty and of much interest to the visiting engineer. To the average American these islands suggest a tropical and unhealthful region only and not many know of the existence and beauty of the mountain sections. The province of Benguet is in the northern portion of Luzon and is reached from Manila by railroad over the low tropical coastal plane to Camp One, a distance of about 150 miles, from whence by auto stage about 30 miles up the renowned Benguet road, into the mountains, to Baguio, the principal town, and distributing point of the province. It is also the summer capital of the Philippine Government and a social and health resort. This region has long been a place for the foreign residents of the islands to resort to

MAP OF LUZON.

for relief from the tropical heat of the lowlands. On American occupation in 1898 a great many improvements were made in the building up of the town of Baguio and the construction of the Benguet road, which made the district easily accessible.

Baguio was laid out by a well known landscape artist and is beautifully situated. There are numerous substantial government buildings, two good hotels, and a number of mercantile concerns; the elevation is about 5000 ft. above sea-level and the nights are always cool; the population varies from 300 to 1000 people, depending on the season of the year. The country surrounding is of great natural beauty and resembles the foothills of the Sierras together with the White Mountain region of New England. The topography of the country is one of sharp relief, with steep hills, deep gulches, and sharp ridges that rise 200 to 1000 ft. above the adjoining ravines; landslides have been frequent and in many places great bare spots testify to the large movement of earth and rock. From a physical point of view the country is in its early stages of dissection, but is being rapidly eroded. Pine forests abound in this section and serve all mining needs for timber. The rainy season is from June to October. At this time violent storms, called *baguios*, occur with terrific winds and rain; as high as 40 in. of rain in 24 hours has been recorded. The destructive effect of these *baguios* has been enormous; in a hilly country these deluges of rain rapidly swell the creeks to raging torrents and with the débris from the frequent landslides furnishes a power which obliterates everything in its path. It has been difficult to find small water-power installations that would not wash out, but there are several large streams in the district where electrical power could be safely developed, and would be of great benefit to the mining and other interests of the district.

The natives of this region are the Igorrotes whose curious customs are of much interest to the new-comer. They are a tough wiry mountain people of darker skin and larger build than the natives of the lowlands, and of cleaner and more wholesome appearance. Numerous small villages, called *barrios*, are frequent throughout the country, having perhaps 50 to 100 inhabitants. Formerly there was considerable rivalry between neighboring *barrios*, and if one increased in population over another, danger would be felt by the smaller and attacks would be made, the victims being decapitated and the heads displayed as a sign of power; hence the derivation of the term 'head hunters' given these people. Their food consists mainly of rice, fish, and *camotes*, the native sweet potato. Dog meat is considered a delicacy. The weekly dog market at Baguio is an interesting sight. Dogs of mongrel type are brought from the lowland towns to be sold, bringing ₱0.50.* Curiously enough, they are not killed until they have been starved. They are allowed to run around the hills until they are thin and emaciated, when the meat is considered choicest.

The Igorrote men usually go about in scant clothing. A turban effect for a hat and a gee-string is about the extent of their dress. The women generally have a brightly colored blanket wrapped around them in a rather picturesque manner. They all go barefooted and their feet are much broadened and calloused. They can travel over the roughest rock slides without discomfort while packing heavy loads. Both women and men are great packers and are met everywhere in the country carrying loads, often weighing as much as themselves, by aid of a tump-line over the forehead. When strangers are met as they journey along, they chant and twang a native stringed bow. This is supposed to drive away the evil influence. Withal they are a peaceful people and are largely used as laborers in the mines and for packing, road work, wood chopping, and other rough work. There are a number of lowland Filipinos in the district who are more largely used for underground mining work. There are also a small number of Japanese and Chinese who make their living as carpenters, blacksmiths, and small merchants. The wage scale is about as follows:

Igorrote laborers, per day	₱0.80 to ₱1.20
Igorrote and Filipino miners	1.20 " 1.60
Native *capitasas*	2.00 " 2.50
Japanese carpenters and blacksmiths	2.00 " 3.00

They are fairly efficient workers if under proper supervision, which is most essential. They perhaps work to best advantage under a contract system. Supervision is accomplished by native shift bosses, who generally speak a little English. Experienced white foremen under a superintendent complete the organization. The cost is high, and in small mines may amount to as much as the actual labor itself. Mining has been conducted in the Benguet province for many years, dating back to old Spanish times. The old workings and the crude stone mortars for grinding the ore are in frequent evidence today and indicate prospecting and treatment of the rich streaks only. Nothing extensive

*The Philippine peso has a value of $0.50.

was accomplished until American occupation in 1898. Since then a number of mining companies have been prompted to exploit this mining field, several millions of dollars having been spent. There are seven mills in the district, but the Headwaters is the only one equipped to make any close saving. The prominent mines are the Benguet Consolidated, Headwaters, Major, Kelly, Muyot, Bua, and the Cammote. As yet no mine in the district is in anything like a stable paying basis, and it is widely conceded that lack of experienced men in charge and wasteful mismanagement has been the cause of the general failure of the district to make good up to date. It is a common thing to attribute mining failures to mismanagement, and while this has undoubtedly much to do with the non-success of some of the Benguet mines, still there are many conditions, both physical and operating, that are difficult or impossible to overcome. The deposits are as a rule low grade with average range of $3 to $8 for workable ore. The rich ore is irregularly distributed and there is much of the vein matter that will not pay to work. The present workings are mostly in the oxidized zone and the ground is soft and heavy, requiring careful and expensive timbering to hold in the rainy seasons. In some cases there are metallurgical difficulties in that a considerable portion of the gold is associated with sulphides which are difficult to treat by cyanidation, and the concentrates are not high grade enough to stand the treatment charges and freight to San Francisco. Most of the ore is clayey and slimes excessively. Agitation is necessary. Generally not over 30% of the gold can be saved by amalgamation. The destruction of several mills and other improvements by *baguios* has been unfortunate and a big setback to several of the mines. As in other mining areas a great deal of money has been wasted in useless work and mills have been built before development justified. The Philippine mining law requires annual work to be done on each claim separately, and this is quite a disadvantage to small operators, as annual work is often done to best advantage at one place for the benefit of a group of claims.

Generally speaking, the mineralization has been extensive over this area, and it would seem that in this as in other districts, some good mines should be developed. The Benguet Consolidated is generally believed to be the most promising property in the district, having a large lead and with a considerable tonnage of ore blocked. Misfortunes have occurred to this enterprise in the total loss of their plant through destruction by *baguios*, but the outlook is now good.

A SCENE IN THE LOWLANDS.

IGORROTE BOYS.

Geological Survey Building

*The offices of the United States Geological Survey have become wholly inadequate and unadapted to its needs. Since 1884, when the Survey was first quartered in the Hooe building, at 1330 F street, the effort has been frequently made to provide for the growth of the organization by adding extensions to the building, but every increase in floor space has been made at the expense of proper lighting of the older portions of the building, so that its fitness for the survey's use has been steadily impaired, and the resultant conditions constitute an actual detriment to health and a menace to life and property, as well as an obstacle to efficiency.

The present quarters of the survey can be described without exaggeration as in large part comparable to a sweatshop. Treatment of wage earners that would excite severe criticism if a corporation were the offender, is tolerated in the case of these employees of the Federal Government. In one division statistical clerks have each on an average only 73 sq. ft. of floor space. In another branch the floor space allotted to each person is 67½ sq. ft., and in still another, in which the workers are for the most part scientists, the average space per man is 102 sq. ft. The figures given do not measure the actual working space available, for not only must desks and chairs be provided, but also bookcases, large file cases, and in many rooms drafting tables.

Lack of Fresh Air and Light

If instead of floor space the cubic capacity of the rooms occupied is measured, it is found that the average volume of air per person is about 652 cu. ft., again without allowance for the considerable space occupied by furniture and therefore not available for air. Certain more or less definite standard minimum requirements for the cubic contents have come into use for various classes of public buildings, these requirements being based on the customary allowances for fresh air. Thus public libraries are planned with not less than 2400 cu. ft., hospitals with a minimum of 1440 cu. ft., and barracks with not less than 720 cu. ft. of space per occupant. The average cubic space available for each person occupying the survey rooms is therefore below even the minimum allowed in barracks and only a fraction of that allowed in other buildings. When ventilation is taken into account the showing is even worse, for more than half the windows of certain rooms open into interior wells and the rest into alleys.

In the matter of lighting the conditions are no more fav-

*From the Thirty-third Annual Report of the Director.

orable. In one of the divisions already cited the average window space per clerk is two-fifths of a small window, and here again many of the windows open into interior wells, so that in most of the rooms artificial light is necessary on dark days and even for several hours on clear days in winter. The generally crowded condition has compelled the occupancy of several rooms in which artificial light must be used practically all the time. In one of the scientific sections the largest floor space assigned to one man—162 sq. ft.—is in a room where the light is so poor that artificial illumination is needed most of the time, and the strain on the occupant's eyes is so great that rotation in assignment to this office is practised in order that permanent injury to any one employee may be avoided if possible.

While permanent or temporary injury to the eyesight of some of the geologists and draftsmen can be definitely traced to the poor lighting of the rooms in which they have been forced to work, it is more difficult to trace the results of insufficient ventilation. That the unhygienic conditions prevailing in the building occupied by the survey must necessarily lower the tone of the health of its employees is apparent. The customary standards for ventilation provide for a minimum of 1000 to 3000 cu. ft. of fresh air per hour per occupant.

The results of this violation of practical hygiene would be more widespread and more apparent were it not for the fact that a considerable number of the members of the survey are field men, whose work during the summer is performed in the open air where they have opportunity to recuperate each year. This open-air work may protect certain members of the force from lung disease and from defective vision, but it does not make the congested conditions seem any more tolerable to a geologist or topographer who has been assigned 1000 square miles for five months of field service and is obliged to work the remaining seven months of the year with an allowance of 100 sq. ft. of floor space.

Rooms Too Hot for Occupancy

The top floor in the main building of the survey and the loft in the annex become so hot in the summer that at times it is impossible for the employees occupying these floors to perform their duties. In the loft of the annex, an old building in an alley, the summer temperature runs as high as 110° F., and neither the employees nor the solutions and emulsions used in the photographic laboratory there can be depended on for high-grade results under these conditions.

The Fire Risk

A menace second only to the existing danger in health is the risk to public records. Estimates have been made at various times of the money value of the records necessarily stored in building. The latest inventory shows a present value of $4,840,000, and this value represents largely the amount that would necessarily be expended in duplicating the unpublished material and in replacing the large stock of map plates which could be re-engraved from published maps. Moreover, there is a sense in which the loss in official records can not be estimated in dollars. The detailed stream-gauging records for 20 years could not be replaced except by another 20 years of observations, and similarly, unpublished geologic data contained in notebooks and plats and represented by the working collections of specimens could hardly be replaced, except in an equal length of time. The land-classification work is now proving how invaluable are these unpublished data, and a destructive fire in the wing of the building occupied by the land-classification board would destroy records whose loss would long delay the issuing of land patents throughout the public-land states.

The library is a collection of geologic literature that in degree of completeness can not be duplicated elsewhere in this country, if indeed in the world. This library therefore has a value which can not be easily estimated, since, if destroyed, it could not be wholly replaced, and such portion as is replaced could be duplicated only at great expense of time and expenditure of public money.

It is believed that every safeguard against fire that is possible through an efficient watch service and the careful distribution of fire extinguishers has now been provided, but the fact remains that although the building is constructed of iron and brick it is honeycombed with light wooden partitions, which present some two acres of surface that could be easily ignited. The exterior fire risks should also be considered, inasmuch as all the buildings in the block, except two, present even greater fire risks than the building occupied by the survey. During the last nine years there have been four fires in the survey building.

Impairment of Efficiency

Maximum efficiency is impossible with such congestion and the attendant inadequate ventilation and lighting and with the impossibility of systematically arranging the offices and working collections; and the dirt and noise consequent upon position at the very business centre of Washington present further obstacles to economic administration. The whole situation not only results in less efficient use and hence in actual waste of government money, but also on that account creates a feeling of dissatisfaction and discouragement among the highest class of scientists and other members of the survey, who wish to make the largest and best contribution possible to the public service. Tests have shown that light suitable for clerical or technical-clerical work fails at approximately a distance of 15 ft. from the window line, yet 12½% of the floor space occupied in the main building is more than 15 ft. from the windows, and this computation is based on the assumption that the windows in the light wells are as effective for lighting as are those on the exterior walls. If a lighting factor of 50% is assumed for the well windows on the lower floors, the space unsuited for clerical work in the building is found to be 33.8 per cent. The crowding of the survey building precludes a systematic arrangement of offices and of working material, including specimens, notes, and maps, that should be close at hand for repeated reference. This separation of men and materials that ought to be closely correlated is seriously retarding the scientific work.

In addition to the prevalent noises of exterior origin, which constitute a great drawback to intellectual work, there are interior noises, inevitable upon the crowded condition of the building—noises that are amplified or intensified by numerous wooden partitions, which constitute excellent sounding boards. The common arrangement of having a stenographer share a room occupied by a high-salaried man engaged in scientific investigations is not to be commended for its efficiency, yet the present congestion is so great that relatively few of the geologists are ever free from the distracting noise of the typewriter. In the computing sections of another of the scientific branches six or seven hydraulic engineers are crowded into a single room, together with an adding machine or two. Inasmuch as hydraulic computations require constant attention and freedom from diverting noises, it is plain that larger quarters and some degree of isolation would facilitate the work. A careful estimate places the possible increase in efficiency at 30%, which would represent an annual gain of several thousand dollars in this one section alone.

Increase of Efficiency Possible Under Better Conditions

Several other estimates have been made by the administrative officers of the survey of the increased degree of efficiency that could be attained by changing the quarters for the various classes of employees from indifferent or worse to suitable accommodations. The estimated increase ranges from 15 to 30 and even to 50 per cent. The present housing of this bureau is unworthy of the nation.

The practical side of this feature is the increased inducement that suitable quarters would afford in retaining in the government service men of the highest professional talent. To retain in the government service the best men is by far the largest administrative problem of the Director of the United States Geological Survey.

Mining Methods in the Waihi Mine

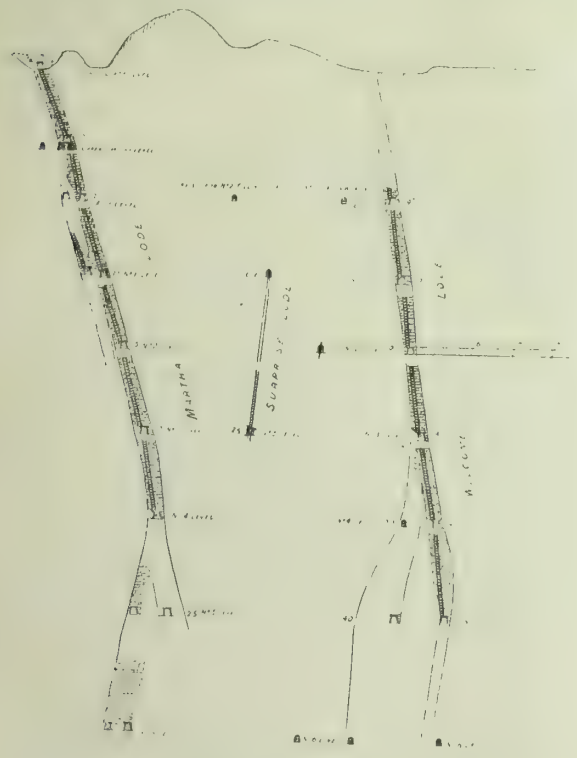
By Jas. L. Gilmour and W. H. Johnston

*The ore is extracted from the mine by several systems, according to the conditions and nature of the orebodies and the enclosing country. The systems may be classified as follows:

(1.) Driving and widening out of levels. (2.) Ordinary flat-back or overhand stoping and filling. (3.) Overhand stoping with square-sets and filling. (4.) Shrinkage stoping and filling. (5.) Taking out of arches. (6.) Surface work.

Driving and Widening Out of Levels

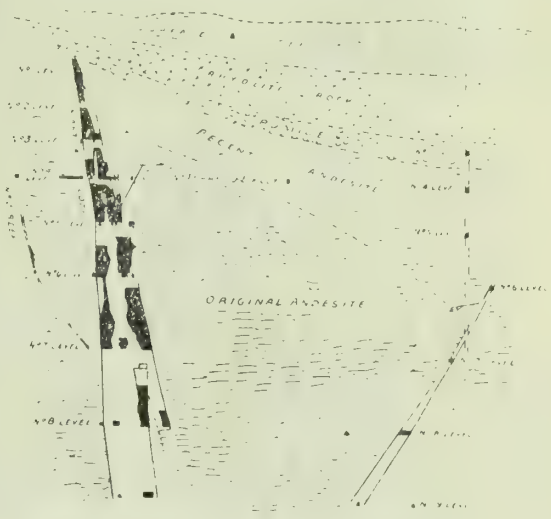
The levels in the lower section of the mine are at 150-ft. intervals. In the upper and older workings the distance varied from 50 to 110 ft. Preparatory to mining, a careful scrutiny and comparison is made of the mine maps, the position of the ore is noted, the character of the lode and the enclosing walls considered, and the system of stoping determined. In most cases the development level is widened out to the full width of the ore and to a height of 10 ft., with machine drills. The tram-line is re-laid, generally with heavy rails where traffic is likely to be constant, and is straightened as much as the course of the lode will permit. Timbering with ordinary sets then follows. The sets are made up of three pieces of timber, usually split rims, roughly squared or sawed, and varying in size from 12 to 15 inches. The legs are hitched 6 in. into the ground, spaced not less than 3 ft. 8 in. in the clear, according to the size of the timber, the sides covered with slabs 5 ft. long of 2 by 9-in., spaced 6 in. apart, and the cap closely boarded up. An illustration is shown in Fig. 1.



CROSS-SECTION OF WORKINGS.

To provide room for sinking winzes clear of the tram-line, two caps 6 ft. in the clear are put in at intervals of 80 ft., with a 5-ft. cap on each side of them. The open space between the outside of the sets and the standing ground is filled with waste, either from dead-work cross-cuts in the vicinity or dumped through winzes from the level above and packed behind the sets up to the top of the caps. Chutes are generally spaced 18 ft. along the level in ordinary stoping blocks, and 9 ft. apart in shrinkage blocks. These chutes are made of 2 by 9-in. planks, with two 2 by 9-in. stoping boards, the angle of the bottom being 40° from the horizontal. The mouth of each chute and the tram-line are placed as close as possible to one side of the drift to permit of horse traffic, if subsequently desired.

Although timbering preparatory to stoping is usally done with ordinary sets, there are exceptions where stulls are used in their place. The stulls, 14 to 18 in. diam., are used up to 16 ft. in length, and are spaced 3 ft. 8 in. (not less) apart, at an angle of 40° from the horizontal, and closely covered with slabs. It has been found, however, that in the round timber used in this system decay sets up much more quickly, so the system has not been used in the later workings. An illustration of stull timbering is given in Fig. 2. The *A* drift or saddleback set has also been used on a lode 18 ft. wide, the legs being hitched into the rock, leaving the lode matter clear of timber. The advantages of both these last methods chiefly is that the arch of ore under foot can be taken right out without disturbing the timbering and without temporary support; but, in spite of this advantage, the ordinary set is in general use, being more reliable and more lasting.



SECTION SHOWING POSITION OF OREBODIES.

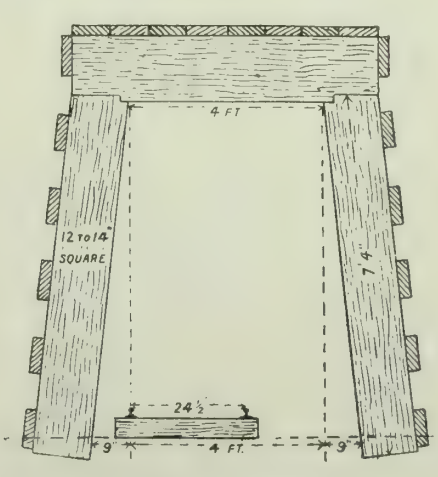


Fig. 1. ORDINARY SET.

Ordinary Overhead Stoping and Filling

Most of the ore from the mine is broken by this method. Winzes are sunk through the block of ore to be worked

*From the *Proceedings* of the Australasian Institute of Mining Engineers.

from the level above, 80 ft. apart, either during the progress of development or before stoping is begun. The first, or leading stope is started at each winze on the top of the level sets, and the filling that has been previously packed in beside the timbers, and the full width of the lode or section of the lode is broken out each way horizontally for a height of 8 ft. and a length of 40 ft., the broken ore being rilled and shoveled into chutes and trammed to the shafts. Under this system, stoping widths of 150 ft. are common on the Martha lode, and on the Edward a width of 80 ft. has been taken out without any support to the

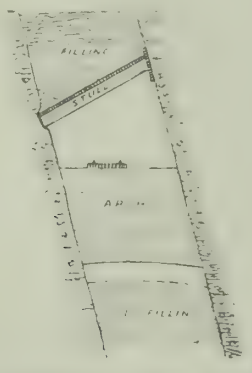


FIG. 2. TIMBERING IN STOPES UP TO 10 FEET.

roof. In stopes of these dimensions, however, it is necessary to have two parallel drifts in the level to facilitate the handling of the quantity of ore.

After cutting a stope, the chutes are timbered up 8 ft. high, with rough split logs or cribbing 8 in. and 9 in. diam. built on top of one another and cut 4 in. deep and 8 in. long at the ends, forming a pass 4 ft. square inside. Filling material is then dumped into the winzes at the level above, safety precautions being first taken by setting in 14-lb. rails 12 in. apart across the winze 3 ft. below the level, and placing movable horizontal bars across the drift 4 ft. from the floor on each side of the winze, besides providing strong 9 by 3-in. foot-planks for crossing.

The filling is trimmed along the stope from the bottom of each winze 40 ft. each way to within 2 ft. of the roof of the stope. Ladder-ways, 3 ft. square inside, are cribbed up about 80 ft. apart in the filling, and fitted with ladders built of 2 by 4-in. kauri timber 12 ft. long, with ¾-in. iron rungs spaced 12-in. centres, dogged and spiked to the cribbing. Slabs are then laid on the top of the new material, and the block is ready for the second stope. Stope after stope is broken out and filled in this way up to what is considered a safe thickness of arch for the temporary support of the level overhead. The thickness of this block varies with the width of the stope and the nature of the lode and surrounding walls, and may run from 7 to 24 ft. In working the stopes it has been found necessary to keep the chutes constantly full of quartz, and strict attention is now given to this. Much delay and expense was formerly incurred through the wearing-out of chutes caused by running them down; but with passes kept reasonably full at all times it is found that the timbers will last till the block is worked out.

In this method of stoping no timber is used, as a rule, to support the roof. The roof is kept well arched, and any loose rock barred or worked down. Machine drills are not used in this system, except, perhaps, in the leading stope, owing to the soft nature of the surface material of which the filling is chiefly composed and the necessity of keeping this material as dry as possible. In wide stopes holes are usually drilled 6 and 7 ft. deep and 7 or 8 ft. above the bottom of the stope. These holes are widened out in the bottom by firing a small charge first, and then the full charge is inserted and fired, generally bringing down large quantities of rock. Stoping by this method is let on contract, the number of tons let in one contract varying from 5000 to 50,000; and a system of weighing, tallying, and checking, determines the quantities. Excepting what is obtained from dead-work underground, the filling material is broken on the surface. The decomposed country rock encasing the lodes is found to make the best filling material, being easily broken, easily handled in damp weather, and packing tightly in a short time. To obtain this material, adits 6 ft. wide and 6½ ft. high are driven into the hill, usually parallel with the course of the lode outcrops, where such occur, and, when far enough advanced to command material overhead, raises are put up to the surface. The bottoms of these are fitted with horizontal doors placed in the centre of the roof of the adit and the material is filled into cars of 42-cu. ft. capacity, and hauled, generally by horses, to the various filling shafts. The filling is at first broken out from surface downward to the back of the level in the shape of an inverted cone; but this is subsequently opened out into an open cut with the floor on the roof of the adit. The cuts are then worked in open faces in benches from 7 to 10 ft. high, which are carried up on a slope of about 40° in a semicircle round the loading chute to heights varying from 50 to 100 ft. This method, besides being economical, is best suited to the conditions of heavy rainfall in the locality, amounting to 101.8 in. per year (average for the past four years), as all water is easily drained off through the adits to a safe outlet. Holes from 6 to 10 ft. in depth are easily 'jumped' in this rock with 1-in. steel, and strong steel boring augurs, worked by hand, are extremely effective in the bottom of the cuts, in holes at an angle of 40 or 45° above the horizontal. Special filling chutes or small shafts are sunk, usually on an underlie, in the solid rock for the passage of this material from the surface to the different levels in the mine, and the upper portions of the shafts, through the wet strata, are generally fitted with 12-in. steel pipes, through which the filling is sent down to the drier zones. Some of these chutes are now in constant use, delivering material at depths varying from 500 to 850 feet.

At the different levels where filling has to be trammed to the winzes in the stoping blocks, large hoppers are constructed with three gates on each side of the chute, and enough material is stored underground to provide work for a day if it is too wet for surface work or if repairs have to be done to the chutes. The hoppers are so arranged that the material can be caught at any particular level, and at the same time sufficient run through for the requirements of any lower level.

Filling-in material is broken and delivered to the passes by contract, at so much per cubic yard, and quantities are determined by measurement on the surface, measurements being taken at the usual monthly intervals. Investigations were made of the behavior of this material in transit, to find if possible a simpler method of tallying at the delivery levels, but the variations of volume were found to be so uncertain, and with such wide limits, that the system of measurement in place was adhered to. Extreme and uncertain differences in volume were found when the material was first broken into cars, when it was dumped into the filling chutes, when it was filled at the receiving level, and finally when it was dumped into the stope, by which time it was generally in a finely pulverized state. The differences were further aggravated by the presence or absence of moisture, depending upon the weather conditions. Owing to surface configuration, the presence of old drifts, cuts, trenches, and dumps, and the necessity of taking material where it can be easiest obtained at the time, without regard to systematic work, the accurate measurement of these cuts is a task of some difficulty. By a detailed system of cross and longitudinal sections, or a combination of both, the outlines of the figures broken out each month are deduced and contents found by the method most applicable to the shape of each body.

OVERHAND STOPING WITH SQUARE SETS, AND FILLING

This system is in use where the roof will not stand without support, or where a band of loose rubbly quartz or old filling exists on the side of the stoping block. The sets are made of rough round timber, about 12 in. diam., placed 4 ft. apart along the course of the stope and 5 ft.

apart across its width, with a height of 7 ft. As each stope proceeds the timbers are put in close up to the work, and wedged up to the roof, and, as work advances, the portion taken out is filled up close with filling from the surface. The following stope is worked off the filling, the timbers being placed on top of the sets in the lower stope, and this system is carried up to the floor of the level above, the whole of the ore being taken out. In certain cases, where a large portion of the lode consists of loose rubbly ore, the winzes, originally sunk in the reef, have fretted away to large dimensions, and eventually have had to be filled with waste, thus cutting off the supply of filling material.

This difficulty has been overcome by sinking new winzes for filling purposes about 5 ft. away from the lode in the foot-wall, from foot-wall gangways, and starting each stope from one of the winzes. Chutes for ore, 3 by 4 ft., are brought up inside the stoping sets on the inclination of the lode, the struts being removed, and the cribbing taking their places, as the sets are passed. These stopes are taken out and by contract at a price per ton, delivered at the shaft.

Shrinkage Stoping and Filling

This system has been adopted during the last four years in places where the reef walls are sound and unlikely to fall away. Seven or eight blocks are now constantly at work by this method, and an endeavor is made to regulate the procedure so that two blocks will have completed ore-breaking, and in process of emptying, while the others proceed with breaking. The preparations for this system are the same as described in the driving and widening out of levels, with the exception that the filling packed behind the sets must be sloped up from the caps to the sides of the stope on an angle as steep as possible, to allow the broken quartz to run down to the chutes, and the chutes must be 9 ft. apart. Only one winze usually is sunk through the centre of a block, from which the stopes are started, and a ladder-way 4 by 4 ft. is cribbed up at each end, through which an air current is led. The length of blocks taken out by this method varies from 150 to 300 ft., and widths up to 50 ft. have been taken. The ore is broken down with machine drills, spalled to small size, and a portion drawn off through the chutes as work proceeds, leaving sufficient in the stope to enable men to work without staging or timber of any kind. In practice it is found that 40% of the broken ore has to be drawn off to leave convenient room for the working of the stope. It is important that the ore-filling should constantly be kept close up to the roof, and in no case is a space of more than 8 ft. allowed between the roof and the broken quartz while work is in progress. No shoveling of the ore is required, and the material is broken out for the full width of the lode or stoping section up to a safe arch for the level above.

This stoping is let by contract at a price per ton for ore delivered at the shaft and a price per ton of ore broken in the stope. The ore delivered to the shaft is fixed by tally, and the broken quartz in the stope is determined each month by careful measurement. As in the case of surface work, this material is measured and leveled in a system of cross and longitudinal sections. Considerable variations may be found in the individual measurements of this work, caused by filling material temporarily hanging up when being drawn off. It is not unusual for a whole body of this material to sink suddenly 2 or 3 ft., although tramming has been going on for some time without any movement.

The price for tramming out the ore temporarily left in the stope for filling is held back until emptying the stope is begun, when it is paid as tramming proceeds. When emptying, the ore is drawn off from one end first, and filling from the surface is dumped into the space down winzes sunk through the level arch. As the ore is drawn away in front waste filling is dumped in till the whole block is filled up tight to the arch above. This is illustrated in Fig. 3.

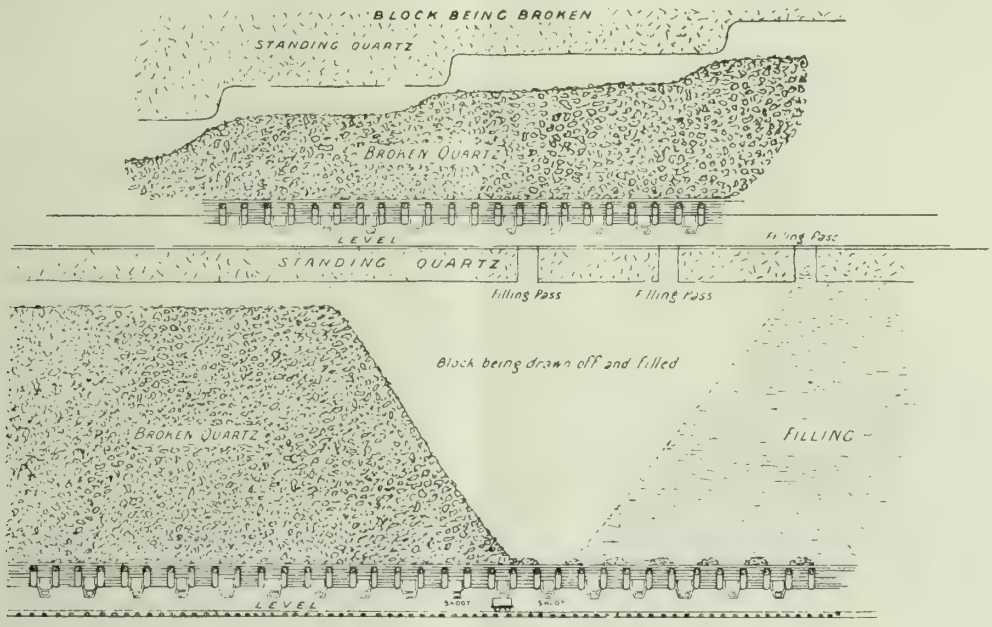


Fig. 3. Shrinkage Stoping.

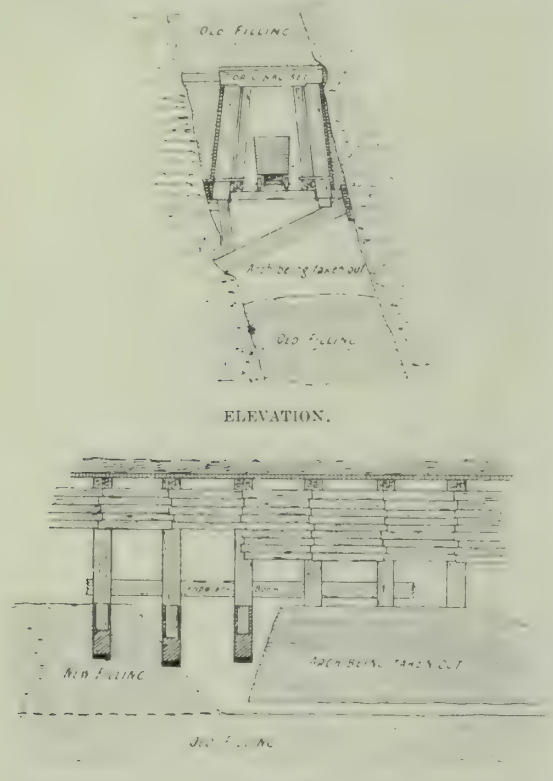
It is sometimes found convenient in blocks of small length, to draw off all the ore first before filling begins, and then quickly fill up the whole space. It is usually found, in drawing off, that some rock scales off from the hanging wall, and follows down on top of the ore; this is finally left in the stope for filling. Under favorable conditions, this system of stoping has been found to be the most economical method yet practised, there being no cost for shoveling ore, no timber used, no cribbing of chutes, and less trimming of filling material.

Taking Out of Arches

In dealing with the arches of ore usually left to support the levels, a start is made by placing strong stringers horizontally along the bottom of the level on each side of the track, close up against the sets. These are 15 to 20 ft. long, or long enough to reach between three or four sets of timber. After they are in position, a 1½-in. hole is bored into each leg, flush with the upper side, and a stout iron bolt is driven into each, with the projecting ends tight on the top of the stringers. This bolt keeps up the leg while the ground is cut away. On top of the bolt and stringer a piece of timber is wedged up under the cap to take the full weight of the set, and spreaders are driven between the legs

to prevent side movement. An illustration of this is given in Fig. 4. The arch is then ready for breaking out for the number of sets supported in this way, and the ore is removed from under the first set, down to the old stope filling. In dealing with lodes up to 15 ft. wide, single stulls are used with advantage for permanent support, being placed under the set just laid bare and firmly hitched into the foot-wall. On this the set is secured, and the booms blocked up from each one as the work proceeds.

After the ground has been taken out for three or four sets the open space is immediately filled in with hard rock, if procurable, and the stringers are moved on another length. It will be readily seen that this method is safe, as one end of the stringers is always resting on the solid arch and the other is packed up from the stull pieces which take the place of the arch. In dealing with lodes up to 20 ft. wide the same system is adopted in securing the level timbers; but,



ELEVATION.

PLAN.

Fig. 4. TAKING OUT ARCHES IN STOPES UP TO 15 FEET.

as the length of stulls for this width would be about 28 ft., saddleback sets are used in place of stulls. This set consists of two legs hitched into the walls with a cap piece between, as shown in Fig. 5.

In cases where the walls are not good, sill pieces are laid down on the top of the old filling in the stope below, and square sets built on these, the level timbers and stringers being taken upon the square sets. This is illustrated in Fig. 6. When the old level timbers are crushed or decayed, a foot-wall gangway is driven in the country rock about 6 ft. from the lode and parallel with it, but about 10 or 15 ft. below the floor of the original level. An ore-chute is constructed from the gangway to the level below, and the arch is attacked from the gangway and timbered with square sets. This method is the safest in treacherous ground, and recovers all the ore standing.

Surface Work

The filling material required underground for packing stopes is derived chiefly, as previously described, from open cuts which are directed, where possible, along the lines of the old outcrops. In the course of excavating large quantities of waste rock, a considerable amount of ore left in the old workings is laid bare, this is quarried out and trammed by horses to the surface hoppers.

Hoisting

The ore is raised to the surface through three shafts—No. 2, 4, and 6. No. 4 shaft is equipped with cages specially built for expeditiously handling timber in long lengths, rails, and pipes. One car only is carried per trip, but the cages are arranged for carrying 12 men. No. 2 shaft is now being re-equipped, and will be fitted with single-decked cages, with two cars per cage, placed side by side. The No. 6 is the main hoisting shaft, and is equipped with 3-ton self-dumping skips. A short description of the plant follows:

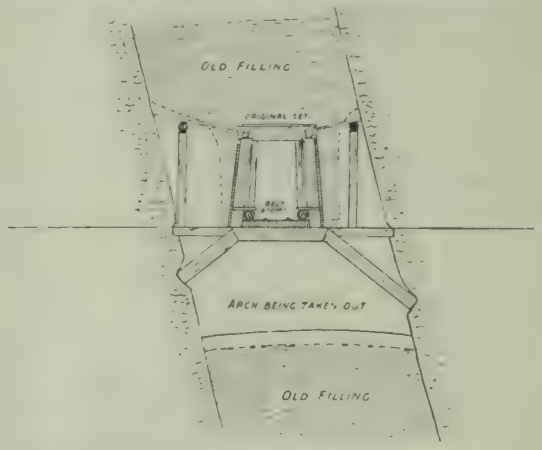


Fig. 5. TAKING OUT ARCHES IN STOPES 15 TO 20 FEET.

The hoisting engine is a two-cylinder high-pressure engine, having 30-in. cylinders, 6-ft. stroke, and is fitted with double-beat drop valves and an automatic cut-off gear. Steam brakes and a steam reversing engine are also provided. The engine is direct-acting, and has cylinder drums 12 ft. diam., the rope used being 4 in. circumference. The plant is supplied with steam power from two multitubular boilers at a pressure of 100 lb. per square inch.

The head-frame is 75 ft. high from the collar of the shaft

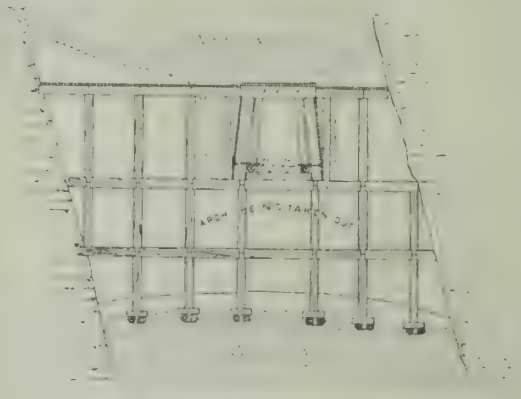


Fig. 6. TAKING OUT ARCHES IN WIDE STOPES, SQUARE SETS.

to the centre of the pulleys, and is built of kauri timber. The pulleys are 12½ ft. diam., and the shafts for the same run in pedestals fitted with ring lubrication. The tipping gear is built into the legs at a height of about 50 ft. from the collar of the shaft. The ore is discharged down chutes lined with rails and grizzly bars into a main hopper capable of holding about 3500 tons. A double-line track runs beneath this hopper, on which the mill cars are filled.

At No. 7 level, 700 ft. from the collar of the shaft, a hopper bin, capable of holding about 350 tons of ore, has been excavated. Beneath this a smaller chamber for accommodating the auxiliary bins has been cut, as illustrated in Fig. 7. Two auxiliary bins are provided—one for each hoisting compartment, made of cast iron lined with rails and steel plates, and the capacity of each is one skipful. The discharge doors of the main bins deliver into them. The doors of the auxiliaries are vertical, and made of steel plate working in guides. They are raised by means of hydraulic

rams receiving water from one of the upper levels at a pressure of about 200 lb. per square inch. They close by their own weight, and are cushioned by throttling the water in the discharge pipe from the cylinder. A steel tumbler is bolted to the shaft sets below the auxiliary bin, and leads the ore from the lip into the skip; the skip coming up closes this tumbler, being assisted in so doing by a balance weight on the tumbler shaft, and the skip-tender has to reopen it by means of a wire rope and lever. This arrangement ensures that the shaft is always clear, with no possibility of the skip striking any of the gear.

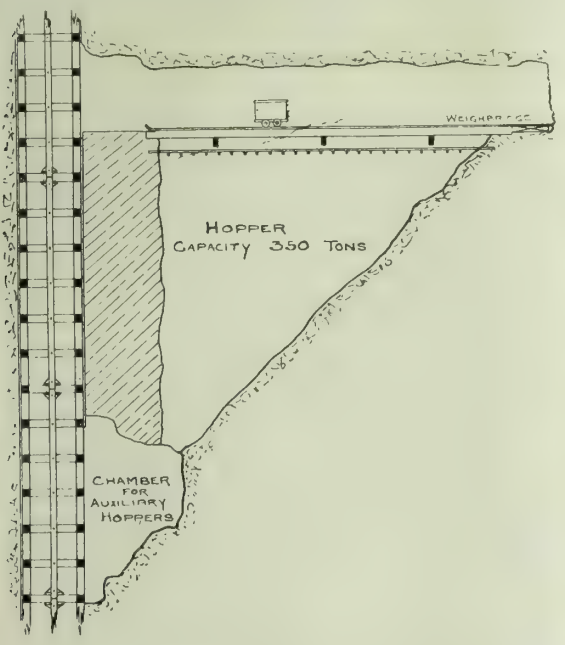


FIG. 7. CHAMBER FOR UNDERGROUND BIN.

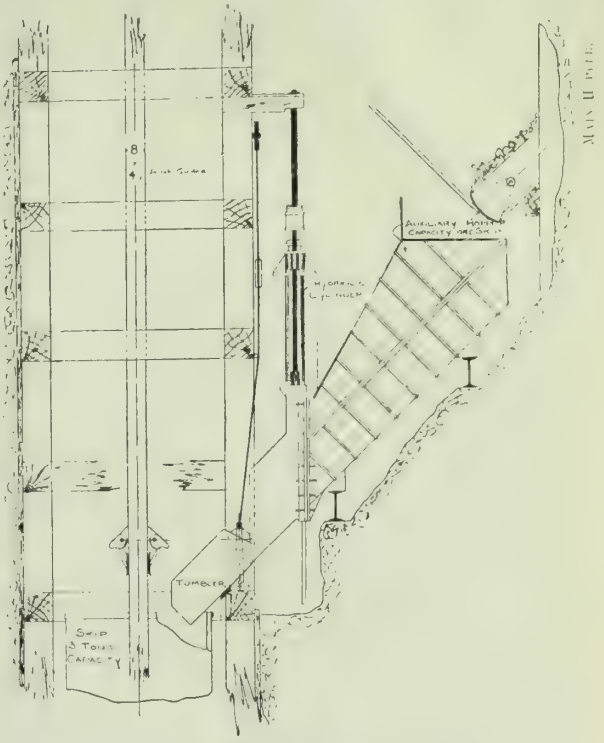


FIG. 8. AUXILIARY BIN AND GATES.

The advantage of this is the saving in time effected in loading the skips, as the auxiliary bins are being filled while the skip is traveling in the shaft. They are emptied by fully opening the door, and there is no danger of spilling, as the capacity of the hopper is exactly one skipful, as illustrated in Fig. 8.

The hoisting compartments in the shaft are, however, too narrow to take full advantage of this arrangement. The inside widths of the skips being only 2 ft. 3 in., it follows that the tumbler and auxiliary hopper widths are restricted, necessitating poking when extra large pieces come through. Notwithstanding this disadvantage, the loading is fairly efficient, and 44 skip-loads (132 tons) have been raised and dumped in one hour from this level, a total height of about 800 ft. This whole loading equipment was constructed in the company's workshop.

At the 1000-ft. level chambers have been cut on each side of the shaft, and arrangements made so that the skip is filled from both sides at the same time. On the south side of the shaft there are cast-iron chutes, with tumblers attached, into which the cars are dumped, the ore going direct into the skip. This takes the ore from the 1000-ft. level on the Martha lode. Owing to water difficulties, a bin cannot be made below this level until the 1150-ft. level has drained off the excess of water. On the north side of the shaft there is an ore-bin, which extends from the 1000-ft. level up to the 850-ft. level. It is about 8 by 10 ft. in area, and has 12 ft. of solid ground between it and the shaft, holding about 450 tons. Owing to the skips being 2 in. narrower on the north side of the shaft than the south, the auxiliary bins referred to at No. 7 level were not attempted at this level, the ore being filled direct from the large bins.

Mining Laws of Peru

Peru's mining laws are practical and fairly enforced. They provide, among other things, that the owner of the soil has title to slate, sandstone, building stone generally, gypsum, sand, potters' earth, earth containing magnesium and aluminum, peat, and phosphates. When these are found on land of the state the Government may work them for itself or issue concessions. Guano beds, salt deposits, and brine wells are state property. Nitrates, borates, and alkaline salt deposits are subject to special laws. All other deposits of mineralized or fossilized substances can be acquired by petition and denouncement, as also water, slag, or tailing. Mining property, once obtained, is irrevocable so long as the mining tax is paid and is as perpetual as common property.

The unit of the mining claim is the *pertenencia* of 100 by 200 metres, being 2 *hectares,* of 4.94 acres. In placers, coal, and petroleum deposits the *pertenencia* is 200 by 200 metres, or 9.88 acres. A concession may embrace up to 60 *pertenencias.* Prospecting and exploration concessions are granted ranging in size from 60 to 600 *pertenencias,* and one person or company may obtain several concessions, which are granted for one year, but may be extended for another.

A tax of 49c. per *hectare* per year is paid on prospecting grants. Mining concessions pay $14.60 per *pertenencia* per year, payable semi-annually. Formerly non-payment during three half-years canceled the title, but arrears could be paid before that time, with 50% fine for that part half a year overdue and 100% for that one year overdue. By a law which became effective on November 3, 1911, however, unpaid mining taxes are subject to an additional penalty tax of 20 or 40%, or both, according to the length of time they are overdue. If three half-years, or 18 months, should elapse before the payment of these taxes the mine becomes an abandoned one, a list of such abandoned mines being required to be published in February and August each year. Peruvians and foreigners alike may own mining property in Peru, except certain specified officials and employees of mine owners. The right exists of expropriation of surface area for necessary buildings, shafts, etc.—From a *Consular Report.*

TIN has been discovered in the province of Alacania, Chile.

The Evolution of a Bullion Refinery—II

By Harold French

(Continued from Page 755)

The Philadelphia plant proved so satisfactory that George E. Roberts, Director of the Mint, detailed R. L. Whitehead to construct a combination Moebius and Wohlwill plant at the Denver mint. This was completed in 1905 and embodied many important improvements. The floors, part of the walls, and most of the interior furnishing were of acid-proof soapstone. Two motor generator sets supplied a maximum current of 700 amperes at 15 volts. The Wohlwill process was operated in a series of porcelain cells, 18 in. long, 13½ in. wide, and 1 ft. deep. As a new departure, gold chloride was directly generated by the aid of the electric current, instead of by heating gold in aqua regia and boiling off the nitric acid from the solution. It is essential that a considerable stock of auric chloride solution be kept on hand in this process to replenish the gold in the electrolyte according to the rate of its decomposition by the current. Glass rods, tipped with propeller blades, and immersed in the solutions, agitated the electrolyte, facilitating the deposition of the gold. These were run by a small motor. The capacity of the Denver refinery averaged for a considerable period 5000 oz. fine gold and 13,000 oz. fine silver per day.

Some of the many improvements in the silver-refining system were the use of gold hangers which, being insoluble in the nitric acid electrolyte, almost completely submerged the anodes in the solution and gave a better contact. A higher percentage of gold was permissible in the silver anodes, remaining as a core, which was lifted out of the solution before it disintegrated. The cathodes were periodically stripped and the sheets returned to the cells. The parting of this doré bullion was effected in large earthenware tanks of the Bertuch pattern, 47 in. long, 26 in. wide, and 22 in. deep, through which the electrolyte circulated *en cascade*. A monteju forced the solution from a sump-tank to a distributing jar, from which it flowed from cell to cell. The gold cathodes were removed when 1 in. thick, washed, dried, and melted into fine bars, containing 1 to 5 parts of alloy in 10,000. The slime, consisting of chloride of silver and gold scrap, was boiled with H_2SO_4, with the formation of Ag_2SO_4 and the evolution of HCl. The slime from the silver cells was digested with HNO_3, leaving the gold residue in a form suitable, after melting, for electrolyzing in the Wohlwill process. For a number of years the output of the Denver refinery has averaged nearly $30,000,000 per year in fine gold and silver.

Remodeling the San Francisco Refinery

At the close of the fiscal year 1906-7, the sulphuric acid refinery at the San Francisco mint was dismantled and a complete new electrolytic plant was constructed by R. L. Whitehead. Work began March 1, 1908. The constructing engineer, at this plant, improved upon his work at Denver in many ways. Greater space permitted the placing of a much larger plant, with many extra conveniences for which there is no room in the Denver mint. The generator room contains two motor-generator sets capable of producing 1000 amperes at 15 volts. A third set supplied a current of 500 amperes at 25 volts to the cell where gold chloride is generated, while a fourth furnishes 200 amperes at 6 volts to a series of copper tanks. A massive six-panel switchboard, built of Alberene, 8 ft. high and 15½ ft. long, was equipped with switches, circuit-breakers, voltmeters, watt-hour meters, and Bristol recording ammeters, affording a check on the efficiency of the gold and silver cells and their operatives. The preparation of gold chloride was conducted in much the manner as at Denver. Anodes of gold, averaging 995 fine, were decomposed in a solution of half-strength hydrochloric acid. Cathodes of much smaller size, hung in porous cups, received a current density as high as 250 amperes per square foot. Generally 500 amperes at 25 volts was passed through these cells, evolving quantities of hydrochloric acid, which was conveyed through a hood to the roof. After nearly two days electrolyzing, the gold chloride attained a strength of 450 to 500 gm. gold per litre, or about 30% gold by weight in solution. At this strength the gold chloride solution acquires a beautiful reddish-orange hue. In the sunlight it frequently shows a shimmering mass of finely divided gold and aurous chloride.

Porcelain cells, 28 in number, were arranged in two rows. The current from the main circuit was distributed through horizontal bus-bars to a series of gold strips bent over angular porcelain rods. From these gold hooks depend the anodes into the electrolyte, while sheets of fine gold, serving as cathodes, were suspended nearly an inch from the anode on similar porcelain rods, the upper end of the cathode being curved to cover the connecting strip of V-shaped gold. Care is taken to make the contacts as perfect as possible. The electrolyte was maintained at about 60 gm. gold per litre, with from 5 to nearly 10% of hydrochloric acid. Circulation was maintained by glass propellers, but objection was made against their use, on the ground that their action was too violent and hurled particles of silver chloride against the cathodes, thus lowering the fineness of the gold product. Mr. Whitehead had designed a porcelain pump with connections which would permit the circulation of the electrolyte from cell to cell. The equipment was ready for use on July 1, 1908, but was not installed for reasons given later.

A similar circulating arrangement caused the flow of electrolyte through the cells of the silver-refining system. Instead of the Moebius method, as employed at the other mints, the Thum process was applied to the separation of doré silver. Perforated stone-ware baskets were suspended in the electrolyte which nearly filled cells of Bertuch earthenware, 39½ in. long, 19½ in. wide, and 1 ft. deep. These receptacles held several anodes, composed of over 30% gold alloyed with over twice its weight of silver and nearly 10% base metal. The anodes were enclosed in 7-oz. duck, retaining the gold and insoluble base metal, but permitting the migrating ions of silver to pass through to the cathodes, beneath which were plates of graphite. The contacts were candle-like rods of silver welded to heavy slabs of silver. At intervals the deposited silver would be removed by rubber scoops. Frequent additions of nitric acid and silver nitrate were made to the electrolyte, according to assays which determined the deficiency of either constituent.

As the electrolyte became foul with base nitrates, it was drawn off and precipitated with copper suspended in wooden vats. In like manner, the chloride solutions, after a week's run, were removed in portable tanks and the gold precipitated with ferrous sulphate. Both spent electrolytes, after their gold and silver content had been removed, were transferred to a large tank where the copper and any of the platinum metals present were precipitated by scrap iron. This action was hastened by suspending the scrap iron in a copper basket and heating the solution with a steam injector. The cement copper has since been cast into anodes and electrolyzed in a solution of copper sulphate; the platinum metals collecting on the bottom of the tanks, where they were segregated and saved for future separation. The gold precipitate and the silver deposits and precipitate were washed in earthenware centrifugal rotors lined with duck, care being taken to keep the chloride washings apart from silver nitrate, and gold apart from silver, by washing the different substances in separate machines.

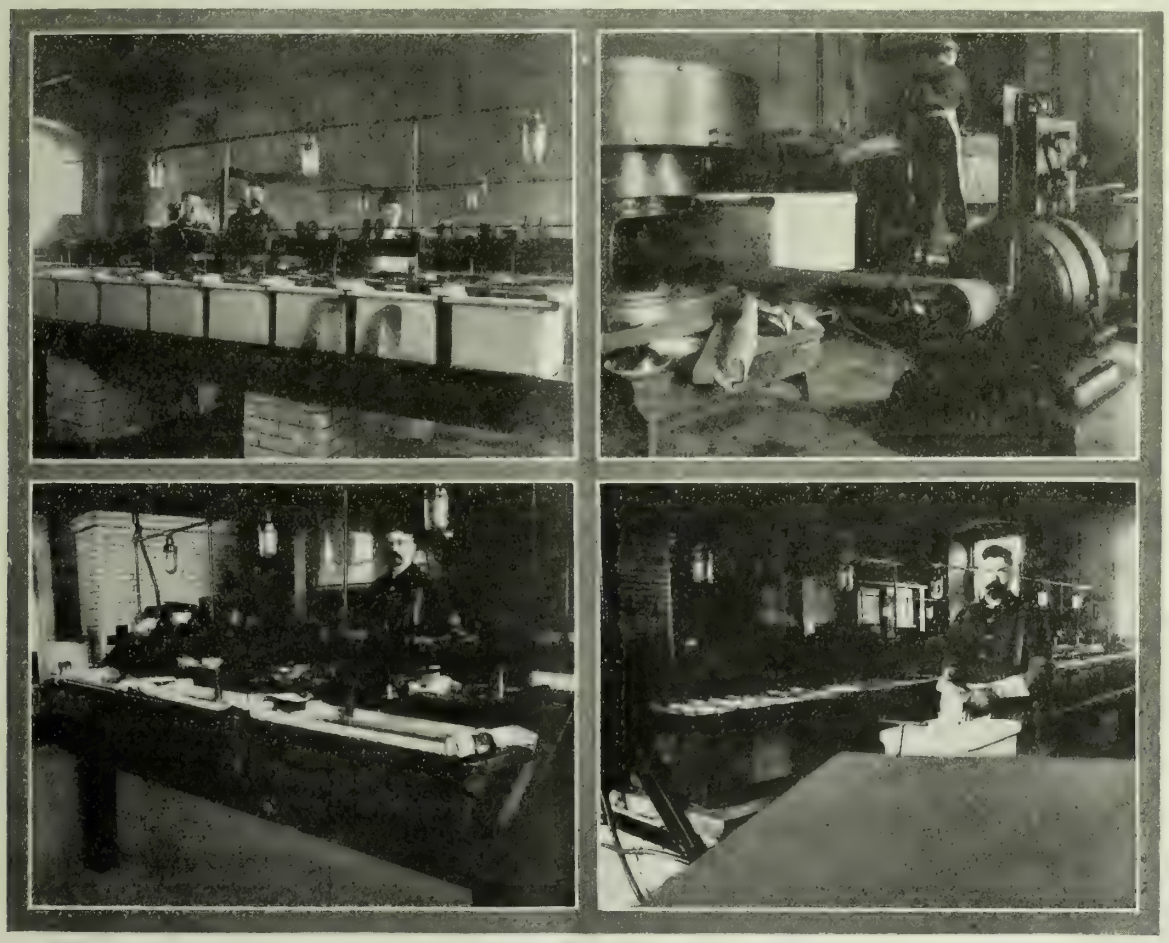
Slime from the gold cells was reduced, after washing in the centrifugal machine, by zinc and sulphuric acid. The precipitated silver, mixed with the gold fragments in the proportion of one of silver to two of gold, was blended with sufficient fine gold to bring the resultant alloy up to

over 900 fine. It was then reëlectrolyzed in the gold cells. The treatment of slime offered a fruitful field for research, as the methods employed here and at the older refineries were far from satisfactory. In the East it was customary to boil the slime first with HNO_3 and then with H_2SO_4 to extract the silver.

Another room of the new San Francisco refinery was equipped with a water-cooled mill for rolling out the cathodes of fine gold. Ingots 14 in. long, 3¼ in. wide, and ½ in. thick are rolled into ribbons 60 ft. long and 0.01 in. thick. All the melting of the refinery is done in a commodious room where four Rockwell furnaces are usually kept running at full blast. Oil as a fuel is used with excellent results, its economy being demonstrated by the fact that less than 4 gal. was consumed per hour per burner. In one month 600,000 oz. was melted at a cost of but $60, or 0.0001c. per ounce. After a successful trial run of about 100 continuous days, a clean-up of all the metal remaining in various forms was made, and on July 1, 1908, the plant was turned over. While from a chemical and metallurgical viewpoint the process had proved highly satisfactory, the cost of its installation and certain excessive operating expenses at that time were economic considerations which almost balanced the technical advantages it offered. From the start, studied efforts have been made to develop the maximum efficiency of the current in depositing metal on the cathodes. All improvements in the electrolytic procedure have since approached more nearly the ideal conditions and normal reactions, as far as the cost of current and reagents would permit.

A number of mechanical difficulties which were encountered at first have since been changed. The method of causing the electrolyte to circulate through the silver cells by the cascade system was abandoned. An expensive porcelain pumping and distributing outfit, which had been purchased as part of the equipment of the gold cells, was similarly set aside. Since then satisfactory circulation has been effected by glass propellers, agitated by vertical rods driven by a small motor, and by placing the electrodes farther apart, the agitation was so conducted as to obviate trouble from mechanical admixture with the gold deposits. The proper interval was found to be a little over 2½ in. between anodes and cathodes, at which distance the deposition of gold was still effected in sufficient quantity by increasing the current density. After considerable experiment the following arrangement of gold cells was adopted. On a long soapstone table, 3 ft. high and nearly 5 ft. wide, 2 rows of porcelain cells, 12 each, are placed. Each cell contains 31 litres of electrolyte agitated by the glass propellers described. From the connecting strips of gold leading from the bus-bars, and bent as an inverted V over horizontal porcelain rods, 6 anodes and 8 cathodes are now suspended, 2 to each connection in series. The ribbon-like cathode strips of pure gold are made to present a greater surface by stamping them in a press, which causes little protuberances to rise ¼ inch on every square inch of area. As the gold deposits on these little knobs it builds out more rapidly than when it formed on the smooth surface. The nodules grow more 'chunky' during the second day of their deposition, with an appreciably increased area, which will permit the passage of a higher current through the cell. In this form the finished cathode, an inch and more in thickness, is more readily and thoroughly washed. In addition to the 24 cells of 31 litres capacity, 6 large tanks of Royal Berlin porcelain have been installed, each containing over 250 litres of electrolyte. These have a great advantage over the smaller cells in that they may be run continuously for six weeks before the slime accumulates in sufficient quantity to require removal. The small cells seldom can be run effectively for over a week without disconnecting the electrodes, siphoning off the solution, and cleaning out the slime.

The decomposition of the electrolyte is more rapid in the



GOLD REFINING CELL, ANODE TO RIGHT, CATHODE TO LEFT. CENTRIFUGAL MACHINES FOR WASHING PRECIPITATED METAL.
THUM CELLS FOR PARTING DORE SILVER. STRIPPING SILVER FROM THE CATHODE.

small cells than in the larger. For that reason the strength of the solution has to be watched more closely so that it may be frequently replenished, while the 250-litre tanks may be maintained at a more uniform density. It is of high importance that the deposit of gold on the cathode should be coherent. If the current density is high (100 amp. per sq. ft. or over), there should be 60 to 75 gm. of gold per litre in solution. With a lower current density, the proportion may drop to 40 gm. at 60 amp. Below this current density it is not economical to electrolyze crude gold bullion. With higher currents the decomposition of the electrolyte becomes more rapid, until a degree of density is reached at which the anode is attacked, but very little in comparison to the manner in which the current breaks up the solution of gold trichloride. It is therefore necessary to ascertain the exact proportion of gold in solution which is required for efficient dissociation and deposition at a given current density. Accordingly, titrations have been made at regular intervals. Samples of 1 c.c. are taken from each cell, the gold precipitated by ferrous ammonium sulphate, and the gold per litre determined volumetrically. Stock solutions of auric chloride, averaging 450 gm. gold per litre, are held in readiness in crocks carried about on trucks. Three times per day fresh strong solution of gold is added to the cells according to the amount determined by the chemist. A greater proportion of hydrochloric acid was found to diminish the resistance of the bath as well as to absorb chlorine at the anode whenever evolved to any large extent. But as the cost of this acid was a considerable factor, its percentage was reduced materially. The principal cause of its loss was due to the formation of silver and base chlorides, and as the percentage of base alloy increased, when hydrochloric acid was required, as well as gold trichloride. When the current density is increased more acid must be added.

During the four years in which this refinery has been in operation, many chemical and metallurgical problems were solved in the laboratory, where a complete analytical equipment was in daily use. Many of the radical changes which have since been made in the evolution of this electrolytic refinery were first tried on a small scale. Also a number of theories were exploded by the results of conclusive experiments. Much of the spirit of healthy competition, characteristic of commercial plants, was manifested in this government-owned and operated refinery, as almost every skilled workman took a keen personal interest in finding better ways of doing his own special work. Most of the improvements in the processes employed have emanated from the practical suggestions of the experienced operatives whose collective ideas have brought many changes for the good of the service. As a direct result the efficiency of the plant has been almost doubled, while the force employed has been reduced nearly one half.

During the fiscal year 1908-9, the horizontal system of silver refining, called the Thum process, as first installed, was almost entirely discontinued. A reversion to a modification of the Moebius process was necessitated by the relatively high consumption of power and HNO_3 required by this method. As the slabs of doré silver were laid in the horizontal basket with the graphite cathodes in the bottom of the cell, the action of the current was only upon the lower sides of the anodes. In order to obtain a large output of fine silver from these Thum cells, the current was increased with the result that a rapid decomposition of the electrolyte ensued. More nitric acid was required, raising the cost considerably, while the canvas lining of the anode baskets was quickly eaten through by the acid. Against these drawbacks was the one advantage that the anodes were entirely decomposed into silver and base nitrates with the residual gold and insoluble impurities separated in the canvas basket. In this form it could be readily prepared for melting into high-grade gold anodes for the Wohlwill process. In the old Moebius method the unattacked tops of anodes which were suspended above the solutions required a second melting and electrolyzing.

From 12 to 18 cells were transformed to the vertical system. Gold strips leading from the bus-bars were bent over wooden rods, and from these gold hooks 36 anodes in 9 rows of four each suspended in a solution of silver nitrate containing 30 gm. silver per litre and 20 gm. of HNO_3 acid together with a small percentage of copper nitrate. The electrolyte was maintained at about this strength by fresh additions of its components according to determinations made by volumetric methods. The entire volume of electrolyte in each cell averaged 137 litres. Forty cathodes of fine silver are suspended from horizontal rods at a distance of nearly 3 in. from the anodes and opposite them. They are 4 in. wide, about 0.2 in. thick, and are immersed nearly 9 in. in solution. The composition of the anodes is about 300 parts gold, 600 silver, and 100 base. This method differs from the old Moebius method, as already described, in that the muslin bags which formerly encased each anode have been done away with. The electrolysis of each anode is now carried to the point where the gold core remains as a black and brittle mass, which is carefully removed so as to prevent any considerable amount of its mass from falling into the slime in the bottom of the cell. Before plunging the cathodes into their acid bath, they are first given a coat of silver chloride mixed with copper nitrate, which forms an adhesive sticky coat covering the cathode. This largely prevents the deposit slipping off the surface. Glue is also used to facilitate the retention of the fine and fern-like silver as it deposits upon the cathode. After the silver is about ½ in. thick, the cathode is removed, and the deposit scraped off with a sharpened piece of silver. The electrode is then replaced. The fine silver recovered from these cathodes is then washed in a centrifugal machine, dried, and melted into fine bars. About every ten days the electrolyte is drawn off and the silver precipitated upon slabs of copper in a wooden tank, and the red metal is later recovered as cement copper by precipitation with iron. The Thum process is still employed for the treatment of the unattacked tops of anodes of doré metal and the slime from the silver cells. These are packed in 7-oz. duck, connected with a candle-shaped piece of silver which produces the contact, and the transmitted current does the rest, the silver passing through the diaphragm and depositing as beautiful crystals upon the cathodes of graphite in the bottom of the cells. The deposited silver is removed from time to time by rubber scoops, washed, dried, and melted into fine bars, while the gold remaining in the basket, ranging from 900 to 950 in fineness, is mixed with crude gold deposits and put through the Wohlwill process.

The one great drawback of the electrolytic refining of gold was the fact that nearly all bullion treated had to be operated upon twice. Anodes for the Wohlwill process must not contain more than 6% silver, otherwise a thick pasty white coating of silver chloride forms upon the surface of the anode, protecting it from further decomposition. Although this chloride was scraped off as rapidly as the refiners could remove it, the current would divert most of its energy to depositing gold out of the specially prepared electrolyte instead of attacking the anodes. One thousand ounces of crude gold, containing 800 parts of fine gold, would be alloyed with 2000 oz. of refined gold bars in order to produce anodes averaging 933 in fineness, the remainder being silver and base metals. It will be seen that the necessity of alloying more than two parts of pure gold to every part of crude gold of average fineness as received from the depositors, was a serious handicap. The metal had to be melted, alloyed, and electrolytically parted; then, from two-thirds to three-quarters of its weight had to be re-melted and re-refined with the next batch of crude bullion, and finally melted into bars for coinage. This meant that practically every ounce required three meltings and two separate partings, when the treatment of anode tops, slime, and the precipitation of electrolytes was taken into consideration. The desideratum was a means of materially reducing the amount of fine gold alloy which was required to bring the anodes up to 930 or 940 fine.

What the Pulsating Current Accomplished

The value of reading reliable technical journals and thereby keeping posted upon progress along the lines of whatever applied science one may be engaged in as a vocation

was demonstrated by the adoption of a radical improvement in the electrolytic refining of gold as suggested in a journal in the spring of 1910. A single-phase alternator was connected in series with a direct-current generator, and the combined currents were led by a single conduit to the bus-bars which distributed the current to the gold cells. The alternator was regulated by careful experimenting until it produced a voltage of lower potential than that evolved by the direct-current generator. In practice the latter developed in each gold-parting cell 1.3 volts to 1 volt produced by the alternator. By the superposition of an alternating current of lower E. M. F. upon the direct current in the above proportion, the current evolved moved continuously through the circuit after the manner of a direct current, but with the difference that its potential rose and dropped with a pulsating effect, according to the influence of the 60-cycle alternator. A notable improvement was accomplished by this peculiar current. Each pulsation apparently imparted a distinct jolt to the silver chloride which accumulated on the anode, causing it to dislodge and fall to the bottom of the cell. This enabled the ions to migrate more rapidly from the anode, greatly increasing the dissociating efficiency of the current passing through the cells. It became possible to largely increase the anode current density. Where the direct current had run at a current density of 80 amperes per square foot, the pulsating current permitted the employment of a net amperage of 110 to 120 per square foot, an average increase of 40 to 50% in the efficiency of the current. The ammeters used did not register the alternating current, as will be readily understood, but represented the net amperage in terms of direct current, from which the current density per square foot was computed.

In addition to the increased efficiency of the cells, a still greater advantage was obtained by enabling the refiners to operate successfully upon crude gold bullion containing only 800 parts of fine gold per 1000. Excellent results have since been accomplished by electrolyzing anodes of 850 fineness. This innovation has largely done away with the wasteful method of alloying from 2 to 2½ parts of fine gold as described. 'Black gold,' the anode product of the Thum cells, ranging from 900 to 950 in fineness, is now blended with lower grade gold deposits to bring the resultant alloy up to about 850 fine. Further advantages have been found to be given by the pulsating current. Formerly, about 10% of the gold anode dropped to the bottom of the cells, and after being recovered in the slime, required a second melting and refining. Now but little more than 1% of the gold falls into the slime. With greatly increased current density, there is no marked evolution of chlorine, as was unpleasantly evidenced whenever the direct current was increased. Also the amount of hydrochloric acid used in the electrolyte has been reduced more than one-half, except when unusually base bullion is being parted. When the pulsating current is passing through the cells electrolysis may be effected with the electrolyte at a much lower temperature.

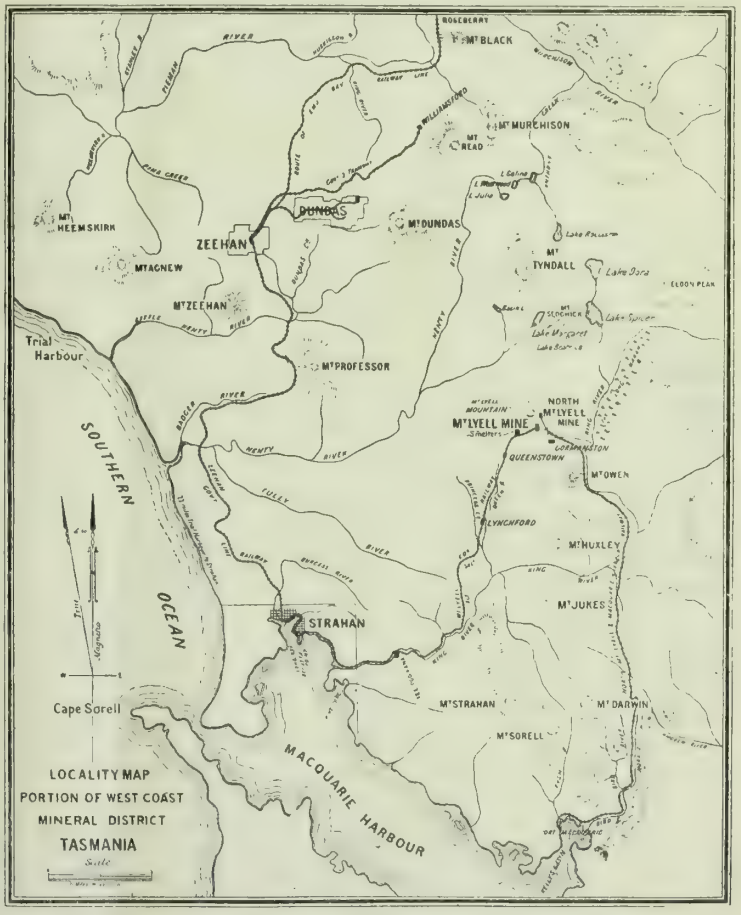
In Victoria at the present time one of the most promising things is the Central Plateau, on the famous old Ballarat field. This mine, after shaft-sinking to a depth of 600 ft. to cut a celebrated vein from which the old Star of the East company paid many dividends in the nineties, has driven north on the strike of the vein, and has found a 30-in. shoot of quartz containing about ½ oz. gold per ton. About 240 ft. of ore has so far been proved and there is about 1000 ft. of virgin ground ahead. The shaft is to be sunk another 100 ft., to endeavor to find the vein at a lower level. The liabilities of the company amount to some $17,000 and recently the price of the shares has risen from 85c. to $2.40.

The Mount Lyell Fire

MELBOURNE CORRESPONDENCE

Into the details of the great disaster at Mount Lyell, Tasmania, whereby 42 miners lost their lives, it is not necessary to enter. The subject lends itself to full treatment in the columns of daily newspapers dealing in the purely personal and in the sensational, rather than to those of a journal that is devoted to the impersonal and technical, but there are certain features of it and certain circumstances in connection with it that are of interest from the scientific point of view and from those concerned in the management of large mining ventures.

Work was proceeding as usual when a fire broke out very suddenly at the 700-ft. level; owing, it is believed, to a break in the electric motor operating the pump, firing the insulation and igniting the timber. The heat of the fire made the shaft a flue through which a dense volume of smoke made its way to the surface, and eventually the shaft became unworkable below the 500-ft. level. The mine being a wet one, the fire was not expected to be very serious, but the fumes given off were deadly, and 42 men thus lost their lives. Unfortunately no organization existed to cope with an outbreak of fire or its consequences. Some helmets were obtained for use by rescue parties, but the miners had had no experience or instruction in their use, and the firemen who arrived on the scene had no knowledge of the mine, without which, attempts at rescue were as likely to prove fatal to the would-be rescuers as to succor the men imprisoned in the levels. The danger of the rescue work was increased by the eddies set up by the ventilation, the smoke in one case going up a raise, proceeding for some distance along the level, and going down a winze. Many more lives would have been lost had it not been for the common sense and presence of mind of one of the men operating the compressed air. Noticing the air had no effect when directed full against the smoke, he turned it against the face, toward which he instructed the



men to work and keep as close to the wall as possible. Fifty men were saved in this way.

In connection with the disaster, J. J. Mahoney, president for Tasmania of the Federated Mine Employees' Association, has made some serious charges against the company. He asserts that men have been leaving the mine during the past four months because of the constantly increasing neglect of proper precautions in working. The miners remaining elected, as they were entitled to do under the mining law of the state, check inspectors to examine the mine and report upon its safety. Mr. Mahoney states that the company blocked an examination of the mine by these men to the utmost of his ability, and after their inspection would not allow them to write a report in the company's book. These check-inspectors insisting on the necessity of a second exit, the miners at a meeting resolved not to re-enter the mine until their representatives had been permitted to make an untrammeled inspection and to this the company agreed, but, in Mr. Mahoney's view, too late to avert the disaster. He further states that the false economy of the company in employing only one man to look after both the pump-house at the 700-ft. level and the one at the 1190 ft. level was alone responsible for the fire getting a hold, with such terrible consequences. Naturally the man could not be in both places at once; and when the fire broke out, he was either at the other level or was traveling between the two. The final and worst accusation made by Mr. Mahoney are best given in his own words:

"Why were the men not notified in terms of urgent warning that the fire was serious? The pumphouse man knew it at 10:45, and must have telephoned up to the officials. It was their place to give strict orders for the men to leave immediately, and see that they obeyed. Every man could have been saved. It takes only half an hour to lift the whole shift. That half hour would have meant at the outside 11:30 a.m. The time when the fumes were at their worst was about noon, or 12:10. When the rush to get out took place they were worse in the shaft than elsewhere. The shaft was the only means of exit. That was why the men rushed there. The other means of exit had been blocked for some weeks, the mullock pass having come together. The men say they would have used it had the company cleared it, as it ought to have been done immediately it was blocked."

The matter is to be the subject of an investigation by a Royal Commission appointed by the Tasmanian government. As the fire could not be extinguished and all hope had been abandoned of any of the men still in the mine having retained any vestige of life, the mine has been sealed in an endeavor to put an end to the fire, but, with doubtful wisdom, it has been twice unsealed in order to see what progress had been made. It is now sealed for a third time, and it is hoped that this time a sufficient period will be allowed to elapse to allow the fire to burn itself out. The process of flooding the mine has been very slow, owing to the shortage of water. Even, however, when the fire has been ultimately subdued and the mine has been freed of the noxious fumes that now fill it, and when the water laboriously pumped in has been pumped out again, the troubles of the company will by no means be at an end. Not only will the shaft, and the various drifts, winzes, and raises have to be re-opened, re-timbered, and repaired; but also there is a certain psychological difficulty to be overcome—the certainty that the men will refuse to start work in the mine again till every one of the 42 dead bodies has been brought to the surface. As some of these bodies may never again see the light of day, there is no future for the mine unless either the miners change their intention not to resume work until the last body has been recovered, or men are obtained from outside who are more callous concerning the past.

Meanwhile, the company, being deprived of the North Lyell ore, is obtaining fluxing material from the open cut at the Lyell Tharsis mine, and is mixing it with a small percentage of boulder schist from the North Lyell open cut. As the Tharsis ore is not so good a flux as the North Lyell, and has a value of considerable less than 2% as compared with the North Lyell value of 6%, it is not to be supposed that present working is being done at a profit. The value of the Mt. Lyell pyrite is only ½%, and the value of the mixture with Tharsis ore may be put down at 1%. The company deserves credit for the heroic efforts it is making to keep all the men employed, with no prospect of profit to itself.

When all the adverse circumstances are taken into consideration, the necessary slow recovery from the labor troubles at the close of last year, the shortage of labor, and the frequent interruptions of work for this or that or the other trivial cause, the Mt. Lyell company's figures for the half year comprising the second and third quarters of 1912 are remarkably good, the output of nearly 3200 tons giving a profit of about $500,000.

Working Costs at the Shannon Mine

By J. W. Bennie

*During the year ended August 21, 285,210 tons of ore was mined from the property of the Shannon Copper Co. at Metcalf, Arizona, of which 42,125 tons came from open-cuts, 216,183 tons from the intermediate levels, 26,006 tons from what is known as the Carter (or lower) level, and 897 tons from development on outside claims. The grade of ores obtained from the lower levels, while not as high as anticipated, is much better than the average of the mines. This is a factor which will have an important bearing on the future of the mines.

Development and Ore Reserves

During the year more than normal expenditures were made for exploration and development, 11,031 ft. of work being driven during the year. Of this, 4600 ft. of drifts was driven on the lower levels, 796 ft. on upper levels, 4700 ft. on the intermediate levels, and 880 ft. on outside workings. Development on the lower levels of the mine has been of an encouraging nature, and while at present only 125 tons per day is being mined from these levels, this output will be doubled in the near future. Development on the outside claims will be continued during the coming year. Nothing of any consequence has been opened by previous development, but there is still a possibility of good ore being obtained in quantity from the El Paso and adjoining claims.

Important new work to be commenced during the coming year will be an exploratory adit to be driven from a point 25 ft. above the ore-bins in Chase creek for a distance of 1500 ft., cross-cutting the main ore formation at a depth of 300 ft. vertically below the Carter level. This adit was suggested ten years ago, and while discussed at various times since then, it is only now that it is considered warranted as a justifiable development scheme.

The policy of confining development expenditure to searching for new orebodies instead of opening known ones has been continued during the year, and with gratifying results, especially in the lower levels. In previous reports I have pointed out it would be very expensive to open ore reserves, with no advantage except that of being able to approximately estimate them. Geological conditions are better understood as each year passes, and it is this better understanding, added to the results of recent development, that warrants the statement that there is a probability of an extended life for the Shannon mines, which was heretofore doubtful.

Costs

The cost of mining per ton was lower by 8c. than that of the year previous, the saving being in lower cost of extraction and cheaper timbers. This saving would have been greater, but miners' wages were increased in June, thus adding to the labor bill. There was also an additional expenditure of 7c. per ton on ore extracted during

*From the annual report of the Shannon Copper Co. for 1912.

development. The total costs, therefore, were approximately the same as last year. During the coming year no material change in costs is anticipated. The only additional extra expenditure contemplated is for new office for engineers and superintendents, the present quarters being overcrowded. All operating departments—that is, the mines, concentrator, smelter, power-plant, and transportation department—have shown marked improvement both in their physical condition and in their ability to operate at lower cost. This was reflected in the cost of producing copper, as will be seen by the tabulated figures below, taken from the report of the president of the company, N. L. Amster. In the month of April copper was produced at a cost of a fraction over 10c. per pound, including every item of expense, both Eastern and Western. In June, however, a new scale of wages was put into effect by the Shannon as by every other mining company in Arizona, and this meant an increase in the monthly payroll of approximately $10,000, or the equivalent of about 0.7c. per pound of copper. The rising copper market also made it tempting to mine and ship to the smelter ores of a grade which on a lower copper market were not considered workable and were not mined; this, too, tended to increase the costs during the last quarter of this fiscal year, as is shown by the following figures:

	Cost per lb. (cents). 1911-12.	1910-11.
First quarter ended November 30.....	11.8	11.009
Second quarter ended February 28.....	10.93	11.923
Third quarter ended May 31.....	10.55	11.085
Fourth quarter ended August 31.....	12.47	12.287

Notwithstanding, however, the increased wages and the lower grade of ore shipped toward the end of this fiscal year, the average costs per pound of copper produced for the year were a little lower than those of preceding years.

Year.	Cents per lb.	Year.	Cents per lb.
1911-1912	11.42	1907-1908	12.6
1910-1911	11.58	1906-1907	14.5
1909-1910	12.1	1905-1906	14.6
1908-1909	12.2		

Liberal expenditures were made during the year for development and exploration work, amounting to $90,415.74, and charged, as usual, to costs. This is 33% more than was spent in 1907 on a 22c. metal market, and more than double the development expenditures of any other year in the company's existence, and the results were satisfactory.

Reduction Works

There have been few changes in the blast-furnace plant; it was thoroughly overhauled during the year and is now in first-class condition. The cost of smelting was materially reduced during the year, due to the reduction in amount of coke and flux used, and less cost of power. During the coming year experiments in the use of basic, instead of acid-lined converters will be carried out, and a material reduction in converting costs is expected. These experiments will be undertaken as soon as a new blowing-engine, which is considered essential, is erected. The costs of concentrating show a marked improvement over the previous year. The supply of concentrating ores is, however, very irregular in quantity, and the operating costs, therefore, are much higher than otherwise would be the case. It is hoped to remedy these conditions during the coming year. Owing to lower freight rates and cheaper fuel oil, costs for power were materially reduced during the year.

Leaching

Experiments commenced last year, leading to an attempt to solve the economic treatment of low-grade semi-oxidized ores, have been continued during the past year, with every reassurance that the problem will be solved. Several months time was wasted in the anxiety to rush these experiments, and we are not, therefore, much farther forward than we were last year. We can state positively that the process we are experimenting with is successful to the extent that it renders the major portion of the copper content soluble in water.

The Swansea Smelter

The Clara Consolidated Co., formerly operating at Swansea, in northern Yuma county, Arizona, has recently been reorganized as the Swansea Consolidated Gold & Copper Mining Co., for which C. Clerc is general manager and W. H. Seamon smelter superintendent. The smelting plant has been overhauled and was recently blown in. Copper is now being produced at the rate of 600,000 lb. per month from custom ores as well as from those produced by the company. For the following brief description we are indebted to the *Parker Post*.

The smelting plant consists of one 750-ton water-jacketed blast-furnace with 42 tuyeres; the blast enters the furnace 33 in. above the bottom; the pressure is 10 oz. at the power-house. The blast-furnace stack is 7 ft. diam. and 125 ft. high. There are two converter stands, capable of turning out from 45 to 50 tons of metal daily. The converters are 8½ ft. long, have cast steel heads and tops, and are electrically operated. A 40-ton electrically operated crane

WESTERN ARIZONA.

(Swansea is at final 'r' in Parker and is connected with Bouse by a railway.)

completes the equipment in this department, there being one main and two auxiliary hoists.

The system of tramways and of handling the custom ores is to be changed by the new management as rapidly as possible. Already a decided improvement has been made in handling the custom ores after they are dumped near the sampling mill. A small hoist has been installed and they are elevated to the tramway on 5-ton cars. Formerly it was necessary to shovel this ore into the cars from the platform. In time the tramway system will be entirely eliminated by the installation of conveyors, which will handle the ore faster and at less expense than under the present system.

Construction of a reverberatory is under way, and its completion is being rushed as fast as possible. It will have a capacity up to 400 tons every 24 hours. The dimensions of the furnace are 19 by 108 ft. When completed the capacity of the Swansea plant will be over 1000 tons per day.

The power-plant contains two 250-hp. boilers. A 15,000-cu. ft. Nordberg blowing-engine furnishes air for the converters, two 7½-ft. blowers for the blast-furnace, one 11½-ft. blower, operated by a Hamilton-Corliss compound engine, which was installed to increase the air capacity, is

not being used since it was found that the furnace was receiving too much air. A 300-kw. D.C. Westinghouse motor, direct-connected, furnishes power for the tramway, electric lights, and miscellaneous purposes. A 150-kw. A.C. belt-driven Ideal motor furnishes power for a pump at the Bill Williams river. This pump supplies the water required for operating and domestic purposes. There are two pipe-lines, one 6 in. and the other 3 inches.

Mineral Industry of California, 1912

The value of California's mineral product for 1912 will reach a total of well over $91,500,000, being an increase of $4,000,000 over the production of 1911, according to a preliminary report by W. H. Storms, State Mineralogist. Great activity has been evident in the mineral industry, and an increased production will undoubtedly be shown in every branch, with the possible exception of copper (owing to the fact that the fume trouble has not been satisfactorily solved as yet), but the value of the copper produced will show a large increase, due to the advance in the price received during the year, the average being close to 16c. per pound, as against 12½c. per pound received in 1911. A conservative estimate of the leading mineral products for 1912 is as follows:

Petroleum, 87,000,000 bbl.	$41,000,000
Gold	20,000,000
Cement	10,500,000
Copper	5,000,000
Crushed rock, used for all purposes	4,000,000
Brick of all kinds	2,500,000
Borax	1,500,000
Natural gas	1,500,000
Quicksilver	750,000
Silver	750,000
Lime and limestone	750,000
Mineral water, salt, and clay pottery	1,250,000
Miscellaneous minerals	2,000,000
Total	$91,500,000

The remaining 26 minerals, listed as miscellaneous, which were produced in 1911 had a total value of $1,800,000. Many of them are known to have had a greatly increased output during the year just passed, probably far exceeding the estimated $2,000,000. Some minerals which have been receiving considerable attention from capital recently are: bauxite, for the manufacture of aluminum; various iron deposits throughout the state; barytes, feldspar, natural asphalt, potash and nitre deposits, tungsten, and vanadium. While practically all the asphalt used in the state is a refined product, it is often listed with the total mineral output, in which case the total figure would approximate $95,000,000.

California ranks first among the states west of the Mississippi river in the value of its mineral production, according to the United States Geological Survey. In former years California's claim to distinction as a mineral producer rested on its output of gold, in which, in fact, it held first place in 1911, although in recent years it has usually fallen behind Colorado in the production of gold. The premiership of gold in the state has, however, been succeeded by petroleum, the value of which in California exceeds that of gold by 94% and gives the state first place among the states in the production of crude oil. California leads also in the production of asphalt, of platinum, and quicksilver, and enjoys a monopoly in the production of borax and magnesite. It is second in the production of tungsten ores, third in the production of cement, and sixth in the production of copper, and stands well up among the states in the production of a number of less important minerals. The total value of the mineral production of California in 1911 was $90,517,566, compared with $86,721,069 in 1910. The average copper content of the ore production in California is higher than any other state or territory, with the exception of Alaska.

New Power Plant, Scottish Gympie

The new power plant at the Scottish Gympie gold mine, Gympie, consists of a Belliss & Morcom compound horizontal-impulse, mixed-pressure turbine, running at 1500 revolutions per minute, direct coupled to and on the same bed-plate as a 500-kw. compound British Westinghouse generator, 220-240 volts. This generator, which is the first large direct current generator of the type introduced into Australia, while utilizing the available exhaust steam from the mill engine, pumps, and other existing engines, supplies electric light for surface and underground, and power to drive 25 stamps in the mill, as well as to drive two compound air-compressors (vertical, by Belliss & Morcom), with a total capacity of 2000 cu. ft. of free air per minute at sea-level to a final pressure of 95 lb. gauge. Each compressor is mounted on the same bed-plate, and direct coupled to a British Westinghouse 200-hp., 220-volt direct current, shunt-wound, inter-pole motor. The compressed air thus supplied is used for driving the rock-drills and other machines. The condenser is by Belliss & Morcom, complete with a two-throw Belliss-Edwards air pump, driven by an electric motor, and is capable of dealing with 20,000 lb. of exhaust steam per hour, with a vacuum of 27 in. barometer, or 30 in. when supplied with cooling water at 80° F. The machine is now working with a load of 484 kw. The water from the condenser is used in the mill.—*Queensland Government Mining Journal.*

Electrolysis of Nitric Acid Solutions of Copper.

By J. H. Stansbie

*The object of the investigation was to find the cause of the failure of the current to completely deposit copper from its nitric acid solutions. A platinum cathode thickly plated with copper was rotated in a solution of nitric acid containing less than 0.1 mg. of nitrous acid, and was then allowed to remain at rest in a similar solution for the same length of time. In one pair of experiments 15.4 mg. of copper was dissolved from the rotating cathode, and 3486.3 mg. from the stationary cathode. This remarkable difference is no doubt due to increased action brought about by the accumulation of nitrous acid or nitrate in the layer of liquid in direct contact with the metal, which cannot take place while the metal is being rapidly rotated. No current was allowed to pass in either case.

In the electrolysis of nitric acid solutions of copper it is found that nitrous acid is formed in the solution, and that the presence of this compound prevents the deposition of the last traces of copper from the solution. The influence of the nitrous acid increases with the concentration of the nitric acid. This is shown by experiments with solutions containing varying weights of nitric acid to the same weight of copper. The copper left in solution was found to increase with the concentration of the nitric acid and the accumulation of nitrous acid in the solution. The presence of free sulphuric acid in the solutions retards the formation of nitrous acid, and it is probable that a nitro-compound is formed from the two acids which is less effective in promoting the dissolution of copper from the cathode than nitrous acid alone. It is quite clear that the rotating cathode is much more efficient than the stationary one, and that all but the merest traces of copper can be deposited from dilute nitric acid solutions containing sulphuric acid, if the cathode is promptly removed and washed, preferably while the current is passing and the cathode rotating. This can be done by directing a jet of water on the cathode from a stationary wash-bottle while the beaker is being lowered to break contact, or by means of a suitably arranged tap funnel.

*From a paper read before the Faraday Society, London, England.

Discussion

Readers of the Mining and Scientific Press are invited to use this department for the discussion of technical and other matters pertaining to mining and metallurgy. The Editor welcomes the expression of views contrary to his own, believing that careful criticism is more valuable than casual compliment. Insertion of any contribution is determined by its probable interest to the readers of this journal.

What are Mining Profits?

The Editor:

Sir—If we agree with the statement of Mr. Finlay that "the profits of mining are just like any other profits," then it would seem unnecessary for Mr. Cabell and Mr. Speer to be traveling through the West studying the question of how to estimate depreciation on oil lands and mining properties so as to arrive at a basis for levying the corporation tax. In view also of the decision of Judge Polk in the case of Stratton's Independence *v.* F. W. Howbert this seems to be futile.

It may readily be conceded that the removal of ore, while undoubtedly lessening the value of a mine, should not be classed as depreciation in making up accounts for the purpose of the tax. Depreciation is a technical term. In a manufacturing business, for instance, it is customary to charge against profit a proportionate sum year by year as depreciation on buildings, plant, and machinery according to their estimated life or usefulness, and such is a proper charge or cost of producing such profit.

Again, if a corporation were dealing in shares or something else of a fluctuating character it would be proper in arriving at the profit to offset any depreciation in value of part of the investment against any appreciation on the other part. On the latter basis it is possible to contemplate the contingency when from the fall in price of some metal there would be an actual depreciation of value of ore in a mine. The ore extracted from a mine, however, does not come within this category. But while it should not be classed as depreciation, it does not follow by any means that it is all income or profit, for in no other business would it be permissible to include sales or product on one side of the account while ignoring one of the costs of production, by whatever name you may call it, on the other.

Take the following as an extreme example. A corporation invests $1,000,000 in the purchase of timber (it does not buy the land on which it is growing). After payment of all expenses it receives back the original investment only at the rate of $100,000 per annum. It will hardly be contended, I imagine, that it should pay any excise tax at all. Logically, as the amount of ore to be extracted cannot be predicated, the actual profit from a mine cannot be ascertained until after the capital expended in the purchase, development and working, and a proper allowance for depreciation of equipment has been returned in full.

Ernest V. Orford.

Delamar, Idaho, November 15.

Filter Patent Litigation

The Editor:

Sir—My interests being affected by the recent decision sustaining the Moore process patent, I called the attention of my patent counsel to the editorial appearing in your issue of November 23, having got the impression from reading the editorial that a judgment of the Circuit Court of Appeals for one district did not affect one who might be an infringer in any one of the other eight districts. The advice that I have received is to the effect that any such impression is entirely erroneous and that while one taking the pains to properly analyze and weigh your editorial, paragraph for paragraph, is likely to reach the conclusion that you intended no such construction put upon it, yet a mere cursory reading is likely to convey such impression to others as it did to me.

I am given to understand that a decision by one Circuit Court of Appeals is in about ninety-nine cases out of a hundred recognized by every other Circuit Court of Appeals as *prima facia* for the granting of at least a preliminary injunction, and that the instances are very rare when the judgment is not considered final, or in effect the same as if it were the judgment of the United States Supreme Court. The present Circuit Court of Appeals, I am advised, was established simply to relieve the United States Supreme Court of consideration of patent and other causes.

I have at all times been willing to concede that George Moore solved the slime problem but one of those who it now turns out was evidently arguing for 'revenue' only, succeeded in convincing me that the Moore process patent would never be sustained by the Courts, and I must confess that with the great number of contrivances previously patented and which were claimed to be "perfect anticipations" of Moore's patents, that I concluded to take my chances with the somewhat extensive list of persons who had evidently become similarly convinced.

It now appears that Moore protected his position fundamentally by obtaining a 'process patent,' and that the steps of his process are not anticipated by any one of the apparatus patents which I had presented to me as "perfect anticipations" of Moore's process patent. I think that I have now discovered just about where I am at, and possibly the publication of this letter might serve a useful purpose to others who have been sailing in the same boat with me.

R. R. Reutlinger.

Philadelphia, November 30.

[We regret that our editorial should have been misunderstood even by one reading it hastily. In pointing out the *possibility* of further litigation we had no intention of suggesting that there was more than a *chance* that the decision just rendered would be reversed. Indeed the latter seems entirely improbable, and we have therefore urged that from now on negotiation rather than litigation is in order. We are glad to see that our correspondent's attorney agrees with us in analysis of the case.—Editor.]

Persistence of Ore in Depth

The Editor:

Sir—The recent articles and letters on this subject seem to have wandered far from the original paper which prompted them and which was apparently based upon the fact that, in the United States, the "new discoveries are not equaling the depletion of those already developed."[1] There seems also to have been a desire to provoke a discussion as to whether new discoveries could be made by more scientific prospecting.

Several of the writers approach the subject as though the only direction in which to search was downward, and pour further ridicule on the already ridiculous suggestion that veins should improve or continue indefinitely. The discussion has brought out much information, but there is a want of detail, and we have, after all, only arrived at the conclusion that some veins become richer, some become poorer in depth, some even have more than one change from rich to poor, and the reverse; but, in the case of those that have become poorer, we have no definite information as to whether this is final and is due to depth alone or to other causes.

The details given by W. H. Storms[2] prove conclusively that, in many instances, the mines on the Mother Lode improve in depth, but his statement that "proper geologic conditions seem to be more important than all other considerations" is disappointing, for he leaves us completely in the dark as to what those proper geologic conditions may be. If when a vein becomes poor in depth there is undoubted evidence that we have reached the roots of that vein, obviously we cannot reasonably expect an improvement at a still greater depth; but, unless we have reached the roots, in the absence of adverse chemical or physical

[1] Garrison, F. L., *Mining and Scientific Press*, September 21, 1912.

[2] Storms, W. H., 'Possibilities of the Mother Lode in Depth,' *Mining and Scientific Press*, October 12, 1912.

reasons other than those due to depth, then the experience on the Mother Lode and elsewhere would seem to indicate that, by still further sinking, a rich zone may be again encountered. There is a limit, of course, to sinking, just as there is to exploratory cross-cuts. The collecting of more instances of improvement or impoverishment of veins in depth will not help in this matter. What is wanted are complete geological descriptions of the veins in the upper and lower levels, and, where possible, some idea of the extent of erosion. George E. Collins[3] says that "prospectors do not usually sink on barren veins in order to find out what is below. Ordinarily prudent people, as a rule, only sink on veins which show at the surface evidence of productiveness." There have been notable exceptions to this, and there are likely to be more. Mr. Storms[3] gives instances of people sinking on veins to 100, 600, and even 1000 ft. before they struck profitable ore.

The Treadwell mines in Alaska are notable instances of improvement and impoverishment succeeded by further improvement in depth, and it is confidently expected at these mines that "such ore as has been mined from the surface to the lowest levels of the mines will continue to a much greater depth."[4] The case of the Mary Murphy mine mentioned by Mr. Collins[3] would be instructive if we had full details, including, of course, evidence as to erosion, for it is not merely depth from present surface about which we want information, but also to know whether much or little has been eroded.

In view of T. A. Rickard's statement[5] that "the most persistently rich lodes are in Archean and Algonkian rocks; they are associated with acid eruptives of the granitic type; they are presumed to be in their primary condition, that is, they owe little or nothing to the secondary enrichment observed within the water-zone", it is a little disconcerting to read later in the same article: "It is fair to ask the mining geologist to remember that it is only the enriched portions of a lode that have economic value to the miner and that such enrichments represent a concentration or re-precipitation necessarily more recent than the lodes as first formed." I have, of course, read the whole of the paragraph and note the question by Mr. Rickard, but would respectfully submit that there have been exceptions and there may be more, including that "barren outcrop at A" mentioned by Malcolm Maclaren.[6] Mr. Rickard cannot go so far as to say that Mr. Maclaren would be quite unjustified in sinking on this vein or he would have to say that much of the bolder work on the Mother Lode prospects was unjustified, and yet—they have become mines!

It is easy to understand why deposits associated with Tertiary eruptives should not continue to great depth, but the point that has not been touched on, except by Mr. Maclaren, is as to whether the top of a valuable deposit may be a poor or even barren vein. As it is admitted that there are zones of relative richness and poorness, obviously we can assume that all possibly profitable veins have not been conveniently eroded to their payable zone.

The great importance of the andesites as goldfields has been pointed out by Mr. Maclaren,[7] and there would appear to be no reason why veins in andesite should not also have poor or even barren outcrops and yet be richer in depth.

The article by Mr. Rickard[8] was prompted by F. Lynwood Garrison's paper before the Toronto meeting of the Canadian Mining Institute, and that paper, judging from Mr. Garrison's letter,[1] was written with a view to encouraging discussion on scientific prospecting. This matter of the improvement of outcrops in depth is one of great importance to the scientific prospector or mining geologist, for whom there would appear to be as much scope or more above-ground than under-ground, if new deposits are wanted.

The possible improvement of lodes in depth (apart altogether from alteration due to ordinary weathering, the water-zone, or the added influence of air-borne sea-spray and manganese, etc.) is of more than mere academic interest, though that would be sufficient to justify a discussion. I don't plead for the opening up of every barren or even poor vein, but I maintain that we have definite evidence that some of them may improve, and though, to make use of the metaphor of Mr. Rickard,[8] "you can't expect a man possessed of unusual vitality at 90 to continue with unabated force for another half-century", still his energies may continue thus for some time longer; anyway, be sure that he has reached that advanced age, and then when his 'time' comes he may die from any one of the numerous and usual causes—even impoverishment, but don't forget that a younger man may suffer from any one of these numerous and usual causes—yes, even the last! but yet recover and have a long, useful, and profitable life; he is, so to speak, like a vein far removed from the zone of flowage.

There is still a third man to be considered, the one born to die young, a slight illness may carry him off, he is like one of the veins which have been eroded nearly to extinction and which cannot be expected to have a long life.

STEPHEN J. LETT.

London, November 28.

[3] *Mining and Scientific Press*, September 28, 1912.

[4] Hershey, O. H., 'Geology at Treadwell Mines,' *Mining and Scientific Press*,' February 25, March 4, 1911.

[5] Rickard, T. A., 'Persistence of Ore in Depth,' *Mining and Scientific Press*, August 31, 1912.

[6] Maclaren, M., *Mining and Scientific Press*, October 26, 1912.

[7] Maclaren, M., 'Gold,' p. 76.

[8] Rickard, T. A., 'Persistence of Ore in Depth,' *Mining and Scientific Press*, August 24 and 31, 1912.

Copper Review for November

By MISHA E. APPELBAUM

During the past month the domestic copper market fluctuated within very narrow limits. A fairly large business was done between 17⅜ and 17¾c. per pound. Between the end of November and the time the Producers' Association figures were published very little business had been transacted for the reason that most copper journals predicted an increase of 20,000,000 to 30,000,000 lb. in the visible supply of copper. As a matter of fact, the increase was about 9,000,000 lb., and, considering the decrease on the other side, practically no change took place in the world's visible supply. At the present moment, the American consumers have very little copper bought for their January to March requirements. The same state of affairs exists in Europe, and, in my opinion, as soon as the copper figures become known in Europe, a stampede will be caused, for it is hardly possible for the European or American consumers to keep out of the market for any length of time. This should result in a very satisfactory business at 17¾c. per pound.

The outlook for the coming year, from a statistical standpoint, ought to be one of extreme satisfaction to the producers. The consumers of copper have enough orders on their books to run full for the next few months, and will therefore have to buy large quantities of copper, irrespective of how business may develop during that period. As to whether the business improvement will continue, or whether there will be a contraction due to the political outlook, is very hard to prognosticate. Inasmuch as the price of copper will be regulated more or less by the actual business conditions, it is difficult to state whether the price of copper will go higher. There is no doubt that the country is right for a cycle of business prosperity, and one can, therefore, but urgently hope that the Democrats will make use of their opportunity by introducing conservative legislation which should not seriously interfere with business and will at the same time do away with the existing tariff abuses.

THE September yield of the Melbourne Cope's Creek Tin Sluicing Co., Tingha, New South Wales, was 6¼ tons, inclusive of 1 ton 2 cwt. of second grade. The previous month's output was over 10 tons. No report has yet been made of the Coodardy and Poonah tinfields in Western Australia.

Special Correspondence

BUTTE, MONTANA

FINANCING EAST BUTTE.—FIRE IN THE WEST STEWART.—MINE INSPECTOR'S REPORT.

There is now no doubt that the East Butte Copper Co. will complete its purchase of the Pittsmont property. The stock consideration, 110,000 shares of East Butte, has recently been turned over to the Pittsmont interests, and over $2,000,000 has been paid on the $2,500,000 Pittsmont bond issue held by Pittsburg banks. The East Butte management deserves great credit for resuscitating what threatened to be a big mining and metallurgical fizzle. The Anaconda Copper Mining Co. has its central employment office and 'rustling card' system in full effect. The miners at large do not seem to object to it particularly, although the socialist minority in the union have held some stormy sessions to protest against the system. The Miners' Union, after some discussion, has referred the matter to the executive board of the Western Federation of Miners.

Monday the ninth fire broke out in a raise between the 1700 and 1500-ft. levels of the West Stewart mine. The 300 miners on shift were promptly brought to the surface. Jack O'Neill, superintendent of the Anaconda mine, and the

SCENE IN BUTTE.

most experienced fire-fighter in Butte was placed in charge of the fire zone, under the direction of John Gillie, general manager. Sixty fire-fighters with oxygen helmets were assembled, and succeeded in confining the fire to the vicinity of the raise. Within a few days, the workings were freed of smoke, and the fire was well under control. The Anaconda company has learned the importance of controlling such mine fires promptly, as the heavy sulphide ores when once heated will continue to burn fiercely with the access of very little outside oxygen. The fire is thought to have originated from a lighted candle carelessly left on the mine timbers.

A representative of the reorganization committee of the bondholders of LaFrance Copper Company was the only bidder at the sheriff's sale of the property on December 3. The property was bought for $100,000. The stockholders will now receive nothing as they lose all rights through the foreclosure of the bonds.

Thomas F. Cole and associates of Duluth have offered to further develop the Butte & London property upon condition that they are given a 51% interest in the property in exchange for certain work done. They propose to sink the shaft 500 ft. deeper from the present level at 1130 ft. At this depth they will cross-cut north and south to the side-lines of the property. Mr. Cole and associates are interested in an adjoining property to the west, the Rainbow Lode Development Co., and to prospect their ground, they are desirous of taking advantage of the present depth of the Butte & London shaft.

William Walsh, state mine inspector, has issued his report for the year ended November 30, 1912. He makes the statement regarding Butte, that during the past year development work exceeded that of any previous year by 57%. This development work was done mainly by the large operators, very little of it having been done by lessees and small operators. Mr. Walsh estimates that the introduction of electric power in and about the mines will finally mean a saving in production costs of 1c. per pound of copper produced. The report shows that throughout the state there were 47 fatal mine accidents during the year, about 0.3% of the number of men employed.

The United States Assay Office at Helena received $136,695 during November from Montana counties. The big producers were Madison, $62,000; Lewis and Clark, $27,000; Fergus, $22,000; Chouteau, $15,000; and Ravalli, $5000.

JOHANNESBURG, TRANSVAAL

SEPTEMBER RETURNS.—FAR EAST RAND.

During the month of September the average recovery per ton of ore milled on the Witwatersrand was 28s. 7d. per ton as compared with 28s. 9d. per ton for the preceding month of August. This is the first time since last January that the recovery has gone back, for month by month since the beginning of the year the average recovery per ton milled has increased. It is not at all an easy task to explain why the recovery has improved to such an extent after such a long period of decline, because as a matter of fact the recovery value, as a rule, declines with the depth. What few exceptions there are to this rule cannot be deemed sufficient to bring about such a change in figures as this year has shown. The fact that working costs per ton have advanced to almost the same extent as the recovery would almost seem to indicate the existence of selective mining to a far greater extent than formerly. In the case of the East Rand Proprietary Mines (one of the three mammoth gold producers on the Rand) the adoption of selective mining would naturally make itself felt on the total gold production of the Rand. Then there can be little doubt that the opening and development of several good properties in the Far East Rand has also tended to improve matters on the whole, while several of the old established concerns have been concentrating their mining operations where better ore can be obtained.

It has already been pointed out that this higher gold recovery has not been represented by a higher proportionate mining profit; in fact, costs in some cases have so advanced that the higher recovery obtained has been wellnigh swallowed up by the higher costs of working. It was confidently expected last July that when the freight rates on coal to the gold mines were reduced on August 1, gold-mining costs would benefit to the extent of 2d. per ton milled. In August they advanced, as a matter of fact, and even today they are quite as high as before the reduced railway rates came into force. Still the working profits per ton milled have recovered somewhat of late, and now stand at 10s. per ton: the total working profit for September being £1,040,820.

The brightest spot in the Witwatersrand goldfields continues in the Far East Rand, for since the finely developed reef of the Main Reef series was cut in the Modder Deep shaft it has also been cut in several other places, showing practically the same content on the same property. In the neighboring New Modderfontein property the Main Reef in nearly as good state of development and as rich has been cut in a circular shaft situated some distance south of the present workings. This would seem to show that there is a good area of this well developed Main Reef. Then again on Rand Klipfontein driving on the reef has disclosed workable stretches, although the point at which it was cut in the shaft exposed reef of only 2 dwt. per ton assay value. At the State Mines the assays in the two shafts where the reef was cut were not very high, but it may be, as in the case of the Rand Klipfontein, further driving may result in the assays and working width being increased to something more approaching the average of the mines in the immediate district.

NEW YORK

Market Conditions.—The Braden Mine. Dividend Disbursements. Siberian Minerals.

The analyst of financial conditions at present prevailing in Eastern centres has never had to face conditions more complex or peculiar. The unanimity with which it is admitted that fundamental conditions are good, that is to say, that abundant harvests have placed a tremendous gain to the credit of material prosperity, admits of no dispute on this particular point. That in the face of such conditions there should have come upon Wall Street a disastrous slump bordering upon a panic seems a contradiction, the cause of which should be obvious, but it is not. That there has been some overextension in the flotation of high-income yielding industrial preferred stocks has been known in the Street for a long time. That these new shares, as yet unseasoned, should bear the brunt of bear attacks in such a slump is an effect rather than a cause. The various factors making for the present conditions form a medley of causes, and to distinguish the dominating factor is practically an impossibility. The dissolution of Union Pacific and Southern Pacific railway systems, as decreed by the Supreme Court of the United States, was something of a surprise to the rank and file of Wall Street, and the effect of the opinion has been to set the Street to calculating what would happen to the many similar combinations now operating in the railway and industrial world. It could hardly be considered possible, however, that this action alone could be held responsible for the drastic declines which have occurred during the past ten or fifteen days in the stock market and which have wiped nearly $300,000,000 of market values off the slate.

The flotation of an Austro-Hungarian treasury loan in New York is probably of equal significance. The quieting of conditions in southeastern Europe has apparently been a rather simple matter, as diplomatic matters go, and probably more simple on its face than it is in reality. That the Eastern question, so long discussed as the skeleton in the closet of European diplomatic circles, the very rattle of whose bones has caused a chill in European capitals for a long time, is to be settled so simply is not credited by those who are inclined to look beneath the surface. There will be much done in the way of adjustment if the 'unspeakable Turk' is to be driven from Europe, and the Balkan states allowed to make progress as independent nations. The place which Turkey filled as a buffer state was an important one, and the Balkan difficulties must not by any means be considered settled. It may be that the possibilities and probabilities in this regard had more to do with the recent action of the stock market than might at first appear. A great deal has been made of the work being done by the Congressional committee which is investigating the so-called 'money trust.' Any new tariff legislation has always proved a disturbing factor, and underneath all of these various causes is the fact that the country has never paid the bill for the panic of 1907.

It is not surprising that, in the strained condition of the market, the favorable report issued by the Copper Producers' Association was without market effect. It was anticipated that an increase in copper surplus would be shown, estimates of such increase ranging from 10,000,000 to 20,000,000 lb. The Producers' figures show an added surplus of approximately nine and one-half million. This increase is a little more significant, however, when it is considered that production for the month was 134,000,000 as compared to 145,000,000 lb. produced in October. As compared with October consumption, domestic deliveries decreased from 84,000,000 to 69,000,000 lb., while exports increased from 47,000,000 to 55,000,000 lb., being a net decrease in consumption of approximately 6,000,000 lb. The unsettled conditions prevailing in the general market have made for stagnation in copper metal, and for the week the movement in copper has been a negligible quantity, though better business is looked for later in the month.

Among the copper-mining shares, Braden has taken a place as a star performer and is still being industriously campaigned for distribution. In this regard it is pertinent to say that Braden carries, to a certain extent, the same handicap that is carried by Greene-Cananea, having a somewhat heavy capitalization in shares and bonds. Braden has a capitalization of $14,000,000, of which $8,000,000 is held in the treasury against the outstanding convertible bonds. Braden's bond issues are $4,000,000 of 6% ten-year first-lien convertible bonds, $1,000,000 of 7% five-year second-lien convertible bonds, and $2,000,000 of 7% three-year convertible debentures. The company is also authorized to issue $2,000,000 in coupon bonds. A copper production of 50,000,000 lb. is prophesied on the basis of present contemplated equipment, when the plant is fully installed. For the time being, Braden has rather usurped the stable honors from Chino, recently looked upon as the premier of the Guggenheim string.

The Phelps-Dodge company has declared a final dividend for the year of 2½ and 3% extra, bringing total payment for the year up to $15 per share. The British Columbia Copper Co. has also declared a regular quarterly dividend of 3%. It is expected that the British Columbia will proceed with the development of a part of the property which it has held under option in the Copper Mountain district and will in all probability put up a 1000-ton concentrating plant. After some months of experimenting with the Peterson process of zinc smelting, the Butte & Superior Copper Co. has decided to erect an ordinary zinc smelter.

LONDON

Flotation Processes.—Tin-Mining in Bolivia.—The Tolima Silver-Lead Mine.

The last two meetings of the Institution of Mining and Metallurgy have been notable for having presented an opportunity to the Minerals Separation company to give a public description and demonstration of its flotation process. The opportunity was provided by the reading of a paper by J. W. Ashcroft on the performance of this process at the Kyloe copper mine in New South Wales. H. L. Sulman, the consulting metallurgist, and Walter Broadbridge, the company's engineer, expatiated at great length upon the special claims of the owners of these patents, and upon their explanation of the principle upon which the process works. Mr. Broadbridge even went so far as to read a document, evidently prepared in the office of the Minerals Separation company, setting forth the views of high authorities as to their patents and process. Much that was said and done in the course of the proceedings was quite out of order. Many of the members present were inclined to waive decorum, because of the irregular opportunity provided for hearing the statement of the Minerals Separation case. This company, as is well known, has always been an apostle of secrecy. The reason for the sudden change is the approaching publication of Theodore Hoover's book on the 'Concentration of Ores by Flotation.' This book will be published at about the time this letter appears in print, and it promises to become one of the classics in metallurgical literature.

One of the largest companies operating tin mines in Bolivia is that founded by Avelino Aramayo. In 1906 the business was incorporated under English laws, under the name of the Aramayo Francke Mines. The interests are manifold, and the ramifications extensive. The properties consist of mines at Chorolque, Tasna, and Chocaya, a smelter at Quechisla, and a number of concentrating plants, the most modern of which, the Sala-Sala, was described in *The Mining Magazine* for March 1911. This plant was designed by Holmans. The district in which the properties are situated is in the southern part of Bolivia, between Potosi and Tupiza. The last yearly profit amounted to over £150,000, an increase of 50% over that of the previous year. Out of the profit, £31,000 was devoted to the redemption of debentures, and £119,318 was paid as dividend, being at the rate of 20%. The sale of tin concentrate during the year amounted to 4053 metric tons, which sold for £355,515, and of tungsten concentrate, 52 tons, bringing £11,625. Figures for the production of

bismuth are not given, as this market is a closed one. The alteration in the nature of the ore worked during the past few years is noteworthy. Originally the tin ore from the outcrops was rich, and ore containing 6% was thrown on the dump. Owing to the exhaustion of the surface ores it has been necessary to provide modern concentrating plant for the treatment of the lower-grade ores, and much money has been spent with this object in view. In 1909 the tonnage of ore treated was 17,522, averaging no less than 19% cassiterite; in 1910, the tonnage was 25,882, averaging 14½%; in 1911, the figures were 36,903 tons, averaging 10½%; and during 1912 up to date, 41,436 tons has been milled averaging 9.9%. The Santa Barbara dumps, averaging 6%, have been exhausted, and other dumps averaging 3% are now to be treated. Hydro-electric plants are being supplied for power and drilling purposes; owing to the high altitude at Chorolque, 14,000 to 16,000 ft. above the sea, the use of compressed air is avoided. A smelter has been erected at Quechisla for the purpose of producing copper matte; this is expected to be in commission shortly. The mines also produce some silver.

Now that the Panama canal is approaching completion, Americans are widening their interest in South American doings, and are receptive of information relating to mining operations there. One of the oldest English ventures in Colombia is the Tolima Mining company, which was formed in 1871 to acquire the Frias silver-lead mine in the Tolima district. In early days large profits were made. Later, in 1903 and 1909, it became necessary to reconstruct and so provide further funds. Last year the mine was once more placed on a profitable basis, and the report for the year ended June 30 last shows that the improvement has continued, for not only have the debentures been retired, but dividends have been paid to the shareholders. The amount of ore raised was 15,645 tons, from which 1291 tons of concentrate was produced, estimated to contain 649,844 oz. silver, or 505 oz. per ton. The amount of concentrate shipped abroad during the year was 1280 tons. The sum of £73,116 appears in the mining account as credit for ore shipped, and against this is an item of £16,445 for freight and smelters' charges. The profit for the year was £19,132, out of which £10,208 was devoted to the redemption of the debentures, and £5000 distributed as dividend, being at the rate of 5%. Developments have been encouraging, and the ore reserve is sufficient to keep the mill going for nearly two years. The increased funds in hand will make it possible to continue development work. The directors are considering purchase of a neighboring gold-silver mine.

Recently some particulars were given of the new group formed by F. A. Govett, H. C. Hoover, A. Chester Beatty, and others for examining and floating mines in all parts of the world, the corporate company being at present called the Lake View & Oroya Exploration. Another new group, centring round the Camp Bird and A. M. Grenfell, of the firm of Chaplin, Milne, Grenfell & Co., is also worthy of attention. Like so many British institutions, both of these businesses have been gradual growths out of other things. Mr. Grenfell's new venture is the outcome of the Camp Bird. Two years ago, when this famous Colorado mine showed signs of exhaustion, the Santa Gertrudis silver mine at Pachuca was purchased, and now that the Camp Bird is actually on its last legs, further properties are to be sought. In fact, negotiations are already pending for the acquisition of another Mexican mine, the name of which is at present kept secret. Six months ago the Camp Bird guaranteed the interest on a new issue of debentures created by the Messina copper mine in the Transvaal, which has been developed under the wing of Chaplin, Milne, Grenfell & Co. These are the beginnings of an important mining business in the city of London, which, having been founded on genuine mining and not on spectacular prospectuses, promises to become a sound and prosperous institution. Mr. Grenfell's report at the annual meeting of the Camp Bird company was given at some length last week. Details of the work at Santa Gertrudis and Messina will be of interest.

BOSTON

Ryan and Cole.—Lawson and Reid.

Fresh evidence is accumulating to support the idea that Thomas F. Cole and John D. Ryan are 'going it alone' in the copper world after having acted together for several years in the Cole-Ryan syndicate. Mr. Ryan has shown himself to be a big constructive figure in harmonizing discordant elements in the copper industry and in bringing into it some of our leading financiers, notably W. E. Corey, late president of United States Steel Corporation, and more recently Daniel G. Reid, of the Rock Island and Lehigh Valley lines, American Can Company, and the new Tobacco Products Corporation, a $50,000,000 company. Mr. Ryan joined Reid, Frick, and others in the formation of this mammoth tobacco company and now it is announced that Mr. Reid has taken on a lot of Inspiration Copper stock, and may later on become a member of the Amalgamated board. Reid, notwithstanding he has been one of the most prominent and active speculators in Wall Street, had never been identified with the copper industry until Mr. Ryan got him interested. As Ryan represents Standard Oil and the Rockerfellers, and as Reid has associated with him First National Bank interests, Frick, and the old guard generally of United States Steel, it is easy to see that some very formidable new interests are being brought into the copper trade through the initiative of Mr. Ryan. Mr. Cole, former active associate of Mr. Ryan, is showing scarcely less initiative on his own account in the copper industry. When Cole was the general manager for the Oliver Iron Mining Co., a subsidiary of the United States Steel Corporation, before the development of Calumet & Arizona, it took hard work on the part of his brother-in-law, James Hoatson, of Michigan, to get him to put some money into the deal. Hoatson finally succeeded and the rich Calumet & Arizona developed, nothwithstanding it had formerly been considered rank heresy to suggest that there was in Bisbee any commercial mineral ground lying outside of the Copper Queen estate. Now Mr. Hoatson is resigning from the presidency of North Butte and Mr. Cole taking his place. Mr. Cole is also cutting a very wide swath in optioning and developing mineral ground in the northern end of Butte, beyond North Butte and Butte & Superior, an enterprise with which Mr. Ryan disclaims connection. Mr. Cole is also heavily interested in the Keweenaw consolidation plan to prospect and exploit the old Ashbed lode on a scale of sufficient magnitude to make it a profitable enterprise, after having lain dormant so long. Now it is believed in Boston that Mr. Cole has his mind upon making Giroux the nucleus of another big copper producer in Ely, which means that the Gunn-Thompson Coppermines estate and perhaps other ground will eventually be merged with Giroux. Mr. Cole has expressed the opinion that the Ely district is too large a territory and too rich to be monopolized indefinitely by any one company. This leads to the inference that he proposes to take a much bigger hand in Ely than heretofere. Doubtless his greatly increased interest in Butte, along with his accession to the presidency of North Butte, is inspired by a similar idea. He presumably thinks that Butte is too large a mineral district to be monopolized by one interest. His movements in Butte and Ely will be watched with great interest, as it is believed that he is on his mettle and will make a supreme effort to get a strong footing in both districts under his personal leadership. The same statement will probably apply to his operations in exploiting the Ashbed lode.

It is claimed that Thomas W. Lawson has been giving battle to Daniel G. Reid in the market recently, Reid taking the bull and Lawson the bear end of the argument. This battle, which followed the Supreme Court decision ordering the segregation of Union Pacific and Southern Pacific, is said to have little or nothing to do with that decision, but was simply a trial of market strength and ability between two prominent operators. The old rumor that somebody was negotiating for the Bay State Gas blanket charter was revived and it was stated that Lawson was piling up big profits on the bear side of the market for the Bay State

Gas treasury. Then it was stated that Reid had rallied powerful banking support and routed Lawson and the bear crowd, taking from them the profits they had been credited with. Meanwhile market interests here are waiting for news from Trinity and First National.

KALGOORLIE, WESTERN AUSTRALIA

GREAT FINGALL REVIVES.—THE LABOR SITUATION.—DEVELOPMENT AT GREAT VICTORIA.

The Great Fingall mine at Day Dawn looks as if it would have a new lease of life. This mine started as a producer in 1895, and by the end of 1898 had produced $375,000 from 30,000 tons, when the first lens of ore cut out at a vertical depth of 150 ft. The mine was within an ace of being abandoned, but fresh capital was raised in 1899, and a fresh lens cut at a depth of 400 ft., which continued to 1500 ft. vertical, when it also pinched out. From 1899 to the present time this lens has produced $32,869,900 from 1,773,200 tons, yielding $8,671,800 in dividends. Winzes put down below the 18th level show that the ore persists. A hoist is being installed at the 13th level, 900 ft. north of the main shaft, where a winze has been sunk to the 18th level. A chamber to accommodate the outfit has been cut 40 ft. high. The reason for this is that the gold shoot has pitched to the north, completely away from the main shaft, rendering it useless for deeper development.

The manager of the Kalgurli, whose financial year ends on July 31, estimated his ore reserves on that date at 250,000 tons worth $10 per ton, against 430,000 tons worth $14.25 three years ago on July 31, 1909. During the past three years 375,000 tons has been treated, returning $43,999,800, or $11.70 per ton, or $2.55 per ton under the estimate. So little ore has been developed in the last three levels that ore reserves have been dissipated at the rate of 60,000 tons per year. The Kalgurli lode is a huge lens 300 ft. long by 240 ft. wide at its extremes, and it is apparently tapering off vertically as it has done horizontally. The company holds 18 acres, much of which has not been thoroughly prospected.

Richard Hamilton, manager of the Great Boulder Proprietary, has just withdrawn his staff of samplers from the Great Victoria at Nevoria, after being there for 10 to 11 weeks. During this time not only the workings at the 60 and 300-ft. levels have been sampled, but trenches have been cut across the lode at intervals along the surface for a considerable distance. The cross-cut at the 300-ft. level has been extended a total distance of 140 ft. without reaching the hanging wall. The value of the ore from 100 to 125 ft. is $12.50, and the remaining 125 ft. of the cross-cut assays $6.50. Mr. Hamilton has made an agreement to work the mine under option for the next 12 months, when a lot of shaft-sinking and other development work will be undertaken to thoroughly test the property. Most of this work will be done by contract. In the meantime the owners will re-start the mill, as they have connected it with a dam three-quarters of a mile away, where there is about two months' supply of water for the mill. Mr. Hamilton is acting on behalf of the Great Boulder Proprietary, of which the principal lode has passed into the Golden Horse-Shoe somewhere between 2500 and 2600 ft. If the deal comes off the life of the Boulder will be indefinitely prolonged.

The Victorians at Ora Banda, owned by the Associated Northern, ran two mills and two Ridgway vacuum-filters during September, and treated 5007 tons, yielding $26,000 and a profit of $11,200. This was converted into a loss of $4100, owing to $15,300 being expended on extra plant. Owing to the salt water used for treatment, the filter-cloths became coated, and the press capacity was only 2500 instead of the 4000 tons anticipated. It is probable that two more filter-presses will have to be added before 12,000 tons per month can be handled with $30,000 profit.

Harry P. Woodward, the only Government geologist in Western Australia who risks a prophecy, was invited by Chesson & Heydon to advise where to look for the lode in the Hidden Treasure mine at Cue, which had been completely cut off. On Mr. Woodward's advice, a cross-cut was started eastward below the bar and the lode promptly found, assaying $40 per ton. The price paid for the mine a few months ago was $175,000, and the owners were much chagrined when the lode suddenly disappeared. Needless to say, Mr. Woodward's reputation has been greatly enhanced by this incident, and it may yet lead to operations being renewed on Fraser's mine at Southern Cross, from which $3,622,500 was won from 325,600 tons, all from above the 300-ft. level. This mine is lying idle, although Mr. Woodward strongly urged the Government to thoroughly test it at depth by boring, and predicted a successful issue.

FAIRBANKS, ALASKA

NEW MILLS. HUDSON DISCOVERY.—THE PRIDE OF THE DISTRICT.

The month of November will see the completion of four of the small mills brought in before the close of navigation and the production from these during the winter should materially swell the output of the Fairbanks district for the year. Of those four plants, the 5-stamp Joshua Hendy mill belonging to the Pioneer Mining Co. on Chatham creek, has already been operating several days. The Hudson Bros. 2-stamp Nissen mill has just been completed, as has also the 2-stamp Hendy mill of the Rexall mine. Capt. Spalding's 2-stamp Hendy mill will also be crushing before December.

While the working shaft of the Hudson mine is not quite ready to supply ore to the mill, it is only a question of time till the orebodies opened up in the prospect shaft will be cut. The installation of the mill this season will make a saving of many months in opening up the mine as it is now ready to handle a fair tonnage and give material returns toward development expenses. Not far from the Hudson vein, William Maloney has found a fine vein of good ore. While the claims have been staked for several years and considerable work done on them it was only recently that the main vein was found. While the vein has thrown many valuable stringers to the surface the main orebody was found only by following stringers and gouge down a distance of 30 ft. At that place the vein is from 2 to 3 ft. wide, with well defined walls and excellent gold content. Two samples taken across the vein showed assays of $80 to $100 per ton.

Another promising display has been made at the head of Big Eldorado by Al Goodwin. Good assays were obtained from surface samples and it is understood that a lease has been taken recently. During the summer and fall, the little 3-stamp mill belonging to Capt. Spalding of the Reliance Mining Co., has pounded out about $15,000. With stamps only weighing 250 lb. and the mill operating only a few hours a day, the ore has averaged close to $400 a ton to produce this output. The new 2-stamp, 100-lb. Hendy mill will be ready this month and with plenty of ore available the production should leap to over $1000 per month. The new mill is placed where an abundant supply of water is available. A quarter interest in this property was recently bought by Dave Cascaden and Harry St. George for $15,000. Two leases have been let on adjoining claims and in one of these considerable ore that should average over $100 per ton has already been blocked out.

The 'Pride of the District,' the common appellation of the Rhoads Hall mine, on Bedrock creek, is sending in its regular clean-up. Cost and production figures from the property would make very interesting reading, but as yet have been denied the public. The first level below the main adit is now being opened up while the winze is still being sunk. The electric sinking plant has proved a big success. A Frue vanner bought from the Rainbow plant is being added to the mill equipment. The Tolovana 2-stamp Nissen mill has just shut down for a short while till the development work in the new winze can make available some of the high-grade ore found in the bottom levels. The operation of the mill is successful to date, the ore being amenable to amalgamation. The tailing content is unusually low, seldom running over $1 per ton. The clean-up netted over $2000.

General Mining News

ALASKA

Fairbanks

It is stated that, for $40,000 cash, C. Fornander, one of the discoverers of the Ruby district, sold out his interests on November 15, making a total of $100,000 which he has netted from all his claims. On Long creek, gravel has been proved for over three miles.

Juneau

Early in December the six Lemon creek lode claims and placers, and the Hallum properties embracing 13 quartz claims on the slope of Mt. Juneau, were consolidated by E. R. Chapman, of New York, and G. R. Noble. The Lemon creek properties include a water right capable of furnishing 1150 hp. throughout the year. This deal makes four large properties under development in the Silver Bow basin, including the Perseverance and Alaska Juneau, and Juneau promises to be a large mining centre.

Valdez

The Fidalgo-Alaska Copper properties are opening well, and 14% ore is being mined. A raise has been driven 127 ft. on the ore. Recently a shipment of 250 tons of ore was ready for the bins, when a portion of the new wharf collapsed, due to the torredos having eaten the piling put in 18 months ago. At the Ramsay-Rutherford, a second vein has been cut 55 ft. from the first one opened. The former was cut at a depth of 120 ft., and is 20 in. wide, with good ore. Work continues during the winter.

ARIZONA

Cochise County

At the Copper Queen mines changes in mining methods are being made, in that 'slicing' will be used in breaking ore. At the Czar mine, circular concrete raises are to be put in starting from the 400-ft. level, and extending to the 200-ft. level. Through these ore will be taken to the 400-ft. level, and then trammed to the Sacramento shaft for hoisting.

Good progress is being made with the new smelter of the Calumet & Arizona at Douglas. The stack connected with the reverberatory furnaces and converters is 380 ft. high, and that with the McDougall roasting-furnaces is 300 ft. Both have been painted. Brickwork on three reverberatories is being built, while on the blast-furnace dust-chamber building the copper roofing is three parts finished.

Gila County

Production of the Old Dominion during November was 2,758,000 lb. of copper, against 2,523,000 in October.

Yavapai County

(Special Correspondence.)—Work on the Bonnie group of claims, which are situated a few miles east of Prescott, is showing some excellent ore. It will be remembered that splendid ore was discovered here several years ago, but the very richness of the ore proved its undoing, for the owners of the property could not agree as to working plans, so the mine has been idle until recently. The ore in the new shaft shows high content in gold and silver, and also a good percentage of copper. The copper content is getting higher as the vein is developed.

G. W. Hull of Jerome has two carloads of high-grade ore from the Cleopatra ready to ship to the smelter at El Paso. The Arkansas & Arizona Co. at Jerome, is making a splendid showing, and its stock is practically off the market, local parties holding most of it. The Verde Valley railroad is completed to the new smelter site at Clarkdale.

Prescott, December 9.

Yuma County

The mines and smelter of the Swansea Con. Gold & Copper Minning Co., are now under new management, and within the past month, the smelter has been working successfully, contrasted with previous trouble. One of the blowers was cut out, and blast pressure reduced from 25 to 10 oz. Production is now at an average rate of 11½ tons daily of copper, 200 tons of ore coming from the Swansea and 100 from the Blue Bell mines per day.

At the mine, development is confined to work at the 300 and 400-ft. levels at No. 5 shaft. Orebodies here are nearly 50 ft. wide, and occur as lenses. Average copper content is about 4%. The ore is soft, and considerable trouble is experienced in holding it up, so a new system of mining is to be tried, involving the caving method. C. Clere is general manager, W. H. Seamon smelter superintendent, and H. D. Hughes, mine superintendent.

CALIFORNIA

Butte County

Timber companies are refusing to allow prospecting on their lands in the Lumpkin district, and mining is thereby retarded. Twelve men are working at the Triumph mine, where an adit is in 450 ft., and 20 tons of ore is being crushed daily.

Calaveras County

The Calaveras Copper Co., operating mines at Copperopolis, is planning to construct an electric railroad, probably between Milton and Copperopolis, a distance of 16 miles, and costing about $200,000. During November 22 cars of ore were shipped to the Kennett smelter, which gave net returns of $23,063.

Kern County

(Special Correspondence.)—Electric power will be available for the mines and mills of the Rand district early in the new year. This is expected to promote the treatment of the large deposits of low-grade quartz exposed on several properties. Development at the King Solomon has been satisfactory. The raise from the 250-ft. level has intersected an ore-shoot said to assay over $80 per ton. A recent shipment of 66 tons yielded $4200. Rich consignments have been recently sent out by Teagle-Lamberson, Cook & Lipps, and other lessees. Much of this averaged about $50 per ton. A half interest in the property has been purchased from E. Shipsey by C. J. Lehman, of Los Angeles. Driving and stoping is progressing from the 175, 235, and 300-ft. levels of the Good Hope claim of the Consolidated Mines Co. Good ore is reported at all three points. The company is doing some work at other points on its group. Los Angeles people are largely interested. Several small properties in the Randsburg and Stringer districts are being developed.

Randsburg, December 12.

Oil lands covering 29,541 acres in the Buena Vista hills

LAKE VIEW WELL.

district have been withdrawn from entry by the U. S. Government, making a total of 67,000 acres reserved for the navy. This is the result of investigations by the U. S. Geological Survey.

Los Angeles County

(Special Correspondence.) — The annual election of officers and directors of the Los Angeles Chamber of Mines and Oil was held on December 12, and the following were chosen: president, S. E. Vermilyea; chairman of committee on library and publications, F. J. H. Merrill;

on membership, E. A. Montgomery; on mineral and geological exhibit, J. N. Nevius; on mines and mining, L. W. Powell; on petroleum, W. W. Orcutt; on reports and certificates, H. D. Mackinnon. Mr. Nevius attended the California Miners' convention at San Francisco, as official delegate from the Chamber. He has gone to Kennett, to investigate for the Smelter Smoke Committee of the Chamber, the bag-house system at the Mammoth plant. This is to get specific information for proposed legislation to be discussed at next session of the State Legislature. The committee is of the opinion that there is equitable ground upon which farmers and smeltermen can agree.

Los Angeles, December 12.

The American Potash Co., recently organized with a capital of $1,500,000, will erect a plant near Los Angeles, and manufacture potash and by-products from kelp. The annual output will be valued at $1,000,000.

Plumas County

A discovery of importance is reported from Belden, in an old channel on the North Fork, one mile above the junction with the Feather, and is owned by J. Nevill, of Clio, California. The property is under bond to the West Sacramento Mining Co. Gold occurs in a deposit 20 ft. wide and from 12 to 42 in. thick.

The Oro Fino, known as the Hewitt mine, on Hopkins creek, is crushing with five stamps; and the owners are getting satisfactory returns. At the Kelly-Reed claims, on Winter creek, a shaft is down 75 ft., and a 3-stamp mill is ready for work in the spring. Snow has interfered with work at several claims.

Shasta County

The Shasta County Farmers' Protective Association has elected a new set of officers, and plan to take action against the Mammoth smelter at Kennett, where, with the adjoining mine, 900 men are employed. The Mammoth people will contest any case brought against them. Repairs to the Mammoth bag-house and other parts of the plant have been finished, and three furnaces were blown in on December 11, eight days after the accident. The Union Iron Works of San Francisco supplied the spare parts, which included two line shafts weighing 4000 lb. each, and a pulley weighing 2500 lb. At the Mt. Shasta mine, a few miles north of Redding, it is intended to start extensive work early next year and employ over 100 men.

Sierra County

A fair-sized gravel deposit has been uncovered at the White Bear claim in New York adit, and the gravel is similar to that known as the Belcher channel, worked by the White Bear company. Gravel containing gold has also been found in a drift being driven in the Mountain House group of claims, which is under bond to Shaw brothers of San Francisco. The main adit has been driven into the gravel 60 ft., and a cross-cut 30 ft., all in gravel. At the Bunker Hill gravel mine it is intended to clean out and retimber the old adit, which was driven several years ago, and probably extend it to find bedrock.

The Haskell Peak mine is on the border of this and Plumas counties; Marysville, Nevada City, and Oroville men are interested. An adit has been driven 200 ft., and last week gravel was entered which pans well. This property is at an altitude of 6300 ft., and much snow has fallen. J. J. Snyder is in charge.

COLORADO

Clear Creek County

(Special Correspondence.)—P. Knaub, of Denver, has taken a lease on the Tobin mine in East Argentine. It is stated that 40 men will be employed within 60 days. Shipments will be started at once. A Norwalk compressor has just been installed at the Smuggler mine on Brown mountain. The machinery will be electrically driven. Pilz & Co., leasing on the McClellan mine on Leavenworth mountain, have started carload shipments of smelting ore. The product is being consigned to the Salida smelter, and is worth $30 per ton in silver and lead. The Geneva adit on Alpine mountain has been driven 200 ft. In the breast a mixed body of ore 10 in. wide is showing which will yield over $40 per ton. Large development is planned by the Onondaga Mining Co., controlling the Comet and Ruler groups of mines on Griffith mountain. It is proposed to drive an adit 4000 ft. to intersect the entire vein system. C. H. Rowland, of Syracuse, New York, is financing the project. The Crist property, on Democrat, will soon be entered among the list of shippers. The adit has been driven 285 ft. and in the breast there is showing an orebody of quartz that is from 10 to 16 in. wide. A. Robert, leasing on the Virginia City, situated on Lincoln mountain, has started shipments of high-grade smelting ore. Returns of $70 per ton in gold and silver are being realized.

Georgetown, December 9.

Gilpin County

Several months ago a drift was driven on the Burroughs vein, in the Phoenix-Burroughs group on Quartz hill, from the Newhouse tunnel at a depth of 1600 ft., a distance of 300 ft., under the shaft and old workings on that and the Kansas vein; and a diamond-drill hole bored through the country to tap the immense quantity of water the mines held. Drainage from this was slow, so another hole was drilled, and cut an ironstone vein carrying good metal contents, which was also cut in No. 1 hole, which was extended later on. Both holes are draining the water at a rate of 24 in. daily, the pressure being 400 lb. per sq. in. This drainage scheme will mean a great deal to the district. R. Sayre and F. Berger have been largely responsible for this work.

Lake County (Leadville)

From the portal of the Yak tunnel, toward the head of California gulch, a good deal of work is being done, and the monthly output of iron, and sulphides and carbonate of zinc is considerable. Lessees are responsible for most of the activity shown here. From the Stars Con. properties, on Carbonate hill, the monthly production is over 4000 tons of mixed ore. The Leadville Light & Power Co. is erecting a new power line in the Kokomo district. About three miles of the line will be used to supply power to the Boston Con. and other small properties. The mill situation in the district is looking better. The Leadville district mill has changed hands, and improvements have been made. It consists of crushers, tables, and magnetic separators, with a 100-ton capacity. The Yak mill will soon be able to treat over 200 tons per day.

Ouray County

Shipments of concentrate from the Ouray station of the D. & R. G. railroad for November totaled 71 cars, containing about 1600 tons. The Revenue mine and mill has been shut down on account of shortage of water. About 60 men were employed. The company expects to start again early in March. At the Barstow, a raise will be driven from No. 1 adit to prospect for new orebodies, and the shaft will be sunk 100 ft. Thirty men are employed.

San Juan County

J. T. Barnett and G. T. Bradley are arranging to build a concentrating and zinc separating plant at Silverton. It will be erected on the site of the old T. F. Walsh smelter. The initial capacity will be 200 tons per day, and it will separate the concentrate of other mills. A complete cyanide plant will be operated with the other treatment. An 80-hp. boiler and 75-hp. engine, formerly used at the Pride of the West mill, were shipped from Howardsville to Aztec, where they will be used for an electric-light plant.

San Miguel County

The Lewis mine has been closed until next spring on account of shortage of water, and 20 men were thrown out of work. Heavy snowstorms have affected the water-supply. About 15 men will be kept on development through the winter and the main shaft deepened.

The Tomboy mill worked 28 days in November, and treated 10,000 tons of ore worth $31,500, with $54,500 from

concentrate shipped, making a total of $86,000. The profit was $40,000, and $5212 was spent on permanent improvements.

TELLER COUNTY (CRIPPLE CREEK)

The U. S. Supreme Court has handed down a decision which affirms the decision of the circuit court for Colorado, which granted the Doctor-Jack Pot possession of the Lucky Corner claim, which the Work company asserted was obtained by fraudulent means, and that there was no discovery vein, and therefore there could be no extralateral rights. The outlook for the Joe Dandy mine is said to be good; 20 cars of ore being shipped in November from the 500-ft. level.

IDAHO

LEMHI COUNTY

A company with $100,000 capital has been organized by O. P. Zortman, of Gibbonsville, to operate a group of 22 claims, covering about 450 acres, and a millsite. The lower adit on the Twin Brothers section is in 1226 ft., with a depth of 800 ft. About 15 veins from 12 to 48 in. wide have been cut, which carry pyrite, and the ore is amenable to amalgamation and cyanide treatment. A gasoline engine and machine-drill will be installed, and a 500-ft. crosscut driven.

SHOSHONE COUNTY

The Federal Mining Co. is negotiating for the control of the Star Mining Co., whose mine adjoins the Morning at Mullan. The former company has been treating ore from the Star mine for several months. Considerable development has been done, and the price offered is said to be over $250,000.

MISSOURI

JASPER COUNTY

The continued production from the Webb City district, averaging more than 2000 tons per week, shows the importance of thin sheet ore mining as a factor in the development of the industry. Although the average sheet ground mined in that district will yield no more than 3%

PROSPECT SHAFT, JOPLIN.

blende and galena, often running down to less than 2%, compared with a yield of 7 to 15% in the soft-ground areas of the district, Webb City has an output of concentrate far in excess of Joplin, from which place the bulk of the ore comes from soft or disseminated ground.

Prior to a few years ago the soft-ground mines produced by far the greatest tonnage of concentrate, but as the sheet-ore districts were gradually extended, vast new areas were opened and concentrating plants of large daily capacity were constructed. Although these mills are forced to handle a much greater tonnage in order to produce as great a volume of concentrate as the mills in the soft-ground districts, their aggregate capacity is so much greater that the quantity of concentrate likewise is greater.

With stronger prices the output of the sheet-ore districts increases faster than does the production from the soft-ground areas, and a decline in prices causes a sharp falling off in sheet-ground production. Should prices drop below a certain level, $40 or $45 for example, the chances are that the volume of soft-ground ore would overbalance that of the thinner regions, this condition being due to the smaller expense of operating the soft-ground mines.

ST. FRANCIS COUNTY

The St. Joseph Lead Co., Bonne Terre, is adding to its power-plant equipment at the Leadwood mines a large 1000-kw. alternating-current generator. In the power-plant of the Bonne Terre mines a new 1250-kva. Curtis turbo-generator is being added to the equipment, and the installation made by the General Electric Co., the builder of both machines.

MONTANA

Articles of incorporation were filed at Trenton, New Jersey, by the Butte Electric & Power Co., Montana Power Co., Madison River Power Co., Billings & Eastern Montana Power Co., and the Missouri River Electric & Power Co., which have a combined capital of $14,000,000. The new company, under the name of the Montana Power Co., has an authorized capital of $100,000,000.

CASCADE COUNTY

(Special Correspondence.)—With the death of O. C. Mortson on December 11, the Great Falls public library has come into possession of a fine and extensive collection of Montana minerals, ores, rocks, and fossils. Mr. Mortson had been making this collection since his first arrival in Montana in 1872, and the palentological section of it was particularly complete, containing much material from undescribed localities.

Great Falls, December 14.

DEER LODGE COUNTY

(Special Correspondence.)—The concentrator at Anaconda has been remodeled and enlarged so that more water is required. As the present big ditch consumes the entire surface of Warm Springs creek during the low season, the company is planning to increase the supply in other ways. A shaft is being sunk to bedrock in the creek bottom below the intake of the flume, and an electric pump will be installed to deliver the underground flow to the flume.

The Butte & Georgetown Mining & Milling Co. has interested French capitalists in its dredging ground near Georgetown. A French mining engineer, Maurice de la Bathie, is to examine the property with a view to the installation of a modern electrically-operated dredge. It is stated that the gravel will yield $1 per cubic yard.

Anaconda, December 14.

LEWIS AND CLARK COUNTY

(Special Correspondence.)—Montana citizens are making strenuous efforts to preserve the United States assay office at Helena. Congress, however, has failed to make the usual appropriations for the offices at Helena, Boise, and Salt Lake, so that their discontinuance seems certain.

Helena, December 14.

MADISON COUNTY

(Special Correspondence.)—The Butte-Virginia Mining & Milling Co. has been operating under lease the Grant mill near Virginia City. During the past few months there has accumulated below the mill a large dump of tailing which assays about $10 per ton in gold, and the company has been remodeling the mill for re-treatment.

Virginia City, December 14.

T. Tonich and associates have been inspecting the Virginia City district. Several improvements have been made at the Grant mill which will enable a higher saving from the ore of the Bell mine. As a result of a tour of the district, a syndicate is being formed in Butte to erect a 100-stamp mill, and construction will be started in the spring. In this custom plant, low-grade ores will be profitably handled.

SILVERBOW COUNTY

At the Butte & Superior the new hoist and second section of the concentrating plant have been started. The former is capable of lifting 7-ton skips from 3000-ft.

depth. The skip-changing device enables cages to be substituted in quick time. It is expected that 100 tons per day will be treated when all is in proper order. The Butte Central mill is treating 475 tons of ore per day, and the second section is about complete, which will mean over 900 tons treated by the whole plant. The opening of a rich orebody on the 2600-ft. level of the Adirondack vein of the North Butte has added considerably to its reserves. It is 15 ft. wide, of bornite and copper glance, averaging 6 per cent.

After several months' delay, the work of electrifying the Butte, Anaconda & Pacific railway has been resumed. The delay was due to union troubles over wages, the scale obtained by electricians from the Anaconda union not being acceptable to those from the Butte union. Other labor organizations attempted to bring about a settlement and finally the local union accepted the offer of the railway company to pay $4.75 for an eight-hour day, which covers all time between leaving the shop and returning.

NEVADA

Elko County

At the Mizpah-Dolly Varden district, 72 miles north of Ely, prospects are said to be fairly good. The mineralized area is about ¼ mile wide by 14 miles long, and veins are in porphyry, containing about 5% copper, and gold and silver. A Keystone drill is working on the Cable group, in the south end of the district, and is in porphyry, while another drill is to test the Moore & McAuley group near the centre portion.

Esmeralda County

At Klondyke, lessees are mining good ore from the various properties. At the Golden, Manning & Tyler have six men breaking out ore which assays from $14.20 to $112 per ton. At Mexican gulch, about two miles south, Woodruff & Randolf are sinking two shafts in low-grade ore. A 25-hp. gasoline hoist is working at the Marietta claim, and two shifts are at work sinking. Lee and associates have teams hauling ore to the Klondyke siding. The town of Golden has been laid out, and streets are being cleared; three stores and restaurants are being built, besides other structures.

During November the Horn Silver mine produced 4095 tons of ore carrying zinc and lead, from the 300, 500, 700, and 900-ft. levels. Several other claims in the district are doing considerable work.

Negotiations have been completed whereby the Merger company acquires the use, jointly with the Jumbo Extension company, of the main shaft of the Polverde mine and also of its plant and other equipment. This will enable the Velvet claim to be developed, as it has been known that the Jumbo Extension, on the 900-ft. level, had opened a rich ore-shoot to the boundary of the Velvet, and is developing this ore on the 1012-ft. level also.

In a circular to shareholders the Goldfield Consolidated company states that dividends to date total $23,839,067. Dividends of 30c. per share require quarterly net earnings of $1,067,744, and of late they have been less than this amount. Prior to October 31, 1912, cash on hand, etc., totaled $1,000,000, but the last dividend made a reduction of this, and the directors believe it undesirable to further reduce the company's cash reserves, and dividends will be only paid as earned.

Humboldt County

Great interest is being taken in prospecting in Rochester canyon, and many claims are being opened, while lessees are taking out ore. The *National Miner* of December 13 gives a long and booming account of work being done and what has been done in this district.

At the Seven Troughs Coalition mine a 24-in. vein is being opened on No. 10 level, and averages $125 per ton. Bullion worth $12,000 was shipped on December 4, the result of a six-days mill-run.

Nye County

The Tonopah Merger has shipped over 550 tons of ore to date, and development is satisfactory. From the November run the Montana shipped 3678 lb. of bullion and 32 tons of concentrate, from the treatment of 3997 tons of ore. Extraction has been up to 93.8% for a week's average. At the MacNamara the amount crushed has been increased to 8 tons per stamp by putting coarser screens on the mortars. The November output was valued at about $20,000. To the end of October, Tonopah mines have produced $56,007,587 in bullion, and paid $14,778,559 in dividends. Average value from May to November was $18.61 per ton. During the week ended December 14 the mines yielded $211,908 from 11,297 tons of ore.

At Manhattan the new cyanide plant at the Brady mill is about ready for work, making three 10-stamp mills and cyanide plants in operation, and a fourth is being erected at the Big Four. On the 100-ft. level, the Big Four company has opened 12 to 18 in. of ore worth $200 per ton.

Storey County

The Mexican company shipped eight bars of bullion, valued at $20,000, during the week ended December 14, and treated 579 tons of ore worth $15,575, with 92.5% extraction. Good headway has been made at the Monte Cristo and Keyes properties. At 2300 ft. in the Consolidated Virginia the east cross-cut is out 206 ft. in formation. The Ophir cyanide plant shipped to the Selby smelter bullion worth $2400. At the Sierra Nevada the northeast drift on the 2500-ft. level advanced 33 ft. on the hanging wall, which carries a little quartz. From the Crown Point 580 mine-cars of ore, worth $4500, was extracted from the 1480-ft. level, and the Yellow Jacket saved 320 cars, worth $1500, from the adit raise.

White Pine County

At a depth of 175 ft. from the surface, rich copper ore has been cut in the Sunday shaft of the Ely Calumet. At the claims of J. D. Tilford and others on Snake creek, near Baker, in the extreme eastern portion of this county, about 50 tons of tungsten ore is on the dump, worth from 15 to 60% tungstic acid. A 42-in. vein has been opened in two shafts and an adit. The ore will be hand sorted to bring the average to 40%, which will return $4 per unit at Newhouse, Utah. In the spring a small mill with concentrating tables may be built.

SOUTH DAKOTA

Lawrence County

(Special Correspondence.)—The Kaleva Mining Co. has been incorporated, and organized by the election of the following directors: C. J. Pease, president; J. B. Tario, vice-president; W. Richards, secretary-treasurer; J. W. Peterson and J. Savage. All are residents of Lead. The company has not announced the property that it will take over, as a number are under consideration.

WASP No. 2 MILL, A SUCCESSFUL BLACK HILLS MINE.

The Cleopatra mine, on Squaw creek, was recently sold at sheriff's sale for $23,000, being bid in by bondholders. The new comers will organize the company and open the mine. The property is equipped with an old fashioned

cyanide plant, which will have to be remodeled before it will be suitable for use. It was one of the first built in the Black Hills.

Construction is being rapidly completed at the Bismarck, all of the machinery having been delivered, and nearly all of it is in place. The electric motors have been ordered and as soon as they are delivered, and installed, the plant will be ready to begin operating, which should be soon after January 1. The North Homestake property has just been examined by J. H. Farell, who spent several weeks at the property, and made a thorough investigation. Preparatory work with the machinery, and getting things ready, has commenced at the Deadwood Homestake, where it is planned to sink 1000 ft. in a search for the northeasterly extension of the Homestake orebodies. The shaft will be started 1500 ft. from the portal of a long adit, at a point about 500 ft. below the surface.

There are three candidates for the position of state mine inspector. They are R. L. Daugherty, the present incumbent, who has satisfactorily filled a 2-year term; G. D. McClellan, of Lead, and S. R. Thompson, of Sturgis. The appointment is made by the governor of the state, F. M. Byrne, who will take office on January 1, and it is expected that his selection will be announced soon after that date.

Deadwood, December 13.

UTAH

Juab County

Dividends of 3, 5, and 3c., respectively, have been paid by the Colorado, Grand Central, and Gold Chain companies, the total being $85,000, making a total of $265,000 paid by the Colorado; $1,654,500 by the Grand Central, and $70,000 by the Gold Chain. High-grade ore has been opened on the 300-ft. level of the Colorado.

Piute County

At the Greenhorn company's property, in the Ohio district, west of Marysville, the adit is in nearly 800 ft., and a contract has been let for driving another 100 ft. The management expects within 200 ft. to be directly under some good outcrops on the surface. The adit is to be equipped with a 6-in. pipe for ventilation, and more tools are being ordered. The face of the adit is in andesite.

Salt Lake County

The ore-bin at the bottom of the shaft of the Bingham Newhaven mine is nearly finished, which will allow direct transportation of its ores through the Utah Con. main tunnel direct to the tramway, and over the mountain to the International smelter. This may mean a saving of 20c. per ton.

Summit County

A movement is on foot to consolidate the various properties on the east side of the Park City district, including the McKinley, South Dakota, East Ontario, and other properties. If sufficient capital can be secured, this section could be systematically developed.

The roasting furnaces at the Ontario mill are now working, and should help to give better results. On the 1500-ft. level of the Old Ontario mine a vein carrying good ore has been opened, and a shipment will be made. The Silver King Coalition Co. has declared a dividend of 25c. per share, totaling $312,500. G. B. Blood, superintendent of the mine, has resigned, and J. Humes, of Los Angeles, has been appointed to the position. The Daly-Judge has paid a dividend of 16c. and bonus of 15c. per share, totaling $90,000. The company has a surplus of about $500,000. A shipment of high-grade lead ore has been marketed from the Thompson-Quincy, and according to the annual report, the mine is opening satisfactorily. The Silver King Consolidated has shipped 40 tons of ore averaging $4 in gold; 81.3 oz. of silver, 47% lead, and 1.7% of copper from the 1600-ft. depth. In November the Park City district shipped 6473 tons of ore.

Utah County

The annual meeting of the Iron Blossom Co. was held at Provo on December 7. During the year ore production totaled 58,733 tons, the present output being 156 tons daily of high-grade ore. Lower grade will be treated in the new mill being erected. The company has $333,807 cash on hand.

WASHINGTON

Clarke County

At a depth of 1000 ft. in the Washington mine, a lode 60 in. wide carrying copper, gold, and silver worth $100 per ton, has been cut. St. Louis, Missouri, men are interested in this property, on which $800,000 has been spent in 10 years. There is a 100-ton mill, compressor plant, and other equipment, all driven by water-power, on the property. Two veins have been opened for long distances, and smelter returns vary from $67 to $165 per ton. It is intended to construct eight miles of railroad from the mine to the Washington Northern line, a logging road connecting with the Spokane, Portland & Seattle, at Prindle.

CANADA

Cobalt

During the week ended December 6, ore shipments totaled 616 tons, of which the Coniages sent out 173 tons; Buffalo, 124 tons; Cobalt Lake, 100 tons; and La Rose, 60 tons. For the year to date the tonnage has been 20,682. Four mines sent out 150,957 oz. of bullion, worth $95,447 during the week. The regular quarterly dividend of the Nipissing company will be paid on January 20, making a total to date of $9,540,000.

The Alexo nickel mine at Kelso is doing well, and in November sent out 300 tons of ore, making 1321 tons since May of this year.

Porcupine

A 10-stamp mill will be erected on the Three Nations mine. It will consist of a 9 by 15-in. Blake crusher, ten 1250-lb. stamps, Frenier pumps, Dorr classifiers, 5 by 18-ft. tube-mill, Dorr thickener, and six Deister-Reid slime-tables. Concentrate will be stored for later treatment. The mill is expected to treat 100 tons per day.

MEXICO

Chihuahua

The Mines Company of America has resumed paying dividends by the declaration of a distribution of 1¼% payable on January 25 to holders of record on January 10, 1913.

Mexico

During November the mill of El Oro M. & R. Co., treated 20,879 tons of ore, and 15,160 tons of tailing yielding $17,980. Mining, treatment, and development cost $118,750, while railway profit brought the total profit to $61,870.

Sonora

T. E. Hardly, manager of the La Barranca mine, states that 100 men are employed, and the mill and cyanide plant are working full time. Ore and concentrate is being shipped to Douglas, Arizona. A band of Yaqui Indians recently sacked La Barranca, this being the second time in two months.

At Cananea everything is working full time. The new shaft of the Capote mine is down 500 ft. Connections have been made with the old shaft at No. 3, 4, 5, and 6 levels. The new conveyor belt between the bins at the mine and at the railroad has been completed. Four Great Falls converters have been installed in the converter building. On the 800-ft. level of the Elisha mine, the new orebody has been opened 55 ft., averaging 6% copper. La Cruz mine, situated 40 miles east of Tonichi, is being developed. The Lampazos mine, owned by the Banco de Sonora, and situated in the southern part of the Moctezuma district, is again working. A concentrating plant has been built, and will treat a good deal of dump ore carrying over 40 oz. of silver per ton. The new smelter of the Minneapolis Copper Co., near Cumpas, is well under construction. Through the 'port' of Agua Prieta, mineral worth ₱2,378,100 was exported to the United States, and the total for 1912 will be about ₱20,000,000.

Personal

Professional men are invited to send news of their engagements and travels. Such news is interesting to friends.

JOHN B. FARISH is at the St. Francis.

A. W. BROWN, of Bakersfield, is here.

JOHN A. FINCH is here from Spokane.

A. H. PROUTY is visiting San Francisco.

F. B. WEEKS was here on Saturday last.

FREDERICK M. LYON is in San Francisco.

M. A. RANDALL is here from Angels Camp.

C. C. LANE, of Los Angeles, is at the Palace.

G. W. METCALFE was in town during the week.

H. W. MACFARREN was in this city early in the week.

J. L. RAYMOND, of Fallon, Nevada, was in town recently.

E. E. KNAPP has been called to Tuolumne county on professional business.

JAMES R. HAYDEN has returned from Seward to San Francisco for the winter.

M. S. GRIFFITHS is underground foreman at the Ojuela mine, Durango, Mexico.

G. R. DE BEQUE passed through San Francisco recently on his way to Mexico City.

S. E. VERMILYEA has been elected president of the Los Angeles Chamber of Mines and Oil.

D. C. JACKLING expects to visit the Alaska Gold Mines property at Juneau, Alaska, this month.

NORMAN C. STINES has gone to London, expecting to sail from New York on the *Cedric* early in the week.

WEBB SMITH was reappointed superintendent for the Kennedy Mining Co. at the annual meeting held during the week.

R. B. STANFORD has been appointed manager for the Bonanza mine, Cape Gracias, Nicaragua, Central America, and will leave about January 1.

HERVEY GULICK, recently of Cuzco, Peru, will reach Tacoma, Washington, about January 1, where he will have offices with W. V. GULICK, 707 National Realty building.

Obituary

ALFRED WARTENWEILER, who died December 13 and was buried Sunday last, was one of the pioneer mining engineers of the West. Born at Kradolf, Switzerland, in 1848, he was educated at the Ecole des Mines in Paris and came to California in 1869. He was at first employed by the Giant Powder Co., but in the early seventies moved to Utah, where he took a prominent part in the development of mining and smelting in the Great Basin. One of the first trained metallurgists in the region, he contributed greatly to improvement of the crude smelting methods then in vogue. In 1879 he moved to Butte, where he became manager at the Lexington mine, and at that and other properties in the district passed the next ten years. He is best known through the West by reason of his connection with the Exploration Company and his activity in placing large American mines with English and other foreign investors. In this work he was associated with Henry Bratnober, and the two did a great deal to build up confidence in American mines abroad. Working in connection with M. Ranvey, S. de la Bouglise, and Professor Cumenge, he sold the Boleo mines in France, and his name is associated with many other profitable ventures. An excellent judge of mines, he was conscientious and honest in his opinions and made few mistakes. He was of a genial, kindly disposition, and is widely remembered for his charitable acts. He joined the American Institute of Mining Engineers in 1875, but never found time to contribute to the *Transactions*. Mr. Wartenweiler's health broke down some months since, and his active career ended over a year ago. His death leaves a gap in the fast-disappearing circle of educated engineers who came into the West when the mining industry was young, and who, despite the supposed handicap of a scientific training, adapted themselves to conditions as they were and 'made good.'

Market Reports

LOCAL METAL PRICES

San Francisco December 19.

Antimony	12—12½c	Quicksilver (flask)	39
Electrolytic Copper	18—18¼c	Tin	52—53½c
Pig Lead	4.60—5.55c	Spelter	8¼—8¾c

Zinc dust, 1400 lb. casks, per 100 lb., small lots $9.50—9.75; large $7.50—8.50

METAL PRICES

(By wire from New York.)

NEW YORK, December 19.—Copper prices remain nominal; buyers continuing to hold off. Lead is still weak but somewhat more business is being done at the lower prices. Spelter is firm and unchanged. Average daily prices for the past week, in cents per pound, based on wholesale transactions, standard brands, are given below.

Date.	Electrolytic Copper.	Lead.	Spelter.	Silver, per oz.
Dec. 12	17.38	4.30	7.08	63⅞
" 13	17.38	4.26	7.08	64
" 14	17.38	4.26	7.08	63⅞
" 15	Sunday.		No market.	
" 16	17.30	4.26	7.08	63⅝
" 17	17.30	4.26	7.08	63½
" 18	17.30	4.26	7.08	63½

LONDON QUOTATIONS

(By cable, through the courtesy of C. S. Burton & Co., New York.)

	December 19.
Camp Bird Ltd	$ 5½
El Oro	4
Esperanza	9½
Oroville Dredging	1½
Santa Gertrudis	7
Tomboy	6½

COPPER SHARES—BOSTON

(By courtesy of J. C. Wilson, Mills Building.)

	Closing prices, December 19.		Closing Prices December 19.
Adventure	$ 4⅜	Mohawk	$ 56½
Allouez	35	North Butte	31½
Calumet & Arizona	67⅜	Old Dominion	51
Calumet & Hecla	516	Osceola	101
Centennial	16½	Quincy	74½
Copper Range	49	Shannon	12⅜
Daly West	3⅜	Superior & Boston	1⅛
Franklin	8⅛	Tamarack	31
Granby	62½	Trinity	4½
Greene Cananea, ctf.	8½	Utah Con	10
Isle-Royale	32	Victoria	1¾
La Salle	4⅜	Winona	3⅛
Mass Copper	4½	Wolverine	66

NEVADA STOCKS

(By courtesy of San Francisco Stock Exchange.)

San Francisco, December 19.

Atlanta	$ .19	Montana-Tonopah	$1.70
Belmont	7.72	Nevada Hills	1.37
Big Four	.55	North Star	.20
Buckhorn	.90	Ophir	.24
Con. Virginia	.33	Pittsburg Silver Peak	.75
Crown Point	.29	Round Mountain	.34
Florence	.58	Sierra Nevada	.28
Goldfield Con.	2.10	Tonopah Extension	2.25
Halifax	1.25	Tonopah Merger	.79
Jim Butler	.64	Tonopah of Nevada	6.25
Jumbo Extension	.27	Union	.19
MacNamara	.17	Vernal	.10
Mexican	1.57	West End	1.20
Midway	.32	Yellow Jacket	.30

MINING STOCK QUOTATIONS—NEW YORK

(By wire from C. S. Burton & Co., New York.)

	Closing Prices. December 19.		Closing Prices. December 19.
Alaska Mexican	$ 13⅜	McKinley-Darragh	$ 1⅞
Alaska Treadwell	41⅜	Miami Copper	25⅛
Alaska United	22⅜	Mines Co. of America	3⅛
Amalgamated Copper	73⅛	Nevada Con	18⅞
A. S. & R. Co.	70⅛	Nipissing	8⅛
Braden Copper	10	Ohio Copper	1
B. C. Copper Co.	4½	Ray Con	20⅛
Chino	42	Tenn. Copper	37
First National	1⅛	Tonopah Belmont	7⅛
Giroux	3⅜	Tonopah Ex	2⅛
Goldfield Con.	2⅛	Tonopah Mining	6⅛
Greene-Cananea	8⅛	Trinity	6
Hollinger	15	Tuolumne Copper	2⅜
Inspiration	17⅛	Utah Copper	56⅜
Kerr Lake	2⅛	West End	1⅛
La Rose	2⅜	Yukon Gold	3
Mason Valley	10⅛		

Company Reports

NOURSE MINES, LTD.

The following table covers results of this company during the year ended July 31, 1912:

Ore treated, tons	609,250
Yield per ton	$7.32
Cost per ton	5.40
Profit per ton	1.92
Profit from treatment of current ore	$1,220,000
Profit from treatment of accumulations	42,000
Total working profit	1,262,000
Dividends paid	610,000
Cost of development, paid out of monthly profits.	330,000
Union Government taxes	105,000

Ore reserves now total 1,969,000 tons averaging $6.60 per ton, of which 628,700 tons were in the Main Reef, 514,450 tons in the Main Reef Leader, and 825,850 tons in the South Reef. These tonnages are based on stoping width of 65 in., 46 in., and 49 in., respectively. Of the surface equipment, practically all the machinery for electrification of the plant is now erected and complete.

LOST PACKER MINING CO.

This company operates a copper mine and smelter in the Loon Creek district, Custer county, Idaho, 120 miles west of Mackay, the nearest railroad point. The company is capitalized for $750,000, in shares of $5 each. It has a 100-ton blast-furnace, but this was not in operation during the past year, and operations in general were somewhat unsatisfactory, largely due to the scarcity of labor. The report for the year ended September 1, 1912, gives the ore in blocked form in detail, the total reserves measuring 4830 tons of first-class ore, valued at $285,731, and 20,000 tons of second-class, valued at $200,000. There also is much good ore filling the stopes, but this is not easy of calculation. The company began the fiscal year with a balance of $33,086.62, there was checked out during the year for supplies, general expenses, taxes, freight, road-making, etc., $26,913.97, leaving a balance at the close of the year of $6172.65. There are supplies of all kinds on hand, valued at $2392.08.

VOGELSTRUIS ESTATES & GOLD MINES, LTD.

This company was formed in 1893 to acquire 3200 acres of property 7 miles west of Johannesburg. The authorized capital is £250,000 in shares of £1 each, and £94,100 in 6% first-mortgage debentures is outstanding. An 80-stamp mill was built in 1896. During the year ended June 30, 1912, this was employed for 363 days, the average number of stamps dropped during that period being 71.25, as against 59.2 for the preceding year. The total number of tons milled is 125,128, as against 101,033 tons last year. The working costs per ton milled (not including the accumulated slime) averaged 20s. 9¾d., showing a decrease of 1s. 10¼d. per ton on last year's figures. The gold recovered from the mill and cyanide and the by-products realized a total amount of £148,496, an increase as compared with last year of £15,827. The management has adopted a new stoping width, and after careful recalculation estimates the ore reserve at 120,120 tons, as against 147,815 tons on June 30, 1911, thus showing a decrease of 27,695 tons. The ore reserve is calculated on the South Reef alone, and does not include any of the Main Reef tonnage. The total debentures outstanding represent a sum of £94,100, an agreement having been made with the debenture-holders under which the £4110 drawn for redemption last year was treated as not having been drawn. The profit and loss account shows, after bringing forward from the mining account a profit of £8593, and after allowing for debenture interest £5646, the directors' fees £1000, depreciation on machinery and plant £8317, and sundry other items, an adverse balance of £7237, which has been carried to the balance-sheet, making, with the debit balance brought forward from last year, a total deficit of £24,344. The policy decided upon last year has been carried out, and the operations at the mine have been conducted mainly with the view of earning as much monthly profit as possible to enable the company to meet its debts and commitments.

SANTA GERTRUDIS CO., LTD.

The Santa Gertrudis company was formed in January 1909. The report for the year ended June 30, 1912, shows that the new mill, with a capacity of 660 tons per day, started work on June 14, 1911. During the year the two mills treated 269,839 tons of ore and tailing, having an average assay value of 52s. 11d. per ton. From this 26,000 oz. gold and 4,420,326 oz. silver were recovered; a total of £631,432, or 46s. 10d. per ton. The working cost was £355,934. After allowing for depreciation, the net profit was £252,421, of which £21,745 was written off for preliminary expenses, and there were also London expenses and taxes to pay. The sum of £207,200 was distributed as dividend, being at the rate of 15% on £1,368,000. In June the old mill was finally closed, and it is expected that the addition to the new mill, bringing its capacity to 850 tons per day, will be in working order before the end of 1912. During the year 16,249 ft. of development was done. The reserve is estimated at 586,000 tons of positive and partly developed ore, and 551,000 of probable, calculated to yield a profit of $7,475,000.

MESSINA (TRANSVAAL) DEVELOPMENT CO., LTD.

The Messina (Transvaal) Development Co. was formed at the beginning of 1905 to acquire a copper property consisting of ancient mine-workings in the north of the Transvaal near the Rhodesian border, 130 miles from Pietersburg. The deposit is rich, but progress has been hampered by the absence of communication with the outside world. Much high-class ore has been mined, chiefly during development, and sent to Swansea, but at a prohibitive cost for transport. Before long the mine will be provided with railway facilities, for lines are being built both from Delagoa Bay and Pretoria to connect eventually with the Rhodesia railway system. At the present time the Pretoria railway is being extended from Bandolier Kop, the present northern terminus, to Messina, a distance of about 100 miles, and the work should be completed by the middle of next year. The railway is being built by the Government, and the company guarantees for 10 years to make good any loss on the working of the line, the amount payable in any one year not to exceed a sum equal to 4½% on the estimated expenditure, £426,831. Connection with Delagoa Bay, through the Selati railway, will no doubt come within a few years' time. The report for the year ended June 30 last shows that 6781 ft. of development was done at a cost of £21,928. Of this, about 2500 ft. was on the lodes, and the part sampled, 1533 ft., gave an average assay-value of 13.1% copper over an average width of 60 in. The content is so far fully maintained down to the lowest workings, and the width of the bonanza orebody increases steadily from the fourth to the eighth level. The copper minerals are chiefly bornite and chalcopyrite, occurring in massive form. The ore reserve is calculated at 170,000 tons, averaging 10% copper, and in addition the probable ore is estimated at 200,000 tons. During the year 9609 tons of development ore was raised, averaging 9% copper, and 10,347 tons was milled; 1162 tons of concentrate was recovered averaging 49.8% copper, together with 836 tons of middling averaging 14.2% copper, to be re-treated later. The tailing and slime are being stored. The amount of concentrate shipped was 1119 tons, and it was sold for £29,761. The cost of mining and milling was £15,868, shipping charges were £6003, Johannesburg expenses £4610, London expenses £6472, development-redemption £2586, allowance for depreciation £2697, making with other small items a deficit of £4674. Debenture interest was £5181, and expenses in connection with the issue were £809, so that the final debit balance carried to the balance sheet was £10,666.

Concentrates

Most of these are in reply to questions received by mail. Our readers are invited to ask questions and give information dealing with the practice of mining, milling, and smelting.

BENDIGO, Australia, has produced 44 gold nuggets of and above the weight of 20 oz. each, found within the auriferous area comprising the goldfield. In 1852 the largest was found, weighing 573 oz., followed by others of 384, 377, 338, and 332 oz. respectively.

HIGH-SPEED tool steel is most durable at approximately the same speed at which ordinary carbon steel is most durable, but it greatly exceeds ordinary steel in length of life at the temperature thus produced.

ALLOYS containing about 36% iron, 60% chromium, and 4% molybdenum are insoluble even in aqua regia, but can be worked in the ordinary way. Fair results, but not so good, are obtained when vanadium or titanium is substituted for molybdenum.

THE total production of all metals in the United States in 1911 was 27,878,282,094 tons, valued at $788,925,046, according to the U. S. Geological Survey. The total output of all ores was 105,258,492 short tons. Pig iron from domestic and imported ores amounted to 26,048,162 short tons, valued at $327,334,624; while the output of platinum was 0.999 ton, valued at $1,308,480; and gold 190.704 tons, valued at $114,981,080.

MUCH American phosphate rock is shipped to Europe to be manufactured into superphosphate, which is valuable as a fertilizer. Exports of raw phosphate rock to Belgium in 1910 were valued at $400,000, and imports from that country for the same year were valued at an equal amount. The opinion of the United States Consul at Chemnitz, Germany, is that the superphosphate could be made more cheaply at home.

LIME is generally used in cyanide treatment in preference to caustic soda, which often causes undesirable results in the zinc-boxes. There are times when freight plays a part in the choice of alkali, and at the Associated Northern mill, at Ora Banda, Western Australia, it was found that one ton of caustic soda would do the work of 30 tons of lime, of which the freight over 20 miles of road was the main item of cost.

EQUIVALENTS for the terms 'arroba' and 'carga', used in Mexico, are as follows. The arroba is 11.5 kg. or 25.3 lb.; the carga, of all kinds of merchandise and material, is 12 arrobas, 138 kg., or 303.6 lb.; the carga of lime is 14 arrobas, or 354.2 lb.; the carga of charcoal is 8 arrobas, or 202.4 lb.; the carga of 'panoche' (brown, unrefined sugar) is 10 arrobas, or 253 lb. The literal translation of 'carga' is 'load'; that is, a mule-load.

LINOLEUM tops for Wilfley and Deister tables have been found at Tonopah to rot away in a few months from the probable action of hot cyanide solutions. To prevent this, at the West End mill, stout canvas is put on in place and given two coats of P. & B. paint, and acts well, lasting upward of 12 months. This black paint would prevent the work of the table being watched at the concentrate discharge end, so the last 12 in. is given two coats of non-acid white paint, which shows up the concentrate plainly.

REGRINDING 12-mesh pulp from stamps by Chilean and Huntington mills, results have shown that upkeep of the latter is much higher per ton of ore reground than the former. Steel consumption is also about twice as much in the Huntington. At one plant in Nevada these mills have 35 to 40-mesh screens, and the Chileans 24-mesh. With this screen the latter will give a finer discharge, and handle a larger tonnage per mill, than the former. The power consumed is 12 hp. for Huntington and 35 hp. for Chilean.

VALUES of metals undergoing treatment at smelters are segregated under the heading 'metals in proces,' and it has been suggested that Rand or other mining companies use the phrase 'gold (or silver) in process,' to similarly include the metals in the partly treated ore, the circulating cyanide solutions, the undissolved zinc, slag, and other by-products. This would necessitate on clean-up days a general knowledge of the weight and metal content of materials in the various stages of treatment, and together with the weight and value of ore and tailing during the month, would enable the metallurgical balance-sheet to be constructed with a fair degree of accuracy.

NEW YORK CITY adds another big city's population, about 125,000, to itself every year, and water-supply is of the greatest importance, so a scheme is well under way to obtain 500,000,000 gal. per day from the foothills of the Catskill mountains. The cost is estimated at $176,857,000, of which about $100,000,000 had been spent to March 1912. There are four distinct types of aqueduct, namely, cut-and-cover, of 55 miles length, constructed of concrete in horseshoe shape, 17 ft. high by 17.5 ft. wide; 24 grade tunnels, of 14 miles length, of horseshoe shape, 17 ft. high by 13.3 ft. wide, lined with concrete; 7 pressure tunnels, of 17 miles length, of 14-ft. drain, lined with concrete; and 14 steel-pipe siphons of 6 miles length, 9 to 11-ft. drain, lined with 2 in. of cement mortar.

SEPTIC tanks operate in the absence of light and air, the bacteria producing in the decomposition of organic matter of sewage, quantities of reducing gases. Among these decomposition products is observed more or less hydrogeen sulphide gas, resulting in most cases from the decomposition of organic sulphur compounds existing in the sewage. In most tanks of this character, the amount of hydrogen sulphide thus liberated is not sufficiently large to cause complaint. Attention has been directed at Los Angeles to the disintegration of cement mortar in concrete resulting from sewer gases, and this is proved to be from the formation of sulphuric acid upon walls and roof of tanks, which attacked the cement, giving calcium sulphate, or gypsum, as a final product. It has been observed that the amount of acid formed appeared to be too large to have been produced by the organic sulphur compounds in the sewage proper; and it is suggested that the only possible sources of this excessive amount of sulphur were the oil wells and the sulphur which is always present in small quantities in normal sewage.

WATER flowing through a pipe containing a contraction shows a pressure at the throat less than at the inlet, due to the increased velocity in the throat. In a properly proportioned pipe this pressure is almost entirely regained at the outlet, this, in turn, being due to the decrease in velocity after the water passes the throat. The temporary loss in pressure at the throat can be accurately measured by a U-tube containing mercury, and it is found to increase approximately as the square of the throat velocity; that is to say, if the velocity of the water at the throat doubles up, the difference of mercury-level becomes about four times as great. This is the principle of the Venturi meter, used on large water-pipes in steel plants in the United States, and exclusively on the conduit of the Coolgardie Water Scheme, in Western Australia. In the latter plant, the mains are 30 in. diam., but at the meter are reduced to about 10 in. diam., the piezometer tubes being about ⅛-in. bore. In various towns and mines forming this system, the Kennedy water-meter is used almost universally. In this type all the supply to individual consumers passes through. This type of meter is also suitable for measuring hot water, as there is an absence of mechanism or projections within the tube.

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EDITORIAL

NOW the Candy Trust is to be dismembered. A sweet job, undoubtedly. Oh, fudge.

MEXICAN customs duties have lately been increased and there have been persistent rumors that taxes on mines were to be raised. No move has yet been made in that direction by the National Congress, and doubtless such increase will be at least deferred as long as possible. The Mexican Government derives a considerable revenue from the mining industry and would hesitate long before taking any step that would check development.

DISTRIBUTION of an extra dividend of 15 per cent is the form of Christmas present proposed for the shareholders of the Homestake Mining Company. Production of gold during the year has increased, and expenditures on betterments have been so liberal during recent years that there is no longer need to divert considerable sums for this purpose. Good business and technical management has here yielded good profits from a good mine.

ESTIMATES of the gold production of Porcupine for the year are given as $1,800,000, nearly equally divided between the Dome and Hollinger mines, though the Vipond and McIntyre contributed small amounts. With new mills in operation the output during 1913 should show a good increase. Porcupine has not attained the heights of lurid promotion literature, but it has done something better, developed into a quiet and steady producer.

TARIFF discussion divides families, and we have many friends on both sides of the question. We cannot forbear, however, to express the opinion that the tariff on zinc-dust is unnecessary and results only in increasing by some 20 per cent the cost of this article to gold miners. As zinc-dust is a by-product from zinc smelting that was long a nuisance and which can be marketed at little cost, we see no reason for protecting this particular infant industry. The practical result is to put one more difficulty in the way of treating low-grade gold ores.

NEVADA, like some of her citizens, is seriously considering the high cost of living. A non-partisan movement has been started to devise means of decreasing the expense of the state government. The system of dual government that obtains in the United States is admittedly expensive. The burden falls especially severely upon the people in those states that have large area and relatively little population. Elbow room costs, even under pioneer conditions. The spirit, however, that converts a desert into gardens can be trusted "to find a way."

JOPLIN operators are taking keen interest in the appointment of mine inspectors about to be made. In the old days, mine inspectors were too frequently considered necessary evils to be tolerated only and to be disregarded as much as might be. This was less because operators desired unsafe conditions than because the inspectors chosen

were, in most states, incompetent political favorites. As the character of the men appointed has risen they have gained the respect of both men and operators. There have always been some good inspectors; we hope the time is near when there will be no poor ones. The position is one of large usefulness and responsibility, and appointments may well receive the careful scrutiny of all concerned with serious mining.

MINE OWNERS have been coöperating with the tax commission of Arizona in the effort to devise a system for fair taxation of mining property. According to press reports, the plan that will be proposed to the legislature next month will involve a levy on the total net proceeds, to which will be added a tax of 12½ per cent on the gross value of bullion produced. Physical improvements are to be taxed on the basis of actual value. The arrangement cannot be criticized until details are at hand, but we commend unreservedly the spirit indicated by the friendly cooperation of the commission and mine owners. No one likes to pay taxes, but all should. The essential thing is to agree on a fair basis of taxation.

GOLD and silver by the ton is, to most of us, mentally associated with the graphic tales of H. Rider Haggard and other romancers, yet it is a not at all uncommon sight in modern life. A single shipment of silver bullion recently made by the Rio Plata Mining Company in the Arteaga district of Sonora, amounted to nearly five tons of metal. It was not 'a king's ransom,' in time-worn phrase, being valued at only $180,000. The gold received at the San Francisco mint during November amounted to over seven tons of metal, valued at $4,300,000. The stock of gold coin and bullion in the United States Treasury on June 30, 1910, was nearly 1750 tons, valued at $1,044,000,000, while national and private banks and individuals possessed nearly a thousand tons more, valued at $600,000,000.

VIGOROUS protest is being made by prospectors in the Centennial district, Albany county, Wyoming, at a return of $43 from a shipment of nine tons of ore that was believed to be extremely rich and on which $90 freight had been prepaid. Of the details of this particular case we have no knowledge, but it may serve as an example of the frequent discrepancy between assays of hand specimens and the sampling of carload lots. Much of the resentment visited upon the 'smelter trust' doubtless has a similar origin. The smelters are, like any other merchants, anxious to buy as cheaply and sell at as high a price as possible. Rates which often seem unjust to the shipper are based upon the fundamental laws of supply and demand, and ore which at New York prices has considerable value, may be worth but little at a smelter where an ample supply of similar material is available. In many cases complaint has been justified, but on the whole smelters deal fairly with their shippers, since in this as in any other business a reputation for fair dealing is a valuable asset.

VISITORS to the packing-houses of Chicago or Omaha are always entertained by the ancient jest that no part of a pig is wasted except his dying squeal. In a similar vein a daily journal notes that kidney pills are one of the by-products of the Pioneer Iron Company, at Marquette, Michigan. The company is engaged in the manufacture of charcoal iron, and recovers the by-products incident to the conversion of wood into charcoal for its furnaces. As is well known, the number of possible products from the destructive distillation of wood is very great, and includes many of the most useful substances employed in the textile industries and in medicine. Utilization of materials formerly wasted is now the order of the day, and such a modern plant as that of the United States Steel Corporation at Gary, Indiana, is at once an inspiration and an object lesson. We have progressed far from the days when the cave man required only some fruit, nuts, and meat, with skins for his covering. The present-day workman demands and expects comforts and luxuries unknown to medieval kings. So great an increase in general welfare demands the conservation of what we possess and care and attention to its increase. Life is now intensive as well as strenuous.

MISUSE of the terms 'build,' 'construct,' 'erect,' and 'install' is a common fault of engineers, for, strangely enough, men who would ridicule an attempt to couple pipes with a monkey-wrench do not exhibit an equal amount of discrimination in regard to choice of words as they do to choice of tools. In such a case words may belie actions, for the natural inference of the thoughtful reader or listener is that a man who is careless in his speech or writing is probably equally slovenly in his work. Install is so often misused in connection with construction work that some careful writers abstain from using it. This is unfortunate, for in its rightful meaning of 'to put into position for work,' it is an extremely useful word that cannot well be spared. For example, a mining company builds a shaft-house, and a manufacturer constructs a hoist, which is then installed in the shaft-house. In his shop the manufacturer makes the parts of the hoist, and when they are finished, he erects or assembles the hoist before it is shipped to the mine. All the verbs in these two sentences are correctly used. Construct, from a Latin root, is almost synonymous with the Anglo-Saxon word build, but not exactly so; thus it might be said that an additional window was constructed (not built) in the side of the house. Erect has the idea of elevation; a tower is erected, constructed, or built; a ditch is dug or made. A thing is made from raw materials, or erected by joining together component parts; thus the parts of a stamp-mill are first made of wood and iron, then erected. Both construct and build have a sense of importance; the contractor builds a residence or constructs a bridge, and in his leisure hours makes a doll house for his little daughter. To install is simply to put in place; a hoist may be installed, but not a tramway or an ore-bin. To convey to the mind of another person the precise mental image of the speaker or writer is at best a difficult task, without careful attention to the forms of speech employed it becomes impossible.

CASTE is the outcome of one of the most futile of traits of human character. We are prompted to this reflection by the undercurrent of thought which runs through several of the letters we have received concerning 'Sticking to the Job,' indicating that many consider that an engineer who has discontinued the practice of his profession to engage in other forms of useful and profitable endeavor thereby loses caste. In a similar vein a civil engineer recently remarked, in response to a suggestion that he join an engineers' club, that a great many of the present members were mining men; the inference being that civil engineers are professionally superior to their colleagues of the mining profession. Invidious comparisons of American, British, German, French, and other technical men are all too frequent. Such concepts are fundamentally unscientific. The man who does good work in a becoming manner earns respect, and the degree of respect should be measured by the amount of brains required for the performance of the work. Graduation from a school of mines does not impose on a man any obligation to engage in the technical work of mine operation. Provided due attention has been paid to the study of mechanical problems, the young man

who has received a thorough education in mining engineering is better equipped than a civil or mechanical engineer to engage in general business work, nor is there any valid reason why he should not do so. The danger from increase in the number of mining schools lies not in the increased number of graduates, but in the tendency of small schools to 'let through' as many students as possible in order to swell the roster. If many young men, after a few years experience, leave mining work for other fields, the chances are that those who remain will be more earnest and efficient. Success in useful endeavor is the proper goal, and the man who preserves his self-respect need not fear the sneers of those who affect superiority.

A Geological Survey of California

A little over fifty years ago California undertook a serious scientific study of her mineral resources. After a short preliminary period during which J. B. Trask directed the work, J. D. Whitney was called from the East. He gathered round him a brilliant staff—Clarence King, W. H. Brewer, J. T. Gardner, W. M. Gabb, William Ashburner, C. F. Hoffman, and the young volunteer Rédmond, "with as good a natural gift for finding fossils as anyone I ever saw," as Whitney says. Probably no more competent, and certainly no more hard-working and enthusiastic corps could have been assembled. With various ups and downs, the work continued until 1874, when the Legislature refused to appropriate further funds. It was not the first time that the money had failed. At one time the state was in arrears $25,000 to Whitney and his brother, who financed the work when official funds ran short. Those were days of unsettled ideals and much bitter controversy. Gilman had a stiff fight to keep the University from being converted into a manual training school, and it is not surprising that, with "$40,000,000 in worthless stocks to be floated," the so-called 'practical mining men found themselves in sharp disagreement with Whitney. It would be unprofitable to go into old quarrels. Perhaps the fault was not all on one side. The serious result was that the state lost the services in the development of the mineral industry of a most competent corps of scientists. When after a few years this lack came to be felt, the State Mining Bureau was created and started under the capable leadership of Henry G. Hanks. Other men succeeded him, but the work changed in character, and in time the Bureau became a moribund institution afflicted with dry rot and devoted to the uses of petty politics. Something over a year ago Mr. Hiram Johnson, as Governor, and acting on the advice of leaders in the mining profession, appointed Mr. W. H. Storms to the position of State Mineralogist, and better conditions began to prevail. Without funds, however, even the best of officials can do little, and the routine work of the Bureau has come to absorb the whole of the present income.

Elsewhere we present a statement from Mr. Storms of the present condition and needs of the Mining Bureau. We commend it to the careful study of our local readers. We note with interest and pleasure that Mr. Storms asks for funds to resume the work of making a geological survey of the state. This, if it be done, will meet a very real need. For years fundamental studies of the state's resources have been neglected. The bulletins issued by the Mining Bureau, excellent and timely as many have been, are mainly rehashes of old information. This is proper enough if only the functions of a bureau of information are taken into account, but old information loses value. There shuld be some provision for keeping abreast of the times in other ways than merely collecting statistics of production. A wholly new California is being created. Knowledge of ore deposits and of mining methods that was ample a quarter of a century ago is but poor material for directing exploration and investment today. The library, reading-room, and museum, the services of a determinative mineralogist, the answering of inquiries, all these are useful, and in supplying these wants the State Mining Bureau performs an excellent public service. This needs to be complemented by some organization devoted to fundamental studies of the composition and structure of the earth's crust if California is to wisely and rapidly develop her mineral resources. The existing Minng Bureau provdes fior much that in other states falls on a geological survey. The state is already carrying the heavy overhead expense, but falls short of reapning full benefit. If California is to be in the front rank of the newer move for the "maximum of use with the minimum of waste," the state should have the exact and unprejudiced information that it is the function of a geological survey to collect. To do things half way is poor economy, and whether in the particular manner that Mr. Storms has suggested or in some other, provision should be made by the Legislature about to assemble for filling in this gap in the work of the state.

Panama Canal Tolls

Panama canal tolls are to the fore again, owing to the British protest recently made public. Briefly, it is complained that relieving our coastwise shipping from payment will automatically increase the rates on foreign shipping if expenses are to be met and a sinking fund provided; that discrimination invites more discrimination and may open the way to free tolls for all American ships; and that the provision against use of the canal by railway owned ships interferes improperly with the activities of Canadian roads. We are not deeply impressed with these arguments, but neither are we concerned for free tolls. Panama canal tolls have been fixed by competition, and so long as the Suez canal route remains in foreign hands no rates can be maintained that are not competitive. Whether few or many ships be exempted from payment is not likely to change the rates. No foreign vessel can enter the coastwise trade of the United States, and its regulation is a purely domestic matter. For our part, we think this very fact affords the American owners of coastwise vessels sufficient protection, and that free tolls are unnecessary. The provision against railroad owned ships was placed in the law to prevent repetition of the conditions under which the Pacific Mail Steamship Company for years ran ships to discourage through traffic by Panama. Old sores heal slowly, and while the jurisdiction of the Interstate Commerce Commission is now broad enough to meet the situation, there can be no doubt that the people are suspicious and also firmly determined that the railroads shall not dominate the canal. The problem of transcontinental freight rates is a domestic one of vital importance to many people. It may be foolish to prevent railway owned ships from using the canal, we believe it is, but it is certainly a matter that concerns us only. There is, we believe, no interference with such ships in foreign trade, and if the Canadians wish to have railway owned ships 'competing' with their railways, doubtless they may be accommodated. None of the provisions to which objection is made appear to us to be vital, though why Great Britain should question them is not evident. What is important, is that we have apparently blundered into a position that we seem afraid to defend before an international court of arbitration. This is serious. If Congress is not sufficiently sure of its position to warrant going into court, by all means repeal the law. The matter itself is not important, but the good faith and good name of the country must be preserved.

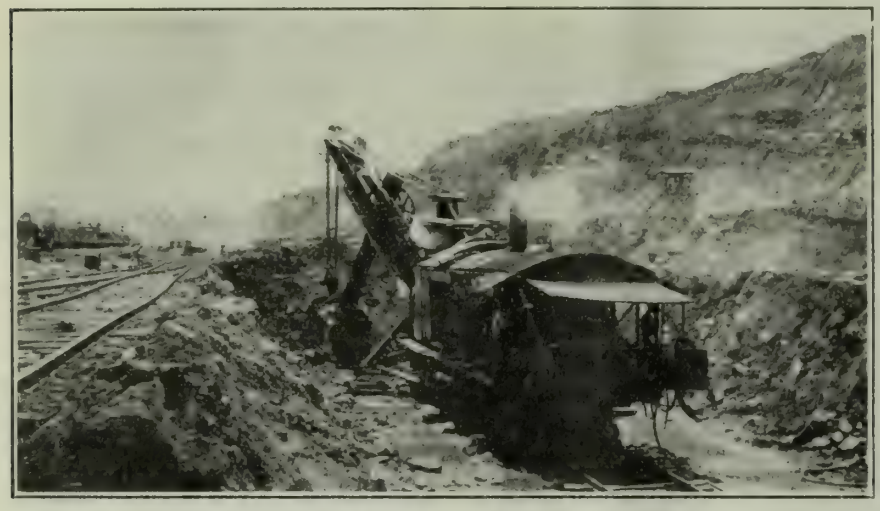
Mining on the Panama Canal

By C. R. Forbes

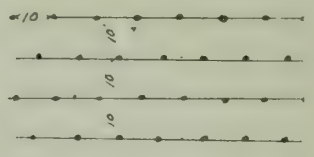
The Panama canal is attracting especial attention just now on account of its nearing completion, and while all are familiar with the magnitude of the work, the difficulties encountered, the great sanitary victory, but little has been written describing actual details of value to the engineer. The following notes concerning the method of working in the big cut at Culebra were taken during a brief visit to the canal, and will perhaps be of especial interest to the mining engineers, since the work is similar to that of many of our large mining operations.

Method of Attack

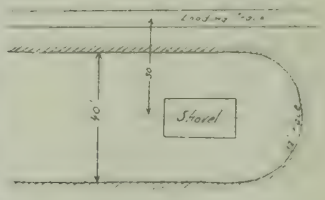
The method of attacking the cut is similar to other steam-shovel work and consists in first taking a 'pioneer cut' through the centre of the canal. This cut is about 12 ft. deep and from 40 to 45 ft. wide; the shovel operates in the bottom of the cut and works against the 12-ft. face, loading into cars on the loading track as shown in the photograph and sketch. The shovel track is composed of 6-ft. sections which can be moved from behind the shovel, carried ahead, and bolted to the preceding section. The work of moving ahead is done usually while waiting for cars, but if this is not possible, little time is lost, because it can be accomplished in a very few minutes.



MAKING PIONEER CUT.



HOLES FOR BREAKING PIONEER CUT.



PLAN OF PIONEER CUT.

Following the pioneer shovel, another one, at some distance, takes the second cut as shown; the second shovel works against a 24-ft. face and loads into cars on a track placed in the original pioneer cut. In both the pioneer cut and the second, the loading tracks are 12 ft. above the shovel tracks; this distance is determined by the height to which the dipper can be raised, and must be such that it can easily clear the loaded cars when drawn up to its maximum height. After this cut has been taken, it may be widened to any width by other shovels working against the 24-ft. face on one side or the 12-ft. face on the other, and loading to a central track as shown in the sketch.

The work is continued in this manner until the desired width is obtained, when a new pioneer cut is started and the work of deepening the canal is repeated as before. The work may be carried on at many different places and with many variations in the above plan which may be made necessary to provide suitable grades for tracks, proper drainage, etc., but this is in general the plan followed.

Breaking Ground

The ground is broken a considerable distance ahead of the shovels, as a rule, in order that there may be no danger of injury from the blasts, and also that there may be no chance of delay from the drilling and blasting operations. For breaking the pioneer cut, the holes are placed as below.

The distance between holes will depend upon the kind of rock to be broken, and varies from six to ten feet. Most of the rocks are comparatively soft sediments, some of which could almost be excavated without blasting, but in places the sediments have been intruded by dikes of basalt or trap that are very hard to drill and require much powder to break.

The holes for breaking the pioneer cut are drilled 15 ft. in depth to the so-called 'powder grade,' which is three feet below the grade at which the shovel works; this is done to insure that the powder will be placed below the shovel grade and thereby diminish the danger of encountering any unexploded powder with the dipper. In breaking the ground for the second and succeeding cuts, holes are drilled to a depth of 27 ft., thus making the bottom of the holes or powder grade 3 ft. below the shovel as before. The arrangement of these holes is practically the same as that used in the pioneer cut, the distance apart depending also upon the nature of the rock.

Another method of breaking the ground after the second cut has been taken, is by drilling flat toe holes into the bank, as shown in the diagram; these holes are drilled alternately 15 and 30 ft. deep and from 3 to 5 ft. apart, and are bottomed 3 ft. below grade as before. These flat holes seem to give the best results and are used whenever possible.

Charging and Firing

The loading of the holes is in charge of a 'powder boss' who determines the amount of powder to be used and supervises the loading. All firing is done by electricity and all possible precautions are taken to prevent misfires; the wiring and shooting are done by an electrician and his gang, who are responsible for this part of the work. Dynamites of 45 and 65% strength are used almost exclusively. All holes are sprung before being shot, and usually they are sprung several times. At one place where I observed the work in a comparatively soft shale, the pioneer-cut holes were being sprung twice, first with 1½ lb. of 60% dynamite, then with 5 lb., and a final charge of 20 lb. used in the centre rows and 15 lb. in the outside rows. It is quite probable that this charge would have been sufficient for a considerably harder rock.

The deeper holes are sprung four or five times, and some of the 30-ft. toe holes in hard rock are sprung six

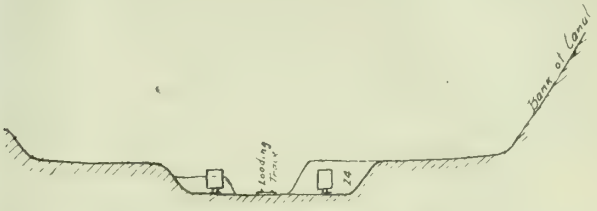
times and finally charged with 150 lb. of dynamite. A push-down battery is used for firing the springing shots, but for firing the final charges a 110-volt lighting circuit is used with the holes connected in parallel. The wires carrying this current run along the banks of the canal and at frequent intervals are connected with firing-

LOADING A ROUND OF SPRINGING SHOTS.

boxes containing a switch. These boxes are kept locked, and, as a further precaution against an unauthorized person attempting to fire a round of shots, it is necessary to make two different connections before shooting, so there is little danger from this source. Every precaution is taken to prevent missed holes; the maximum number of holes fired at one time is 150, although it is uncommon to fire more than 100 at once. Since the adoption of the present firing system few misfires have occurred, but before that when batteries were used they were not uncommon. The accompanying photographs show the men engaged in loading a round of springing shots and the shot itself. Note the long wooden poles used in lowering the powder into the holes.

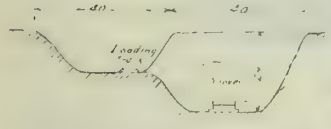
Drilling

Two types of drills are used, the well drills or churn-drills, and the ordinary compressed-air piston drills, known on the canal as tripod drills. The well drills are worked in batteries of six, as shown in the accompanying photographs, and are run by compressed air. The rate of drilling with the well drills varies from 20 to 75 ft. per day, depending on the kind of material, depth of holes, etc. Most of the drilling is done with the well drills, as they are more easily handled than the tripod drills in making deep vertical holes. When very hard rock is encountered these drills are too slow, and then the tripod machines are used. These machines are large piston drills of the tappet valve type, with 3¼ by 3⅝-in. cylinders. The tappet valve has been found most suitable for drilling these deep holes, as its positive movement insures a powerful return stroke which is essential when drilling a vertical hole 27 ft. deep. The rate of drilling varies from 20 to 30 ft. per day in hard rock for holes 27 ft. in depth and bottomed 2 inches in diameter. The accompanying photograph shows a group of tripod drills at work. Note the long piece of steel in the hands of one of the drillmen.

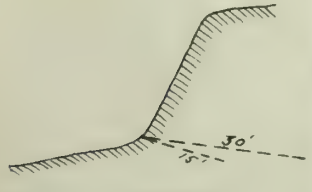


WIDENING AFTER SECOND CUT.

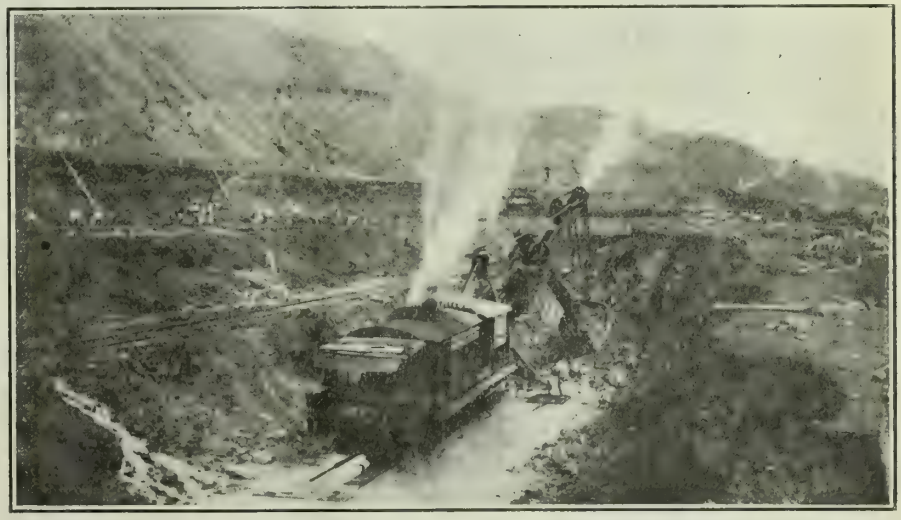
I was surprised at the class of labor employed on these machines, as they are practically all Jamaica negroes and the highest paid receive but 20c. per hour. Their skill, however, in handling these big machines is remarkable, and much credit is due the foreman for the patience that must have been necessary to develop these untrained negroes into skilled drill runners. In discussing this matter with the foreman, I was informed that many of these poorly paid men were the equal of many American drill-runners, and from a brief observation of their work I would judge such to be the case. When the work was first started drill-runners were sent down from the States and were paid good salaries for this work, but they required two helpers and refused to do anything but crank the machines, so they were gradually displaced by this cheaper class of labor.



CROSS-SECTION OF SECOND CUT.



TOE HOLES.



MAKING SECOND CUT.

The work of taking down the slope or bank of the canal is done by drilling holes with tripod drills at the angle of the slope; these holes are placed close together and are met within one foot by other holes drilled horizontally in the foot of the bank, so that small charges of powder are sufficient to break the rock back to the slope without loosening the remaining material. The drilling of these slope holes is extra difficult and hazardous work, as the machines are mounted in some cases on a very narrow ledge of rock and perhaps beneath an overhanging cliff from which rocks are liable to fall. One of the few recent accidents was from this source, and three men were killed by a big boulder coming down upon them while they were engaged in drilling these slope holes.

Cost of Work

The following figures taken from the *Canal Record* of August 7, 1912, give an idea of the cost of the excavation work on the canal. These figures are the average for April, May, and June, and for a quantity of 4,386,000 yards:

	Per cu. yd.
Drilling	$0.047
Blasting	0.054
Loading	0.050
Tracks	0.065
Transportation	0.077
Dumps	0.023
Pumps	0.004
Maintenance of equipment	0.077
Plant arbitrary	0.030
Division expense	0.017
Administration	0.033
Total	$0.479

From the above figures it may be noted that the cost of the work is a trifle less than 50c. per yard, and of this amount the largest single item is that of transportation. The work of excavating the Culebra cut is not a question of steam-shovel capacity, for very few of the shovels are run to their maximum capacity; it is not a question of drilling or blasting; but the great problem is that of transportation, of getting the cars to the shovels and away from them in the shortest possible time. Obviously, in a narrow cut, several miles long and with room for only a few tracks, it is not possible to keep every shovel going continuously, but the percentage of time lost in waiting for cars is remarkably small, considering the difficulties, and is kept to a minimum only by having tracks in such condition that trains can be moved rapidly without constant fear of accident and maintaining plenty of good rolling stock with competent train crews.

AIR-DRILLS.

CHURN-DRILLS.

Peru possesses great areas of alluvial gold country and quartz mines. Tentative efforts have been made to solve some of the problems, and in two cases, large plants have been started, notably the Aporoma Goldfields and the New Chucuitambo Gold Mines. The new cyanide plant of the latter company must be adapted to deal with copper in the ores. News comes from Aporoma that the first clean-up has taken place since the installation of the hydraulic plant. The Poto hydraulic plant is working steadily. There has been an influx of miners, overflowing from the Bolivia stampede to Tipuani. The New Chuquitambo company, near Cerro de Pasco, has started to sink an incline shaft to open up its ground below the Santiago tunnel. During September the Cerro de Pasco smelter produced over 4,000,000 lb. of copper, and as soon as improvements are completed, there will be a further increase.

The Tomboy Mill

This mill consists of 60 stamps and a concentrating and cyanide plant. During the year ended June 30, improvements were made and the following details are published in the recently issued annual report. The grading plant, consisting of three Wilfley tables and one Deister slimer, receives the mixed concentrate of the Wilfley tables, and the entire concentrated product of the Frue vanners, and turns out a finished product of high-grade galena concentrate, over 60% Pb, carrying much gold; a zinc concentrate containing 24% Zn, and higher; and an iron product which, under the present smelter schedule, commands a much more favorable price for gold, silver, and lead than when, formerly, the iron was included in the zinc concentrate.

Previous to remodeling of the concentrating room, the treatment of the entire mill product was accomplished by means of 15 Wilfley tables and 12 Frue vanners. Of the former, four were restricted to re-treatment of middling and concentrate, leaving 11 for the actual work of primary tables. The construction of the grading plant for re-treatment of concentrate liberated two Wilfleys, while the sending of the middling to the middling plant released two more Wilfleys for the concentration of original feed. The addition of two new Wilfleys on the north end of the mill, three on the south end, and the installation of two Wilfley roughing tables, which materially relieve the work of the other tables, makes 22 tables working on primary feed.

The middling plant was designed by Gelasio Caetani for the re-treatment of the high-grade tailing, which repeated tests proved to be contained in that portion of the tailing nearest the middling streak on the Wilfley tables. The feed to this plant will be obtained from the higher grade portion of the tailing discharged from the Wilfley roughing tables, and the high-grade tailing from the primary Wilfleys. The plant consists of two Hardinge conical tube-mills for re-grinding, eight copper plates for re-amalgamation, classifiers, seven Callow tanks, seven Deister slimers, and eight Wilfley tables for the re-concentration of the re-ground middling product. For the relief of the filter plant this year, and with a view to its entire replacement in the future, it has been decided to employ four 10 by 32-ft. Dorr thickeners. It is hoped that these improvements in the recovery of clear water will permit of the maintenance of increased tonnage due to new plant throughout the year.

During the year ended June 30, 1912, the mill treated 107,577 tons, yielding $954,981, at the following cost:

Milling, per ton	$0.67
Concentrating, per ton	1.00
Water supply, per ton	0.19
Assaying, per ton	0.04
General and taxes, per ton	0.59
Total, per ton	$2.49

The California State Mining Bureau

By William H. Storms

*Before the fortuitous discovery of gold by James W. Marshall, at Coloma on the American river in 1848, California was little known to the world. It was believed to be inhabited by a few thousand Indians, commonly referred to as 'Diggers.' The civilized population was largely of Spanish-American birth, and the life and customs of the Spanish people were strongly impressed upon everything, educational, commercial, and religious, in California. Gold had been discovered and mines worked at various places in the southern portion of the state, notably in Los Angeles and San Diego counties, but as these deposits, although profitable, were limited in extent, they created no more than a local interest. The discovery made by Marshall, however, came at a most opportune moment in our history. The news of the discovery of gold spread rapidly and reached to every part of the civilized world as fast as the means of communication of those days permitted. Thousands of men set their faces toward this El Dorado, and within two years California had accumulated what at that time was probably the most cosmopolitan population in the world. The wonderful development of the Golden State from that date is familiar to all. Since the discovery of gold at Sutter's mill, California has produced more than $1,500,000,000 worth of gold, the greatest yearly production being made in 1852, when it exceeded $81,000,000. This was largely due to the unprecedented yield of placers.

Today, although the production of gold has decreased, the annual output is still large, approximating $20,000,000. The development of the other mineral resources of the state has, however, continued uninterruptedly, until the total output now exceeds $80,000,000. Although these resources have been exploited with energy for more than sixty years, the possibilities of new development and of still greater yield in the years to come, are evident to all who are familiar with our mineral industry. So rapidly were the mineral resources of the state developed, in those early days, particularly the gold deposits, that the greater importance of the mining industry was early recognized, and the necessity for scientific and systematic knowledge soon became apparent.

Prior to this there had been more or less desultory geological work done in California, the first exploring expedition of this character being made in 1838 to 1842 inclusive. James D. Dana, who in after years came to be recognized as one of the foremost authorities on mineralogy, was geologist of this expedition, and James Hill was geologist for another expedition which did considerable exploratory work in California under John C. Fremont in 1843-4. Several others in years immediately subsequent to this made geological researches in various portions of the state, among these being Philip P. Tyson, William P. Blake, and John B. Trask. This latter gentleman was, in fact, the first officially appointed geologist of California, he acting under authority of the State Legislature in 1853. On April 21, 1860, the State Geological Survey of California was created by the legislature and J. D. Whitney was appointed state geologist. Mr. Whitney continued in this office until the State Geological Survey came to an end by the refusal of the legislature of 1873-4 to make an appropriation to longer continue the work so ably carried on by Mr. Whitney.

For six years or more, nothing of an official nature was done to aid the study of the geology of the state or to promote its mineral industry. In 1880, however, the great and growing importance of the mineral resources of California was once more officially recognized, and the earnest efforts of the friends of the industry were rewarded by the creation of a state department of mines, to be known as the State Mining Bureau. This was done under the direction of the twenty-third legislature, which also created the office of State Mineralogist. The bill which created the State Mining Bureau required that the principal office of the Bureau be situated in the city of San Francisco; that the State Mineralogist should collect mineralogical and geological specimens throughout the state and place them in a permanent exhibit; to provide and maintain a library of works on mining, mineralogy, and metallurgy; and also to annually make an official report to the governor, giving data and information as to the conduct of his office and of the State Mining Bureau.

Henry G. Hanks was appointed mineralogist by George C. Perkins, then governor. The early reports issued under the administration of Mr. Hanks were most helpful to those engaged in the mineral industry and are now difficult to obtain. The first situation of the State Mining Bureau and the mineral specimens collected by Mr. Hanks was in San Francisco on the south side of Pine street between Sansome and Montgomery. Here, in a suite of three rooms, were the office of the State Mineralogist, the library, and the museum. Mr. Hanks' first report contains the following in reference to these: "The collection embraces 1327 specimens from all parts of the Pacific Coast, many of them of special value. The library numbers 78 volumes and 25 pamphlets." After occupying the Pine street quarters for about a year, the Bureau was removed to Sutter street where the office and library were situated on one floor and a large room on the floor above was used for display of the rapidly accumulating mineral collection.

Mr. Hanks was State Mineralogist until May 30, 1886, when he resigned, and was succeeded by William Irelan, Jr., who was appointed by Governor Stoneman. Mr. Irelan had been chairman of the board of trustees of the State Mining Bureau, and at once assumed the duties of office. The sixth annual report states that 7000 specimens were collected and displayed in the museum during the administration of Mr. Hanks, and to this collection Mr. Irelan added 2000 more during his first year as chief of the department. It is worth noting that in July 1912 the museum contained not less than 17,500 mineral specimens, besides which the State Mining Bureau has distributed thousands of classified specimens of the rocks, ores, and minerals occurring in the state, to educational institutions throughout California. There is now on exhibition in the Bureau, in the Ferry building in San Francisco, one of the most valuable and beautiful mineral collections in the world. To this it is hoped that important additions will be made as soon as the necessary space for their display can be secured.

Mr. Irelan was succeeded as State Mineralogist at the expiration of his term by J. J. Crawford, who was appointed by Governor Markham in Februry 1893, and Mr. Crawford was succeeded in turn by A. S. Cooper, who was appointed by Governor Budd in 1897. Each of these gentlemen served about four years through their respective terms of office, each doing his share in the upbuilding of the Mining Bureau and in placing the ever increasing importance of the mineral industry of California before the world through a series of carefully prepared reports and bulletins. These documents were issued by the thousands and have been sent to those interested in the industry, to every part of the world. Few official reports are more eagerly sought than those of the State Mining Bureau of California.

Mr. Cooper was succeeded at the expiration of his term of office by Lewis E. Aubury, who was appointed by Governor Gage, April 6, 1901, and continued in office for nearly 11 years, being succeeded by William H. Storms, December 1, 1911. During his administration Mr. Aubury issued numerous bulletins on the mineral resources of the state, which have been distributed in the same manner as those of his predecessors, although during Mr. Aubury's term of office, the legislature passed a law, March 10, 1903,

*Read before the California Miners' Association.

authorizing the board of trustees of the State Mining Bureau to fix a price on all publications issued by the State Mining Bureau, the money derived from the sale of such publications being used as a revolving printing and publishing fund for the publication of other reports, bulletins, and maps.

The main purpose of the State Mining Bureau is not only to collect and publish statistical data of the mineral industry of the state, as required by law, but to aid in every possible legitimate way the development of the mineral resources of California and to invite the attention of foreign as well as local capital to the vast possibilities of the state in the development of its mines, quarries, and mineral deposits. The mineral production of California for the year 1911 shows a total of $87,497,879. This figure does not include asphalt, manufactured from crude petroleum, and which alone amounts to $2,250,000; nor does it include the kerosene, gasoline, benzine, and other light products which result from the fractional distillation of petroleum. These products of crude petroleum, if included, would increase the total to at least $95,000,000. No natural asphalt is produced in California.

Of the vast total of $87,497,879, petroleum constitutes nearly one-half, having been $40,552,088. Following this is the gold production, which was $19,738,908. The silver production, which in 1910 was nearly $1,000,000, was somewhat less in 1911, being $673,336, the difference being due wholly to the reduced copper output, which was seriously curtailed by the court decisions that closed several smelters for a time during the year. The third substance in point of value of production was cement, amounting to $9,085,625. These figures, as compared with those of a decade ago (1901), when cement manufactured in California was valued at $159,842, shows to what large proportions this industry has grown within a very few years. Copper production, which in 1910 was $6,680,641, fell to $4,604,753. This heavy decrease was due, as previously stated, to the enjoining of several smelters in Shasta county, owing to damage resulting from fume. Much effort is being devoted to the study of fume control, and when a satisfactory settlement is reached the copper industry in California should advance at an astounding rate, for there still remain large copper deposits as yet scarcely more than prospected in a superficial manner. These copper deposits are found in numerous localities, in the northern counties, in the Sierra Nevada, and even in the Coast Range of mountains.

The value of crushed rock produced in 1911 was $3,610,357, as compared with $2,777,690 in 1910. The brick industry in 1911, including all kinds, showed an output of $2,638,121, as against $2,934,731 for 1910. The falling off in the use, and consequently the price, of brick is due to the substitution of concrete for brick in building. This also accounts in a great measure for the large increase in the production of cement.

In 1911 there were produced 41 different minerals. These were worked in 55 of the 58 counties of the state. But three counties of the entire state failed to respond to letters of inquiry sent out by the statistical department of the Mining Bureau, these being Alpine, Sutter, and Yolo. It is known that there are mineral deposits or mines in each of these three counties, but they appear to have been idle during 1911. The complete total of $87,497,879 actual production is the largest ever made by the mineral industry in the history of the state. As the population of the state increases and as its commerce expands, the demand for its natural mineral products and for the various articles manufactured from them must be augmented in at least a corresponding ratio, if not exceed such expansion and development, for the reason that California will export large quantities of her mineral products. It is confidently believed, therefore, that the value of California's mineral output will hereafter show an increase rather than otherwise, particularly in the line of structural materials.

The gold mining industry is one that will probably keep up its present production for years to come. There are many gold properties, both veins and ancient channels, still undeveloped which promise to yield handsomely upon development and equipment with suitable mining and metallurgical machinery. Ores rich in gold, at present considered base or refractory, will in time be treated as readily as those now known as free-milling. The copper industry must assume far greater importance as soon as smelter-fume difficulty is overcome, and indications are that this fortunate condition will soon be reached. The iron industry in this state is in its infancy. Splendid pig iron has been made in the electric furnace in Shasta county from the magnetite that is so abundant there. There are immense masses of iron ore in various portions of the state, and these, in the coming years, will form the basis of a great industry. The production of structural material must annually increase as these enter so largely in the upbuilding of our ever-growing cities. Besides these there are other mineral resources which will show an increasingly greater production in the coming years.

The only institution in California that officially represents the great mineral industry of the state is the State Mining Bureau. The production of California mineral in 1911 was $87,497,879, clearly indicating it to be one of the most important industries of the state. Notwithstanding this large output of minerals of almost every description, I am confident that the Mining Bureau, if properly supported by legislative appropriation, will be directly instrumental in greatly increasing this large total, by directing attention to the undeveloped as well as the developed mineral deposits of the state. Almost unlimited money is available for investment in the various branches of the mineral industry, if only the attention of capital can be properly called to the many existing opportunities.

Nearly every state in the Union has a department of geology or mining, or both, that issues annual reports, in addition to bulletins on special subjects. During the first ten years of the existence of the Mining Bureau, general reports were issued annually, followed by biennial reports in 1892-1894 and 1896. Since the latter date there has been no general report on the mineral industry. The effect of the discontinuance of the general report has been to deprive the people of California of any definite or official statement of the progress of the mineral industry in the state. The Mining Bureau is daily in receipt of questions, not only from the citizens of this state, but from other states and foreign countries as well, seeking information that the Mining Bureau is supposed to give. Up-to-date information in many instances is not available for the reason that the Mining Bureau has been unable for sixteen years to collect the necessary data, simply for lack of the money required to employ competent field-men to visit the counties of the state and collect from the proper sources the available data.

In view of the approaching exposition in San Francisco in 1915, it is particularly desirable that California now take the necessary steps to properly present to the world the splendid commercial opportunities which her vast mineral resources afford. The best possible channel through which to call attention to our mineral industry and its advantages for investment is the State Mining Bureau. The constant demand for the publications of the Mining Bureau and the fact that so few of them are now available (notwithstanding that for the past nine years the Bureau publications have been sold instead of distributed gratuitously as formerly), shows better than anything else the importance that the public attaches to the reports and bulletins of this state institution. To be of the greatest value these reports must be brought up to date.

Fully realizing the fact to be as above set forth, I have made an estimate of the needs of the State Mining Bureau for the sixty-fifth and sixty-sixth fiscal years. It is the intention to take up the compilation of a general report which will treat particularly of the gold-mining industry of the state, and to generally review the existing conditions of the mineral industry in California. It is also planned to undertake special studies of the iron deposits of the state and to publish the results of such investigation in the form of a bulletin. Also a bulletin on the metallurgy of gold, another on mining methods, and a third on the Mother Lode.

which is each year becoming of greater importance. It is also requested that a special study of the undeveloped ancient gold-bearing rivers of the northern part of Sierra and Nevada counties be undertaken, as it is believed such studies will prove to be of great value in furthering the development of mining there. The need of a proper display of California mineral wealth at the great Panama-Pacific Exposition no Californian will question. In order to make the most creditable display, money is necessary, and for this purpose alone the sum of $25,000 is asked of the legislature.

It is now many years since the State Mining Bureau has been so well equipped in the personnel of its staff as it is at present. The department of determinative mineralogy is a most important branch of the work of the Mining Bureau. Ths department has for nearly fourteen years been in the hands of E. B. Preston, who has now been connected with the Bureau, as field assistant and as determinative mineralogist, since 1889. The fact that Mr. Preston has made in the past fourteen years over 30,000 determinations of the rocks, ores, and minerals of California, keeping an official record, and that in addition to these, he has made determinations of not less than 10,000 other samples submitted in person by visitors at the Mining Bureau, indicates the extent of the popularity and usefulness of this branch of the Bureau's work. Mr. Preston is a graduate of the school of mines at Freiberg and is widely known throughout California.

The library of the State Mining Bureau is under the direction of Walter W. Bradley, a graduate of the College of Mining of the University of California. The statistical work is in the hands of E. S. Boalich, who was formerly employed in the statistical branch of the United States Geological Survey. Mr. Boalich is also a graduate of the College of Mining of the University of California. Fred L. Lowell, who has been appointed curator of the mineral collection of the State Mining Bureau, is well qualified for the duties of that office. He, too, is from the University of California. The fact that the staff of the State Mineralogist is composed entirely of mining engineers of experience is of great advantage, as the members are each competent to perform the duties of the others. W. W. Thayer has been connected with the Mining Bureau since early in 1906. In his care are the accounts of the Bureau, and he also has general supervision of the structural exhibit now being placed in the corridor leading to the museum. In this are exhibited some of the best of the state's building stones and manufactured structural materials.

THE following estimates of appropriations necessary for the support of the State Mining Bureau have been made by W. H. Storms, State Mineralogist, and approved by the board of trustees, covering the sixty-fifth and sixty-sixth fiscal years, a period ending June 30, 1915:

For salary of state mineralogist		$6,000
For the support of the State Mining Bureau, including salaries		40,000
For a geological survey and preparation of a general report—		
Six field men, salaries	$21,600	
Six field men, expenses	17,400	
		39,000
Special work on Mother Lode		2,000
Special work on iron deposits		2,500
Special work on metallurgy		2,000
Special work on mining methods		2,500
Special work on ancient channels		6,000
Panama-Pacific Exposition		25,000
For printing, binding, ruling, and all other work performed and materials furnished by the State Printing Office		10,000
Total		$135,000

A 15-stamp mill is to be erected at the Hillside mine, in the Mud Springs district, California. An adit has been driven 400 ft., and a fair quantity of ore opened.

Explosion-Proof Motors for Mines

The United States Bureau of Mines has recently published the results of an investigation of explosion-proof motors by H. H. Clark, who has charge of the electrical investigations of the Bureau. The term 'explosion-proof', as applied to an electric motor, refers to a motor inclosed by a casing so constructed that an explosion of a mixture of mine gas (methane) and air within the casing will not ignite a mixture of the same gas surrounding the motor. There are two classes of motors so constructed: first, a totally enclosed class built strong enough to withstand high internal pressures and so designed that the efficiency of the covers can be satisfactorily maintained; second, a class provided with relief openings or valves designed to relieve the pressure of an explosion within the motor casing and to cool any products of combustion discharged through the valves. A satisfactory motor of the first class is much more expensive to build than an equally safe motor of the second class. For this reason attempts to make motors explosion-proof have been confined chiefly to motors of the second class.

The function of explosion-proof devices for electric motors is to reduce the temperature of any flames that may be discharged from the motor casing below the ignition point of methane. Various plans have been proposed and developed for removing heat from the products of explosion. The principle of the Davy safety lamp has been the basis of most of the protective devices. The application of this principle consists in causing the discharged gases to pass over or through metallic plates or screens which by conduction remove the heat from the gases. In some types of devices the cooling effect of expansion is also utilized.

Water Supply of the Rand

Water supply of important mining districts is always of interest, and the following notes are from the seventh annual report of the Rand Water Board: The total yield from wells and bore-holes during the year ended March 31, 1912, was 2,994,525,448 gal. When the new Springs and Zuurbekan schemes are completed there should be available 10,700,000 gal. per day. For the supply from the Springs mines, the Victoria Falls & Transvaal Power Co. is supplying electric power at 1c. per unit + $48 per kilowatt per annum, which brings the total cost to 1.24c. per unit. This scheme will cost $270,000, and there will be 36,740 ft. of 16-in. $^{3}/_{16}$-in. thick pipe from the Springs pumping station to the Leeuwpoort reservoir; 15,080 ft. of 16-in. ¼-in. thick; and 6013 ft. of 13-in. $^{3}/_{16}$-in. thick pipe from north and south shafts to the pumping station; and 9746 ft. of 6-in. 10-gauge pipe between the north shaft and the Springs service reservoir. During the year the total supply was:

District.	Total per annum sold, gal.	Daily average, gal.	No. of meters.
Johannesburg Municipality.	964,104,350	2,634,165	72
Germiston Municipality	133,407,700	364,502	19
Roodepoort-Maraisburg Municipality	15,634,300	42,717	9
Springs Municipality	16,343,900	44,655	3
Benoni Municipality	20,606,000	56,300	10
Boksburg Municipality	30,596,500	83,597	8
Krugersdorp Municipality.	23,326,580	63,734	13
South African Railways	108,122,100	295,415	21
Witwatersrand Gold Mines (Contributors)	1,488,709,409	4,067,512	138
Witwatersrand Gold Mines (Non-Contributors)	36,536,583	99,827	12
Victoria Falls & Trans. P. Co.	11,807,200	32,260	5
Sundry Consumers	32,413,950	88,563	27
Non-Potable Water	181,199,950	495,082	...
Totals	3,062,808,522	8,368,329	337

Graphic Representation of Oilfield Structure

By Alexander J. Heindl

*Two methods, one to a certain extent dependent upon the other, have been used to represent underground structure in the oilfields. These are: (1) vertical sections, determined by plotting the logs of several wells along certain lines; (2) underground contours, representing the surface of oil or water-sands by means of contour lines. In addition, there is the method of stereographic projection, to which particular attention is directed in this paper. Stereographic projection for diagrammatic purposes in mining work has, in several cases, proved to be useful, but its practical application to detailed underground studies in oil work is new.

Logs and Records

Log of a characteristic California well is shown below.

Depth from	Depth to	Feet.	Formation.
0	455	455	sand and gravel
455	475	20	blue clay
475	505	30	sand shale (sulphur water at 490 ft.)
505	720	215	sand
720	735	15	blue clay
735	742	7	water-sand, water
742	745	3	shell; very hard
745	755	10	sandstone
755	760	5	soft clay
760	795	35	water-sand, water
795	799	4	clay
799	801	2	shell
801	817	16	blue shale with sand
817	825	8	blue clay
825	840	15	blue shale
840	850	10	clay
850	855	5	tar sand
855	860	5	blue shale
860	863	3	shell
863	872	9	tar sand
872	880	8	sand
880	886	6	tar sand
886	894	8	blue shale
894	901	7	clay
901	959	58	blue shale (hard shell at 915 to 930 ft.)
959	981	22	blue clay, gumbo
981	984	3	shell
984	1022	38	blue shale
1022	1024	2	oil-sand
1024	1034	10	shale showing oil
1034	1084	50	blue shale
1084	1099	15	brown shale
1099	1104	5	oil-sand
1104	1114	10	brown shale
1114	1138	24	oil-sand
1138	1209	71	brown shale
1209	1211	2	oil-sand
1211	1219	8	brown shale
1219	1234	15	sandy shale

	Feet.
Total depth drilled	1235
Bridge to	1232
6-ft. wooden plug to	1226
Iron heaving plug 1 ft. to	1225
Bridge on iron plug to	1223

Casing:

Size, in.	Ft.	In.	Size, in.	Ft.	In.
12½	588	6	8	1035	0
10	895	0	6	1234	0

Perforated:

1104 ft. 4 in. to 1218 ft. 5 in. Size of perforation, ⅜ by ¾ in. Three rows each joint.

*Published with the permission of the consulting geologist of the Southern Pacific Company.

The discrimination made by the driller between shale and clay is sometimes justified by the inspection of the drillings. As a rule, however, it depends upon his judgment, and the judgment of drillers is not uniform. Gumbo is a field term for soft sticky clay. Heaving sand is a soft sand, frequently carrying water, which rises up in the casing and often causes difficulties in drilling. The water of the water-sand is sometimes saturated with hydrogen sulphide, and in such a case it is labeled as 'sulphur sand.' The 'tar sand' carries variable amounts of heavy oil; forming imperceptible gradations from sandy shale to poor oil-sand. These formations frequently change in character within short distances; they may vary considerably in thickness or even 'finger out' entirely. Not infrequently logs of two or more wells within two or three hundred feet of each other will differ to such extent as to make the correlation of their components impossible.

Besides the personal equation mentioned above, the methods of drilling are, no doubt, responsible in part for this inconsistency. In case the usual standard drilling machine is used, a 'screw' of 5-ft. length is drilled before the material is bailed out for inspection. If more than one kind of rock has been penetrated, their relative thicknesses have to be estimated by the action of the drill, aided by the amounts of different material brought up in the bailer. With the rotary or the standard circulator, the determination depends upon the inspection of the sediment that is being continually brought out in suspension with the drilling mud. Frequently this determination is practically impossible. There are, however, characterstic strata occasionally found that are persistent over large areas in the field, and they form good material for correlation of well records. Such persistent beds in California are usually clays or limey strata having characteristic color. The fossil contents, as sometimes revealed in the drillings, often aid in similar correlation.

Fig. 1 is a graphic representation of the above log. In practice these logs are usually drawn to a scale of 1 in. representing 100 ft. Several of these graphic logs, when placed side by side, with the horizontal and vertical distances corresponding to those of the respective wells in the field, form what is known as a vertical section or profile. While the vertical section gives an excellent idea of the structural conditions along a particular line, it fails to interpret the structure of that part of the field, simply because a section is drawn in two dimensions, whereas the actual relation of the formations in the field would require the introduction of a third dimension.

Underground Contours

Fig. 2 is an underground contour map. In determining the position of the contour lines it is necessary to make numerous sections across the field in order to correlate the various strata, such as the oil-sands and water-sands, shown on the well logs. The elevation, relative to sea-level or to some arbitrary bench mark, of the top of the persistent strata (oil-sand) is then determined for each well, and the result plotted on a map, the connecting points of equal elevation with contour lines. On the same map the surface contours are indicated. The surface and underground contours are usually drawn in different colors, or one is a solid and the other a dotted line. Care should be exercised in correlation when several oil-sands, one above the other, are found in the field. Usually only the most persistent and widespread oil-sand is mapped.

When the surface and underground contours are plotted the depth of the stratum at any point can be determined by the simple sum or difference of the elevations represented by the two contours, depending upon whether the elevation of the stratum is negative or positive. For example, if the surface elevation of a point is 1000 ft. and

the stratum –100 ft., the depth below the surface is 1100 ft. If, on the other hand, the elevation of the stratum is +75 ft., then the depth with be 925 ft. The underground contour maps, at best, can show only one or two of the underground strata. If several lines representing

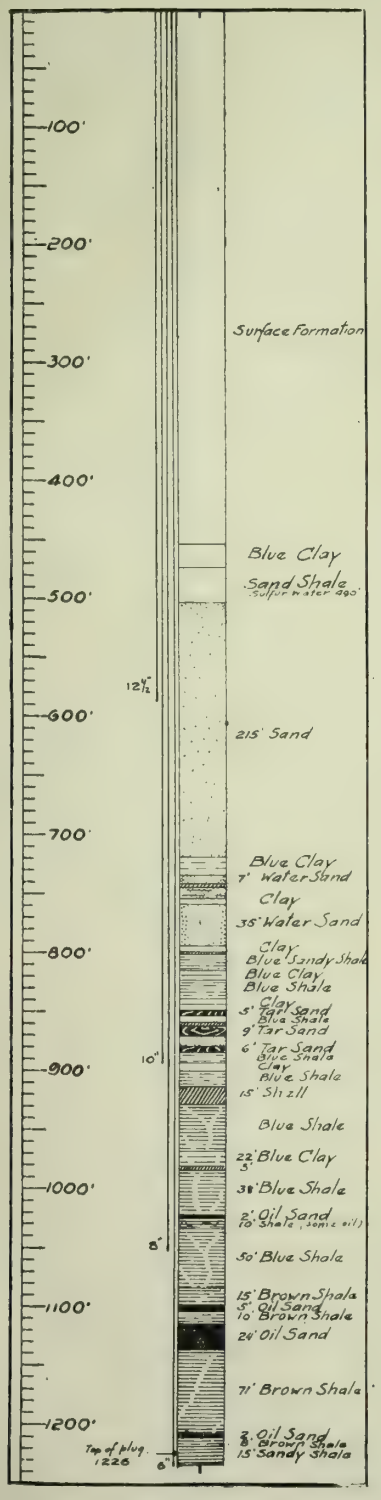


FIG. 1.

various strata are plotted on one map, the result is complex and difficult to use.

STEREOGRAPHIC PROJECTION

The stereographic projection has the advantage over the other two described methods in that all the conditions of the wells under an area of considerable size can, in the one drawing, be brought before the eye. The isometric perspective, which is used in this case, shows a cube as if it were looked upon from a side, somewhat above the upper plane. The foreshortening is omitted, so as to have the length of each edge in the cube equal; the acute angle of the upper plane is arbitrarily taken as 30°. It has been found, as a result of experiments, that for oilfields the use of two scales is very convenient: one for all horizontal dimensions (1 in. = 400 ft.), and the other for vertical (1 in. = 200 ft.). Using these two scales, there appears to be a practical limit to the area mapped. Each separate drawing can conveniently show a block of ground whose surface area is equal to about one square mile, while the vertical extent is usually limited by the lowest oil-sand, not exceeding, in general, 3500 ft. below the surface. Following is a method of constructing such a 'block.':

An arbitrary plane has to be chosen somewhat above the highest surface feature, on which the position of all wells is to be indicated, remembering that if a well is, for example, 180 ft. south and 300 ft. west from the northeast corner, the position would be found by measuring these

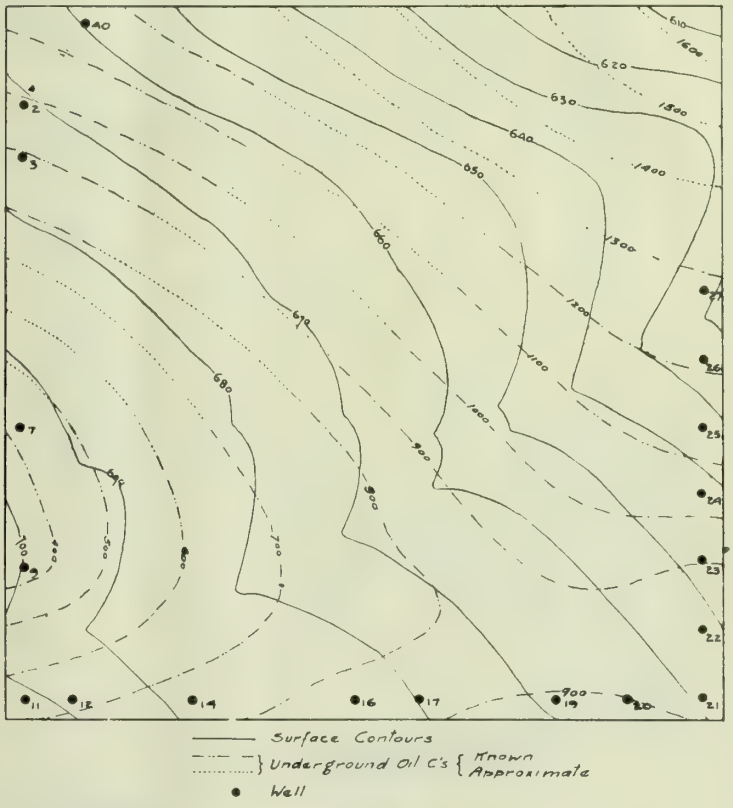


FIG. 2.

lengths true to scale in directions parallel to the border lines of the reference plane (Fig. 3). These points, however, do not represent the collars of wells as it would be in an ordinary plan; they are only the points of intersection of the axis of each well with the reference plane.

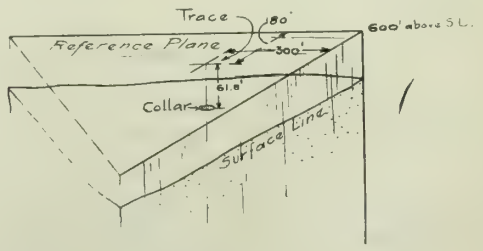


FIG. 3.

In order to find the position of the collar, a vertical line is drawn through the point of intersection, and the difference between the elevation of the well and that of the reference plane is measured downward from the trace. In Fig. 3 the elevation of the well indicated is 538.5 ft., while the elevation of the plane is taken as 600 ft. above sea-level.

If several collars are defined in similar manner, a general idea of the topography of the area is obtained, which will be made clearer when the intersection lines between

the surface and the border planes are drawn (see Fig. 3). A much more satisfactory result can be obtained if a topographic map of the area is available and the contour lines are transferred on the diagram. The log of each well is then plotted from the collar downward, using different colors or symbols for different formations of interest, such as shale, tar-sand, water-sand, or oil-sand.

Considerable difficulty is usually found in the correlation of various formations, except the oil-sands. The latter fit usually into a continuous blanket, and the exact determination of the form of each is the aim of the method described.

At least three wells not in a straight line are required to give an approximate idea of the form of the oil-bearing zone. Fig. 4 shows the method of plotting. For the sake of brevity, the oil-sand in each well is indicated as a point, which might be taken as the upper limit in the well. Imagine a vertical plane drawn through two wells. A line drawn through points marking the upper limit of the sand will lie also in a plane which, prolonged, will intersect the two border planes at points which will be on the intersection lines of the plane with the sides of the block. Similarly, other vertical planes may be used to define the points on the border planes, and by connecting these points with straight lines the outside rim of the oil-sand may be found. This is usually shown by a full line on the

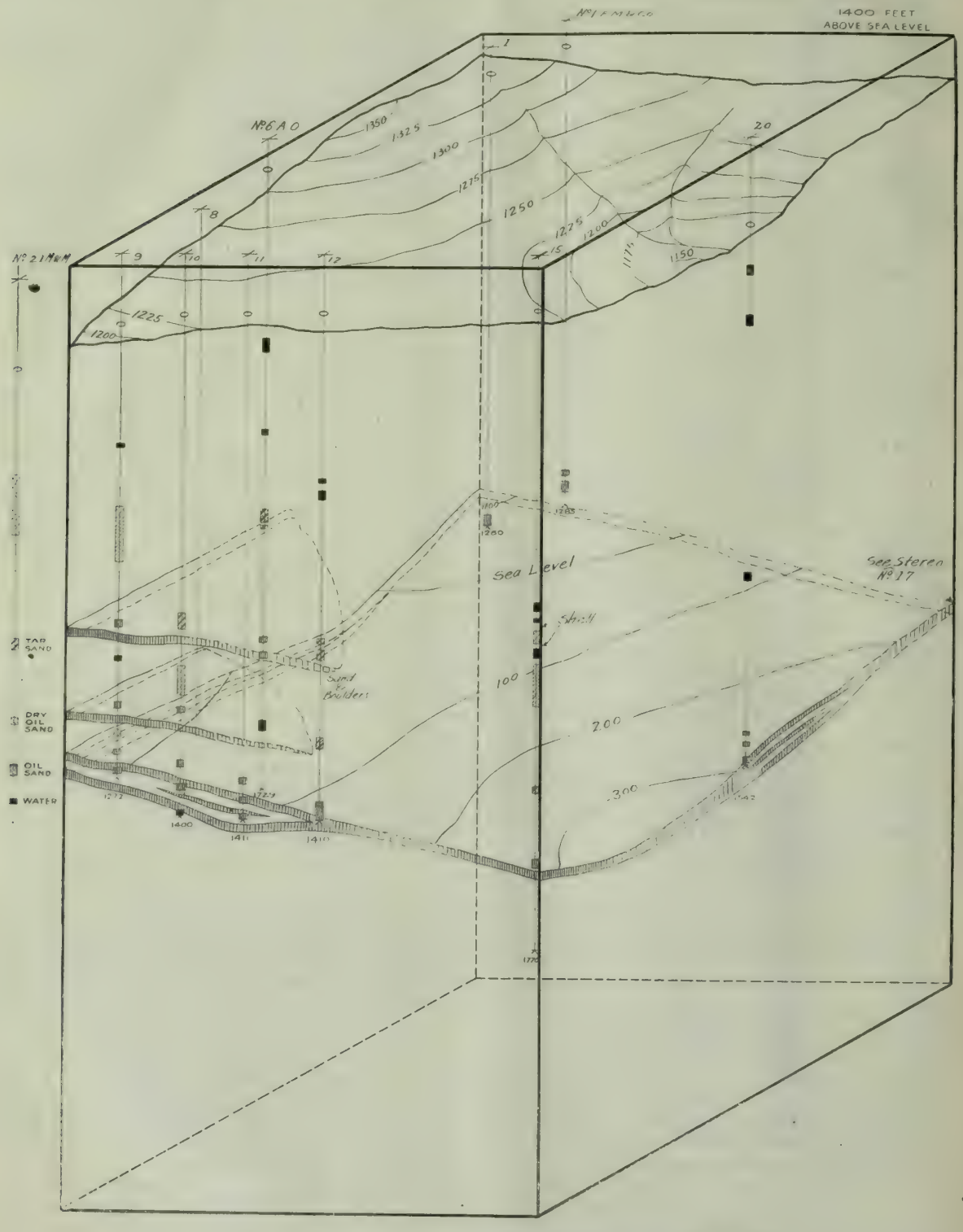


FIG. 4. STEREOGRAPHIC PROJECTION OF A CALIFORNIA OIL SAND.

front planes and dotted on the back planes. Evidently, the drawing of any of the vertical planes is reduced to the drawing of three lines, which simplifies the whole construction.

As mentioned, the *plane* which passes through the first three oil-sands is only a first approximation to the actual form of the oil blanket, and each additional well will modify its form and bring it closer to the existing configuration. From six to ten wells, scattered along the border lines of a section, will usually give good initial information about the internal conditions of this section.

Wells outside, within a certain distance from the section mapped, furnish just as valuable data as those inside, the method of plotting being identical with the one previously mentioned. In several instances a section was plotted, guided by the outside wells only. Fig. 4 is a copy of an office drawing of similar kind.

A further plasticity is added to the stereogram when contour lines are drawn on the surface of the oil-sand. This is accomplished by drawing horizontal planes at an interval of 100 ft., referred to the sea-level, and observing where each plane intersects the oil zone. The oil-sand contours of drawing Fig. 2 were originally drawn on the stereogram and afterward transferred to a smaller scale drawing.

It might happen that the oil-sand has such dip and strike that, when plotted under standard conditions—that is, with the east-west line parallel to the observer—the form of the oil surface will approach a line, because of the fact that it lies in the plane of sight. This is easily avoided by turning the block 90° around its vertical axis, making the north-south line parallel to the observer.

It is to be noted that such a stereogram is a drawing in the technical sense of the work; that is, everything that is shown on it can be measured and read to scale. The direct reading of distances (to scale) between two points can be made in the three main directions only; to read a distance between any two points, the line connecting these two points has to be rotated (around a vertical axis) until it comes to a position parallel to the front plane. The same thing holds true for the angles of dip.

Potash Explorations in Nevada

The results of explorations for salines in Silver Peak marsh, Nevada, recently made by the U. S. Geological Survey, have been published in a short report by R. B. Dole, of the Survey, as Bulletin 530-R, an advance chapter from Bulletin 530. Silver Peak marsh is a salt *playa* or dried-up lake, of prehistoric origin, about 20 miles west of Goldfield and 25 miles southwest of Tonopah, two well known mining centres of Nevada. The exploration was made for the purpose of ascertaining whether deposits of potash salts in commercial quantities lie within easy reach of the surface. No extensive beds of such salts were discovered, although the salts in certain samples of brine contain as much as 3.43 and 3.80% of potash (K_2O). Drill-holes were sunk at several points in the old lake bed by means of a small portable drilling outfit, operated by a burro, the borings being carried to a depth of about 50 feet.

Practically the entire surface of the *playa*, 32 square miles, is covered with salt that averages in depth about one-quarter of an inch. The upper muds, averaging probably 10 ft. thick, contain not less than 2% of salt. It is estimated that not less than 15 square miles of the northeastern part contains a 10-ft. saline bed, of which at least 60% is salt. It is calculated from these moderate estimates that 15,000,000 tons of salt lies within 40 ft. of the surface. The high rate of evaporation, which would permit solar concentration of brines, the absence of long-continued rainfall to interfere with operations, the nearness of a railroad, and more especially the high degree of purity of the product as indicated by analyses of the brines are extremely favorable features in regard to the possibility of utilizing these deposits. Salt is now being produced on a small scale by Frank Porter, of Silver Peak, who states that about 150 tons has been sacked and sold in three years.

Mining in Burma

That mining in Burma is receiving increasing attention is shown by the fact that during the fiscal year 1910-11 new applications for prospecting licenses numbered 1224, as against 262 in the preceding year. Applications numbering 738 were received for prospecting in the Tavoy district, where large deposits of tungsten and tin are known to exist.

The production of the principal minerals in Burma during the calendar year 1911 is given in the following table (ton = 2240 lb.; hundredweight = 112 pounds):

Minerals.	Quantity.	Value.
Rubies, carats	222,968	$316,495
Lead (slag) tons	31,954	331,926
Lead (pure), tons	13,259	299,029
Tungsten ore, hundredweight	17,765	297,634
Gold, ounces	6,422	118,590
Tin, tons	88	75,609
Jade, hundredweight	2,062	55,908
Silver, ounces	103,850	55,308
Silver-lead ore, tons	3,218	23,403
Sapphires, carats	17,269	9,146
Spinel, carats	47,976	3,171
Galena, tons	189	3,495
Iron ore, tons	20,995	2,484
Copper ore, tons	159	2,400
Platinum, ounces	38	1,188
Amber, hundredweight	13	649
Total	.....	$1,596,426

The Ruby Mines Co. of Mogok, Upper Burma, experienced a bad year, the value of its output being given as only $316,495. Low prices for rubies in the London market were responsible for the small production. According to the census of 1911, this company employed 1393 workers. Most of the lead and silver obtained in Burma during 1911 was produced by the Burma Mines Co., Ltd., at the Bawdwin mines in Tawngpeng, northern Shan States. The quantity of silver-lead ore and lead slag obtained in 1911 was considerably larger than the production of 1910, but the value of pure lead obtained was only $299,020, as compared with $773,851 in the preceding year, while the value of pure silver was nearly three times as great as that obtained in 1910. The Burma Mines Co., Ltd., has a lead smelter at Mandalay employing 536 persons.

There were, in 1911, 17 tin and tungsten mines in operation in Burma, 11 in Tavoy, 5 in Mergui, and 1 in the southern Shan States, employing 1935 persons, mostly in the tungsten mines. Although prospecting on modern lines for tungsten in Burma commenced only within the past two years, great development has taken place and the prospects are extremely good. Ore has been discovered in workable quantities in the Tavoy and Mergui districts of Lower Burma and in the southern Shan States. The industry in the last named region is greatly handicapped by want of adequate means of transport. The mines are about 300 miles from Toung-gu, in the southern Shan States, where there are no railways or cheap means of communication. The production of tungsten in Burma in 1911 amounted to 995 short tons, but it is not stated whether this is ore or concentrate. This would seem to indicate that as the industry becomes more developed, Burma will become one of the world's largest producers. The Burma Gold Dredging Co. produces most of the gold found in Burma. This company has four dredges of Australian manufacture working in the Irrawaddy river, near Myitkyina, in Upper Burma.—*Daily Consular and Trade Reports.*

The Hedley Gold Mining Co. has declared the regular dividend of 3c. per share, and a special one of 12c., a total of $180,000, making the 1912 distribution of $360,000. The Utica mine is on Kaslo creek, in the Ainsworth district, and Spokane capital is interested. Since July 1, when operations were resumed at the property, gross earnings have been $40,000. The ore contains silver, lead, and zinc.

Metallurgy at Tonopah

By M. W. von Bernewitz

Simplicity of operation seems to be the key-note of treatment methods at this interesting mining centre, having been brought to such a point by much intelligent experimenting. To obtain an average of 93% extraction at a cost of, say, $3 from ores carrying 30 oz. of silver and a few grains of gold per ton is good work, and not long ago would have been termed impossible, especially in such a situation as Tonopah.

Tonopah ores may be described as consisting of fine granular quartz (the silica averaging perhaps 80%), without noticeable quantities of sulphides, poor in the baser metals, and containing disseminated silver minerals, and gold. The primary metallic minerals are silver sulphides, principally polybasite, stephanite, and argentite, with occasional pyrite, chalcopyrite, galena, and blende. Silver selenide also occurs. Silver chloride, bromides, and iodides occur, mainly at least, as secondary minerals. Silver also appears in the metallic state. Gold occurs in the proportion to silver of about 1 to 100 by weight, and has been seen in the free state.

In Tonopah there are five mills—the Belmont, Extension, MacNamara, Montana, and West End—while at Millers, 12 miles north, are the Belmont and Tonopah mills, ore being shipped to these at a cost of 70c. per ton. In nearly every case gyratory crushers are used for breaking ore as it comes from the mines, the procedure being to crush first in a large crusher, up to the No. 7½ type K Gates size, pass through revolving trommels, the oversize being again reduced in No. 3 size gyratories, the final product for the stamps being about 1¼ in. Sorting is done at the Belmont and MacNamara mills; at the former on a pan conveyor from which 15% is rejected; and at the latter on a 30-in. rubber belt, from which 6% is sorted out. From the crushing department, the ore is taken to mill bins by 20-in. belt conveyors, or bucket elevators, and distributed by the usual automatic devices.

Tonopah millmen have not been troubled with the heavy-stamp mania, although the ore is fairly hard, and the 320 stamps at work vary between 1100 lb. at the Montana to 1400 at the MacNamara, the latter having probably the toughest ore in the district. Several different methods of driving stamps by motors are to be noticed, and will be separately described later. Foundations are usually of concrete, and give satisfaction. The new Belmont mill has sheet-lead under its mortars, but this is being replaced with rubber. There are no high-speed stamps, the average being perhaps 103 drops per minute with 7-in. drop. Both square-mesh and ton-cap screens are used, sizes varying from 6 to 20 mesh, and the stamp-duty is from 4 to 8 tons per day. The Challenge feeder is now a simple contrivance compared with the original, and may be described as a double monkey-wrench grab, which turns the gear and feed plate. There is no amalgamation at Tonopah, nor is it necessary on this class of ore. Crushing is done in weak and warm (from 50 to 80°F.) cyanide solutions, so the ore is in contact with solution from the stamps to filtration. This is necessary as well as the heating, which, although somewhat expensive, quickens the solution and accelerates the dissolving action. Solutions are usually heated to about 95°, and in one case 120°, by live steam introduced in the agitators.

The practice of using hot solutions is briefly as follows: At the new Belmont mill the temperature at the stamps is from 60 to 70°F., and at the Pachuca agitators exhaust steam from the mill air-compressor is fed in, increasing it from 90 to 100°. In the *Mining and Scientific Press* of January 27, 1912, A. H. Jones, metallurgist at this plant, gave some valuable data on this subject. On an ore carrying 0.05 oz. of gold and 18.2 oz. of silver per ton, 60 hours' agitation with both 60 and 90° solutions, the tailing averaged 0.0175 and 3.45, and 0.0125 and 1.90 oz. respectively. Tests on 48 and 69 hours at similar temperatures gave as marked results. Besides the effect on extraction, the hot solutions flowing through the mill kept the whole place at a good working temperature. At the Montana-Tonopah, ore is crushed in 50 to 60° solution, which is increased to 110° at the Hendryx agitators by live steam. It is found also that the heat aids settling. There is a marked decrease in extraction without hot solutions.

The MacNamara mill recently had experience with cold solutions, owing to an enforced shut-down for two days. The Trent agitators are usually kept at from 115 to 120° by live steam and it was found that it took several days to heat everything again, in the meantime the time of agitation had to be increased and extraction fell off considerably. Heat is necessary in the summer, but less steam is used. The cost is about 30c. per ton treated. The Extension ore is crushed in 80° solution, and live steam is added to the Trent agitators as soon as possible, making the temperature up to 120°. It was found that this was better than 90° and extraction has improved 1.5 to 2% during the past few months, it being 94.5% at present. About 2100 tons of solution is circulating in the mill, and it takes 7 days to heat this if it should get cold, meanwhile extraction falls off.

Cost of heating is 18c. per ton. It has been found at the Belmont mill, at Millers, that in passing through a tube-mill the temperature of the solutions increases, presumably by the grinding action of the pebbles, mill liners, and ore particles. A test taken while I was there showed feed temperature at 65°, and discharge 70°. In the *Mining and Scientific Press* of February 24, 1912, Noel Cunningham, at Millers, contributed the results of some experiments, proving that laboratory work had shown greatly improved results from hot solution. At another plant treating Tonopah ore, crushing is done in 75 to 80° solution, increased to 95° in the agitators by live steam in coils. Recent tests showed a saving of 24 to 32c. at a cost of 11c. per ton. The same temperature is kept up in summer and winter. At the Mexican mill, Virginia City, solution is heated to about 96°, at a cost of 12c. per ton, results being improved by this system, the average extraction being 92 per cent.

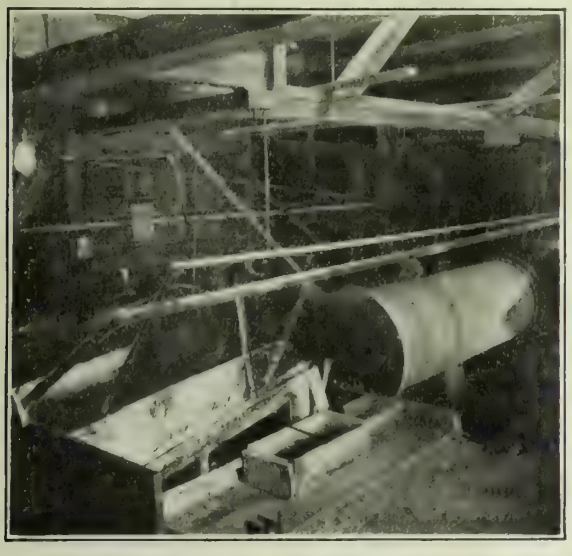
It is to be hoped that millmen in Cobalt, Mexico, and Waihi will give their experience with heating solutions. When I was with the Waihi company in 1898, heating was tried, but I kept no data. It may be interesting to mention that, at Kalgoorlie, treating an ore containing practically no silver, some argument was raised as to the benefit of hot solutions in treatment. The heating there is not intentional, as at Tonopah, but comes about through the hot roasted ore being mixed with solution, bringing it up to nearly 200°. The discussion resolved into whether by cooling prior to mixing there would be less consumption of cyanide, and less trouble with sulphates being deposited in launders, pipes, and pans, or whether there were benefits derived from the resulting hot pulp. The Associated, Associated Northern, and Kalgurli, more particularly, found that there was no appreciable decomposition, and up to 50% of the gold was dissolved at that point; while the Great Boulder, Perseverance, and South Kalgurli preferred to cool the ore before mixing.

Tonopah ores carry as much as 3% of pyrite, but concentration is not always employed, it being done only at the Belmont, Montana, Tonopah, and West End. It would seem that if the grade of the ore and percentage of mineral is not too high, tables are not necessary, and this varies from time to time in the various plants. At any rate, a very close saving is not attempted. The Extension company dispensed with their Deister tables, selling them to the West End. The Belmont, Montana, and Tonopah use Wilfley tables. Concentrate is collected, steam dried in large trays, sacked, and shipped to smelters. Freight and treatment cost nearly $70 per ton. It seems a pity that such a high cost is necessary, and that the product could not be handled locally by some central plant, which would treat the combined output at about $10 per ton.

All-sliming is the standard method, with the exception of the Tonopah mill at Millers, where three products are made; concentrate, sand, and slime. At this plant reduction is by stamps, and Chilean and Huntington mills; while at Tonopah the procedure is as follows. The pulp from the stamps is fed into Dorr duplex classifiers making 12 strokes per minute, from which slime overflows and coarse material is fed into tube-mills by means of a special feed. Discharge from these is elevated to the Dorr classifiers, and a further classification takes place, further grinding in the tube-mill, and so on. The only product which escapes to the slime plant is from the Dorr machines. This is termed the closed-circuit system, and is a good one. At the West End, the Dorr classifier discharge is:

	%
100 mesh	99
150 "	93
200 "	89

There are 16 tube-mills in the district, varying from 5 by



DORR CLASSIFIER, TUBE-MILL, CLOSED CIRCUIT.

18 ft. to 5 by 22 ft., revolving at about 26 r.p.m. Usually the locally-made smooth liners give good results. These are ½ in. thicker at the feed than discharge end, and last over nine months. At the Extension mill, there are two classifiers and two tube-mills in the closed-circuit, arranged thus in series: coarse pulp from No. 1 classifier is fed into No. 1 tube-mill which is fitted with ribbed liners, and is discharged to a bucket elevator, which in turn lifts the partly-ground material to No. 2 classifier which feeds No. 2 tube-mill fitted with smooth liners, the product being returned to the No. 2 classifier. The consumption of pebbles is 4.5 lb. per ton milled. It is claimed that ribbed liners are better on coarse pulp than smooth ones, and the latter can do the final grinding better. The ribs pick up pebbles and toss them about more in the mill, this giving extra impact for coarse material which is not necessary for the fine. At the Goldfield Consolidated mill this is also the practice. Pebbles remain in a better rounded shape with ribbed than when used with smooth liners, which tend to produce flat surfaces. When discussing the action of various crushing machines in the *Mining and Scientific Press* of December 10, 1910, I mentioned the corrugated liners used at Kalgoorlie affording a long life and extra grinding results. Some of the Tonopah mills find that it is not necessary to get an extremely fine product, the pulp being 73 to 89% through 200 mesh.

Various types of thickeners or dewaterers are in use, the practice being to allow the clear solution to overflow and decant off as much as possible for battery storage. When it gets too high in gold content it is decanted to the tank for precipitation. As at many other mining centres there is quite a difference of opinion regarding the efficiency of agitators, the Trent being used at the MacNamara, Montana, and West End; the Hendryx at the Montana; Pachuca tanks at the new Belmont mill; and ordinary mechanical agitators and air-lifts at the Belmont and Tonopah at Millers, these being in series at the Belmont plant. Centrifugal pumps and air at about 20 lb. pressure are used for the Trent system; and better results are obtained if pulp is drawn off near the top of a full vat and pumped through the arms as usual. Agitation proceeds for upwards of 48 hours. At the new Belmont mill, slime is first agitated in six Pachuca tanks, and from these it is elevated to Dorr thickeners by an air-lift, prior to going to another set of six Pachucas, making a total of 48 hours' agitation, the idea being to get rid of as much valuable solution as possible before sending slime to the filter-plant. Cyanide and lead acetate are added to the agitators, the former being from 2 to 5 lb. solution, while regular addition of the acetate is found necessary at all mills. Lime is usually slacked, and added to the tube-mill feed. Consumption of chemicals at the Extension is as follows:

	lb.
Lead acetate, per ton	0.9
Cyanide, per ton	2.5
Lime, per ton	3.5

Agitated slime is drawn off to stock-tanks, which serve the purpose of storage from agitators and excess from

NEW MILL, BELMONT COMPANY.

filter-plants. The latter have little of special note about them, they being of the ordinary stationary leaf type which have been described so often in technical papers.

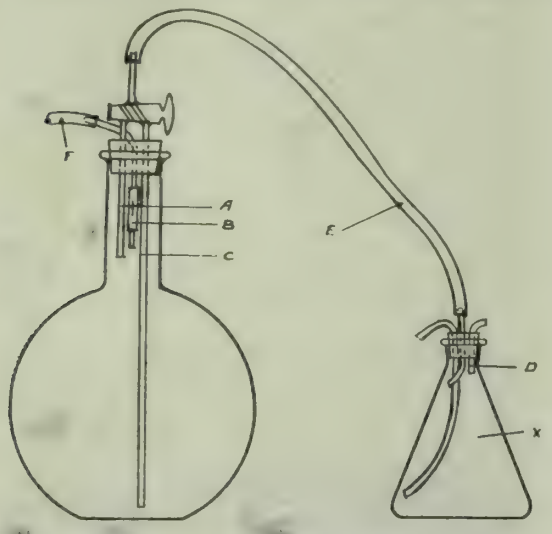
Zinc-dust precipitation is used at the new Belmont and Montana mills, and zinc shavings at the Belmont, Extension, MacNamara, Tonopah, and West End. Methods of dealing with precipitate vary somewhat. At the new Belmont precipitate is dried, mixed with 5% of borax and smelted in double-compartment, oil-fired Rockwell furnaces, lined with carborundum, kaolin, and water glass. At the Extension it is dried, fluxed, and smelted in oil-fired Steele-Harvey tilting furnaces, which contain a No. 250 graphite crucible, while at the Tonopah mill the fine zinc shaving precipitate is incompletely dried, mixed with crude borax which swells up through the mass, and then is smelted in six coke-fired tilting furnaces. Crucibles last from 90 to 130 hours, and are turned once. Tonopah bullion will average 950 fine in silver, and a trifle over 10 in gold, and is sampled by being bored at opposite corners of top and bottom of bars. The bullion is shipped by freight like any other merchandise.

The mills at Tonopah are fortunate in having such a good supply of electric power as is available, and mechanical details are thus much simplified. I do not think there is a single engine in any mill there, also every machine having a motor drive. Chain drives are fast becoming popular, and apparently there is no dissatisfaction with them, once their peculiarities are understood. Such items as motor drives, and elevating pulp will be discussed later. In conclusion, it seems to me that generally the treatment of silver ores at Tonopah has been simplified to a fine point with good results, and is creditable to all concerned. There is not a dismantled mill, nor a badly designed one, nor any built for a mine without ore, to detract from the good work of the district.

A Self-Filling Measuring Bottle

By O. C. Smith

In washing a precipitate or residue with a certain volume of liquid, this apparatus is very convenient. By using a small necked flask for the smaller one, this arrangement will discharge to within a couple of drops of a given amount. In fact, this apparatus will fill a 100-c.c. flask to within one drop by exercising a little care. The large flask is placed on the back of the desk out of the way. The rubber tube



AUTOMATIC MEASURING BOTTLE.

F is used to supply air. This ends in a tube, *B*, in which there is a slit to serve as a valve. By blowing in *F* water is forced through *C* and *E* into *X* and when this is full, out through *D*. By moving *D* the capacity of the flask can be changed. The stopcock is now turned and air enters through *A* and *E* into *X*. By closing *D* with the thumb *X* is converted into an ordinary wash bottle. *Jour. Ind. & Eng. Chem.*

Tempering Copper and Bronze

The production of bronze alloys in one operation and the hardening and tempering of copper are perpetual topics of popular discussion, so that the statements made by Walter Gowland at a recent lecture in London are of interest. Mr. Gowland, besides being a distinguished metallurgist and emeritus professor of the Royal School of Mines, is also an antiquary of note, as is evidenced by the fact that some years ago he was deputed to make the historical examination of Stonehenge. His researches into the history of metallurgy in all parts of the world are elaborate and learned. In his lecture he showed that during the early metal age, and even later, bronze was not obtained by melting metallic copper and tin together, but by the reduction of oxidized copper ores containing cassiterite, or of copper ores to which cassiterite ore was added. It is important that this fact should be recorded, seeing that some modern metallurgists allege that such a process is impossible, and that whenever tin and copper ores are smelted together the tin does not unite with the copper but passes into the slag. These allegations were evidently not founded on experiment, but on erroneous deductions from the methods of smelting in use at the present time.

In order to determine the possibility of producing bronze, Mr. Gowland constructed a simple furnace consisting merely of a hole in the ground. In this he treated a mixture of 15 lb. of malachite, containing 30% copper, and 10 lb. of cassiterite ore containing 20% tin, together with charcoal and limestone. The furnace cavity was filled with charcoal, which was also piled above it for 2 or 3 inches. When the charcoal was well alight, a layer of the charge was spread over its surface, then another layer of charcoal, and so alternately until a conical heap was formed. A gentle blast was then started through a 1-in. blast-pipe, and when the charge began to settle the blast was increased. On the conclusion of the reaction, the slag and remaining fuel was removed and the metal allowed to solidify. An analysis of the metal showed 78% copper and 22% tin. A series of experiments were undertaken with varying proportions of the ore, and in every case copper-tin alloys were obtained. In the later bronze age, the varying qualities of alloys of different composition were well known, and the ancient metallurgists were obviously experts on the properties of alloys. The second point raised by Mr. Gowland referred to the supposed lost art of tempering bronze. In the old days the bronze castings for tools and weapons, were hammered at the cutting edges to produce the right degree of hardness and temper. No other method was ever employed, such as heat treatment. The same effect can be produced on modern bronzes, by hammering, and in fact an even greater hardness can be obtained. Thus the notion that the art of tempering bronze has been lost is a fallacy. Mr. Gowland might have added that soft copper tools can be hardened by heating them in contact with minerals containing arsenic or antimony, when a casehardening action is produced through the formation of a glass-hard copper-arsenic alloy. Analyses of old 'tempered' copper tools have shown them to contain nickel and other metals; thus the supposed 'tempered copper' is really a hard bronze.

Electrolytic Determination of Copper

By C. E. Travillion

In order to obtain a good deposit of copper by electrolysis, it is necessary to have the cathode well supplied with copper ions. If diffusion alone is depended upon to bring about this result, concentration changes will be set up in the electrolyte, with a result that a solution near the cathode becomes depleted of copper. Under these circumstances only a feeble current will insure a coherent deposit. In order, then, to utilize a fairly high current density and thus shorten the time of electrolysis, it is necessary to employ some sort of device to preserve the homogeneity of the solution.

The effectiveness of the rotating electrode can be duplicated and the manipulation simplified by an apparatus using air as a stirring agent. This apparatus consists essentially of a glass tube, through which a platinum anode wire is run, and a side tube for the introduction of air under small pressure. The anode wire is sealed in at the top, while the bottom of the tube is drawn out slightly with an opening for the release of the air bubbles. It also serves to lead out the anode wire. This terminates in a spiral, which is wound about the tube. The cathode is a platinum cylinder suspended about midway in the solution. The receptacle for the solution is an ordinary tall electrolytic beaker, which is covered with a split watch-crystal to prevent loss of solution by spattering. In operation the bottom of the tube is placed just above the lower edge of the cathode, and air is allowed to bubble through not too violently. An effective circulation is set up. The bubbles on rising create an upward current, which draws the solution under the cathode. This rises with the bubbles on the inside, which break on top, and a downward circulation along the sides of the beaker is produced. In addition to this, there is more or less agitation due to the action of the bubbles.—*The Chemist Analyst.*

The Raub Australian Gold Mining Co., Pahang, Federated Malay States, produced gold worth $176,000 during the year ended March 31, 1912, of which $29,000 was written off at $20,000 carried forward. At the Raub gold mines development is being done on 640 and 740-ft. levels.

Operating Costs at the Goldfield Consolidated Mill

The following costs have been supplied by J. W. Hutchinson, metallurgist of the Goldfield Consolidated mill, which consists of 100 stamps crushing 100 tons per day, followed by classifiers, Chilean mills, tube-mills, concentrators, agitators, and vacuum-filters; while the concentrate is agitated raw with cyanide, roasted, given acid treatment, washed, mixed with mill pulp, and finally filtered. Precipitation throughout is by the Merrill zinc-dust method.

Cost Per Ton Treated	
Crushing and conveying, per ton treated	$0.034
Stamping	0.133
Elevating and classifying	0.023
Chilean mills	0.104
Tube-mills	0.208
Concentrating tables	0.070
Neutralizing	0.054
Settling	0.065
Dissolution (agitation, chemicals, etc.)	0.453
Experimental	0.009
Filtering	0.050
Assaying	0.024
Precipitation	0.056
Refining	0.055
Water	0.108
Surface and plant generally	0.016
Steam heat	0.007
Watchmen	0.032
Storehouse and office	0.016
Stables	0.003
Lighting	0.021
Superintendence and foremen	0.063
General	0.011
Electrical department	0.011
Returning water	0.026
Mill total	$1.652

Mill operation	$1.488
Repairs and maintenance	0.164
Concentrate plant:	
Operation	0.377
Repairs	0.033
Total	$2.062

Cost of Supplies	
Cyanide	$0.328
Zinc-dust	0.034
Lime	0.091
Lead acetate	0.058
Water	0.108
Belting	0.013
Lubrication	0.007
Borax	0.006
Litharge	0.009
Pig lead	0.004
Shoes and dies	0.023
Pebbles	0.060
Tube-mill lining	0.019
Chilean mill steel	0.022
Chilean mill screens	0.006
Filter cloth	0.003
Assaying	0.021
General stores	0.121
Total supplies	$0.933
Total labor	0.388
Total power	0.332
Total costs	$1.652

The Wedge Mechanical Furnace

By L. S. Austin

The Wedge calcining furnace, of the same general type as the McDougall and Herreshoff, has been before the public for some years, and its general appearance is familar to metallurgists. It differs from the Herreshoff principally in having a large central shaft. The furnace is built in sizes from 12 to 22½ ft. diameter, and with three or more hearths and a dryer hearth. It may be arranged with a fire-box or not, according to the nature of the ore to be roasted. Fig. 1 is a seven and Fig. 2 a five-hearth furnace, the latter having a fire-box.

The ore is fed at the periphery of the furnace at the top or dryer-hearth, and is mechanically rabbled across it, entering the upper hearth at the centre of the furnace. By thus utilizing the top of the furnace for drying and preheating, the entering ore begins burning on the upper hearth almost at once, and need not wait until dried out. In fact, the heat used in drying out an ore containing 7% moisture may be computed as equivalent to raising the temperature of the dried-out ore to 250°C., at which a self-burning sulphide will begin to ignite.

The central shaft is 4 to 5 ft. diam., and is lined outside with fire-tile, so that it is not so hot inside but that workmen may enter at any time and remove the breech-block of any arm that is worn out. Workmen on the outside withdraw the arm through one of the doors and insert a new one, the men inside again replacing the breech-block. Each arm, whether air or water-cooled, has its own supply and discharge-pipe, and hence independent regulation and replacement. The weight of the central shaft and attachments is not borne on a step, but on roller-bearings.

The furnace is built with flat firebrick hearths, since accretions are more easily removed from the flat hard surface, which is better adapted for uniform rabbling. Fig. 2, the fire-box furnace, has an external fireplace, so that it can be used for a dead roast or for a chloridizing or sulphatizing roast. The passage, or drop-holes, from hearth to hearth are left of ample area, so that the velocity of the upward-passing gases is low, and hence less dust is carried away by the air currents.

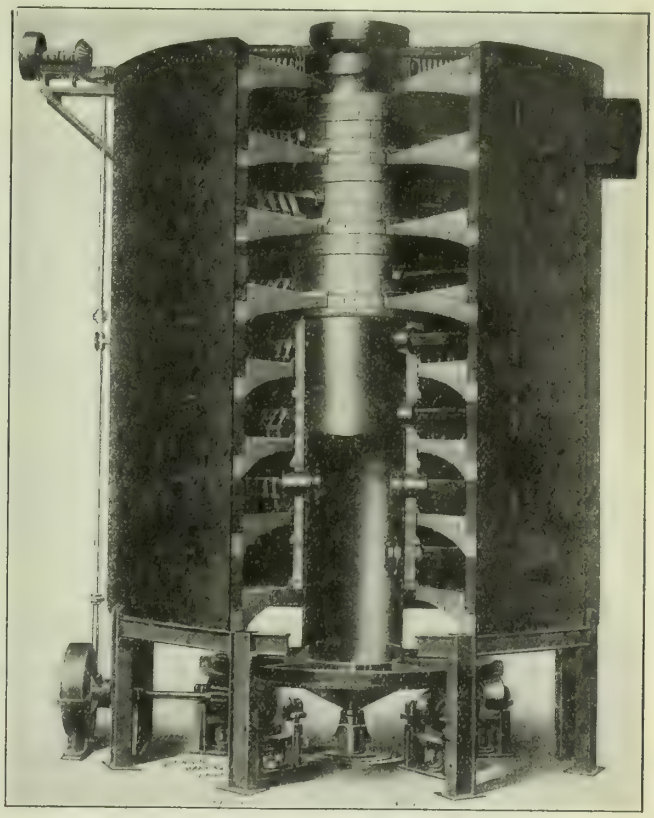


Fig. 1.

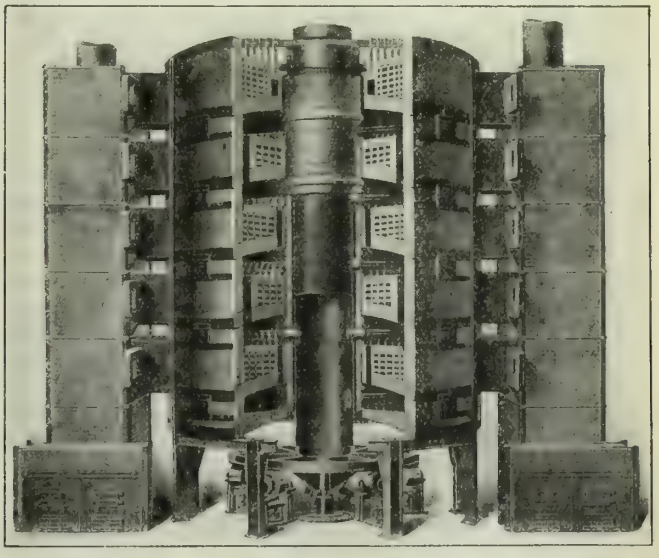


Fig. 2.

The Elmore vacuum plant at the mines of the Sulitjelma company, in Norway, produced 1126 tons of copper concentrate during the month of November.

Discussion

Readers of the MINING AND SCIENTIFIC PRESS are invited to use this department for the discussion of technical and other matters pertaining to mining and metallurgy. The Editor welcomes the expression of views contrary to his own, believing that careful criticism is more valuable than casual compliment. Insertion of any contribution is determined by its probable interest to the readers of this journal.

No Intentional Misrepresentation

The Editor:

Sir—My attention has been called to a published statement by the Director of the U. S. Geological Survey, to the effect that I misrepresented myself while in private work as still being connected with the Survey. This does me an injustice. In fact I was for some time a member of the Survey and am proud, perhaps foolishly so, of the connection. Since leaving the Survey I have used a limited number of cards, usually in a social way, upon which I was designated as a member of the Survey. In every case where such cards were used, I explained verbally that I am now in private work. It was my usual practice to mark out the offending line. In no case were cards used with the purpose, or as I believe with the result, of deceiving the recipient. In the particular instance causing the trouble, an unmarked card fell into the hands of one who, knowing the facts in the case thoroughly, none the less used it to injure me in retaliation for criticism I had passed upon wild-cat drilling for which he was responsible. From this small basis of fact the large burden of criticism has grown.

I was careless and indiscreet but I was not dishonest. Nothing was further from my thought than to injure the Survey or to obtain information under false pretenses. Such a policy is neither expected nor tolerated by the company for which I am working.

LEON J. PEPPERBERG.

San Francisco, December 20.

[We are glad to give place to this explanation. The Geological Survey must protect itself from any misuse of its name and the Director was naturally jealous of its good reputation. It is pleasant to know that in this case conditions were better than they at first appeared. EDITOR.]

Flotation Patents

The Editor:

Sir—An advertisement has appeared in your pages for some months past which I consider does me a substantial injustice. It is an advertisement inserted by the Minerals Separation American Syndicate, Ltd., and purports to describe the situation as regards patents claimed to be owned by the Minerals Separation, Ltd. I assert that this company does not own the process which it is now using and charging royalty for, but that the process now in successful use by them belongs to me and is described in my patent 787814, dated May 22, 1903. The advertisement cites the House of Lords decision in an action between the Elmores and the Minerals Separation, Ltd. This decision has no bearing on anything but the use of oil and acid, and it involved processes none of which are now in use. The company claims in its advertisement to have 15 patents. It is obvious to anyone who will take the trouble to read through these that there is only one of them that in any way refers to the process now actually in use, and this patent was taken out over a year after my patent, which clearly and without any ambiguity described the flotation concentration processes now being used.

The essential principle underlying the process now being successfully used for the flotation of minerals is the beating in of air and the 'over-treatment' of the pulp by violent agitation, and my patent is the first to describe and show how this can be applied in practice.

It has been unfortunate for me that for some years I have been unable to protect my rights, but I am glad to say that this difficulty is now removed and I intend to hold both the Minerals Separation, and any other person who may use my process, responsible for their infringement of my patents.

J. D. WOLF.

London, England, December 4.

Market Support

The Editor:

Sir—As a regular reader of your interesting and instructive journal, containing sound editorials and many excellent contributions from your readers, I, who am manager of a mining company now systematically developing its property for production, have been much impressed as well as much mystified at times at some phases of the phenomena of the workings of the human mind regarding mining investments. There would appear to be considerable confusion regarding what constitutes a real mine investment and what a mere stock-juggling guess on the course of the market.

From long-continued observation of the phenomena, it would appear as though the losers are generally those who buy mine shares merely for a quick turn, for the purpose of selling out at a rise as soon as possible. People of this class are not mining investors at all. So far as the mining industry is concerned they might just as well—or, in fact, better—bet the money on a prize-fight, a horse-race, or a poker game, for they would not then forever after delude themselves and mislead others with the old time-worn fallacy that they had 'lost money in mining.' The *real winners* in mine investments are those who buy a stock 'for keeps' (usually while low in price) and who profit by the intrinsic enhancement backed by constant development of the mine represented, and finally by the enormous percentage of dividend returns.

Quite a large class of mining investors, as would appear, have been led to believe that unless 'market support' of some particular stock is assured from the outset, the enterprise or mine represented must necessarily be of little value. Whereas, it is proved by the history of nearly every big mine out in this big Western country of prolific mines that exactly the reverse condition has been the case. In other words, speaking frankly, a mining company conscientiously, intelligently, and consistently engaged in the actual work of developing its property cannot 'carry water on both shoulders,' as it were, by using its funds in supporting the stock market and expect to properly develop its mine at one and the same time. This is especially true during the period when the money for such development is coming in through the sale of treasury stock at subscription price. Later on, of course, when ore shipments have become an established factor, it is possible for a mining company to support the market very easily, but as a rule there is then no longer occasion for doing so, for capitalists are then only too glad to do this for them, and without being asked. By this time, however, the stock has risen so in value that the ordinary investor no longer stands to secure his rightful share of the profit that would be due him had he purchased earlier, at or near subscription price.

The point I wish to make here, however, is that a mining stock is not necessarily bad for the reason that at the outset there is temporarily no established market support for quick convertibility, nor is it necessarily good for the reason that there is financial support 'at the market,' especially as long as the market is advancing. In fact, some of the worst 'packages' ever handed out in the past were those which were artfully 'supported' during the going up time or 'unloading' period. Is it not a fact that the *true value* of the stock of any mining enterprise is not necessarily determined by the stock-market price of its shares at some particular time, but in the last analysis is definitely decided by the actual economic relation of mine development work to productive capacity and earning power, with the estimated time of such production properly and safely discounted in the early price to allow of liberal profit, such as is found only in the business of mining?

MARK E. DAVIS.

Oakland, California, December 20.

The Bonanza Belt East of the Sierras

The Editor:

Sir—In the October 12, 1912, issue of the *Mining and Scientific Press* Mr. Storms has an article on 'Possibilities of the Mother Lode in Depth,' which interested me, not so much in the summary of what the different mines had done, as in the introduction which contains the arguments upon which he bases his conclusions. Of course he has brought out his now well known theory of the surface indications of ore-shoots and made this his main argument. In my limited experience and knowledge of the Mother Lode mines, I believe he is right. I also believe the broader principles of his reasoning apply to all mines. This pertains to the mines of the Mother Lode, which would come under one class and the same set of conditions would not necessarily apply elsewhere. However, in another district and another set of mines other general characteristics would apply and the successful mines would be found to exhibit certain similar conditions. I believe that in the whole so-called 'Bonanza Belt,' east of the Sierras, extending from Idaho into Mexico, an extent even larger than the Mother Lode, certain characteristic physical conditions accompany all the valuable mines and that a number of them can be classified. The similarity of these conditions is not only in surface indications and exposures, but in the general characteristics of the mines and districts as well. A careful study and comparison of some of the successful mines of this metallographic province will show a similarity of surface characteristics and without possessing these no prospect has made a mine or produced enough of the precious metals to be classified as successful.

In the past ten years the area under discussion has been studied in much detail by the United States Geological Survey and the contributions of W. Lindgren, F. L. Ransome, and J. E. Spurr contain many facts and suggestions relative to these points. Without going into a discussion of the various hypotheses of the genesis of the ore deposits and the ultimate source of the precious metals and ore-bearing solutions, it must be admitted that the conclusions of each of these geologists are so similar that it can scarcely be doubted that these various ore deposits were formed in the same general way, varying more or less in minor details, but in the whole producing orebodies possessing the same general characteristics throughout. In Professional Paper No. 42, U. S. G. S., 'Geology of the Tonopah Mining District, Nevada,' J. E. Spurr, in his comparison of this district with similar ore deposits elsewhere, goes into quite a lengthy discussion of this metallographic province and says: "Unquestionably the close relation between the Nevada mineral districts, Tonopah and the Comstock, with the far more numerous array in Mexico; and the individuality of this group as compared with other known veins of North America, shows a metallographic province." He concludes that at least in a large part this metallographic province coincides with the petrographic province of the Great Basin in which the general sequence of lavas is as follows:

1. Rhyolite. (Eocene).
2. Andesite (Miocene).
3. Rhyolite, with occasional basalt. (Miocene-Pliocene).
4. Andesite. (Late Pliocene—Early Pleistocene).
5. Basalts, and occasional rhyolites. (Pleistocene).

After a description of a number of mines in this province he gives the general characteristics of this group of veins as follows:

"They occur in Tertiary volcanic rocks of similar character in different localities, being chiefly Miocene andesites or rhyolites. They constitute strong masses or frequently branching and linked veins of quartz, which have as gangue essentially quartz, with frequently a little calcite, while adularia, barite, rhodochrosite, or rhodonite may also be present in limited amount. The ore is characteristically a silver-gold one, silver being usually predominant, though the relative proportions may be reversed and in some extreme cases either metal may occur with little admixture of the other. In any case the abundance of silver or gold, or both, in reference to the lead, zinc, iron, etc., is characteristic. Silver sulphides, especially argentite, also stephanite and polybasite (with ruby silver) and gold, probably largely in the free state, are distinguishing features in the great majority of cases. Tellurides and selenides may also be present. Pyrite, blende, chalcopyrite, and galena are usually present in varying quantity. Where they become predominant the vein becomes relatively low grade. Tetrahedrite, stibnite, and bismuthinite are also known to occur. The wall rocks are characteristically much altered to quartz, sericite, chlorite, calcite, epidote, pyrite, and sometimes adularia. Frequently the rocks nearest the veins are chiefly altered to quartz and sericite, those farther away to softer 'propylitic' alteration, consisting of calcite, chlorite, pyrite, epidote, etc. The rich ores occur in irregularly outlined portions of the lode called bonanzas. These bonanzas are of limited extent both horizontally and vertically. They are believed to have arisen as a consequence of the irregular intersection of transverse fractures or fissures with the main vein channel, producing maximum enrichment in these portions. Intervening portions may be low grade or barren. In the oxidized zone, silver chlorides and bromides, free gold, manganese oxide, etc., occur."

These general characteristics apply to the mines both as to surface and depth. I shall confine myself strictly to surface indications and formulate certain characteristic conditions that have existed in all of the successful mines of this province and must necessarily be found at the surface in any new prospect before any assurance of its successful development into a mine can be given. They are as follows:

1. The country rock should be Miocene andesite or dacite or a close connection with these formations should be shown.
2. The zone should show extensive fissuring (what is called a good break) with indications of strong cross-fracturing.
3. The zone should show extensive surface alterations, silicification near the vein, propylitic alteration farther away.
4. The zone should show some high-grade ore on the surface, not necessarily a continuous streak or in great quantity.

That the first condition is necessary, is evidenced by the fact that all of the successful mines in this province are either in this formation or connected with it. Spurr says in this connection: "In this metallographic province ores occur in Miocene andesites in the great majority of cases and their formation followed soon after the eruption of these rocks. In occasionally recurring cases (such as Silver City and De Lamar, Idaho, and others) they appear in Miocene-Pliocene rhyolites, which succeeded the andesites. . . . In general, however, the Miocene andesites of this province are, as Humboldt noted, the metalliferous formation par excellence."

In *Economic Geology*, Vol. IV, No. 5, W. Lindgren, in discussing metallogenetic epochs, places these ore deposits in class 5—deposits of the late Tertiary epoch with characteristics as follows: Ores, gold and silver. Lead and zinc not conspicuous, copper not abundant, tellurium and antimony are common. Continuing, with reference to these deposits in the late igneous rocks and the association of certain rare metals with certain magmas, he says: "Large areas of volcanic rocks are barren. The metal deposits seemed to have formed at or near the foci of igneous activity where connection could be established with underlying magmas. . . . Metallization is also dependent on the nature of the rocks in which the deposition takes place. . . . It is well established that magmas of different types contain different associations of the rare metals. . . . At the same time rocks of a given general composition may, in different localities, vary considerably in the quantity of rarer metals contained. Our knowledge of the contents of rarer metals in igneous rocks is fragmentary, but it is at least often the case that ore deposits formed after the eruption of an igneous rock will contain the rarer metals characteristic of it. It may be true that for each differentiated rock type there are corresponding types of deposits, varying with the conditions of deposition."

The similarity of the deposits under discussion is no

doubt due to the fact that they were formed at or nearly the same time by the same general volcanic activity, and the magmas from which they were derived were of the same general type and composition. Also to the fact that the andesites which were erupted at this time and in which the deposition has taken place are of the same nature. F. L. Ransome, in describing the geology of the Goldfield district, separates the Miocene flows into andesite, dacite, and latite, the two latter being of practically the same age and of the same general composition as the andesite. In all probability they are simply a differentiation of the same magma. Ore occurs in the three formations. It is quite reasonable to believe that the ore deposits of the Miocene rhyolites in the few scattering mines in this province are derived from the underlying andesitic magmas. However this may be, the great preponderance of the occurrences in the Miocene andesites establishes my first premise of the necessary surface conditions for a successful mine in the district, namely: The formation should be Miocene andesite or dacite.

Secondly, the zone should show extensive fissuring (what is called a good break) with indications of strong cross fracturing. This would seem to be a self-evident truth, but in considering the great number of veins in the andesites that are absolutely barren or of such slight content as to be worthless, it is apparent that something was lacking in their formation necessary to make commercial ore. In nearly every instance the successful mines in this belt are found at or near a deep-seated fault plane extending to depths not yet reached and accompanied by branching faults and extensive cross fracturing. The whole constitutes a great fractured zone, through which the mineralized waters and vapors have circulated, depositing minerals and replacing country rock. It looks reasonable to suppose that this deep-seated fault has opened the way to the source of the metals below. The Comstock lode is a vein four miles long, which has formed in Tertiary eruptive rocks, chiefly andesites, along a fault line, having a maximum displacement of three thousand feet. Tonopah, while not showing any one fault as extensive as this, has hundreds of smaller ones extending to depth.

In Goldfield, the main Columbia Mountain fault traverses the district its entire length and although the ores, so far discovered, are not found in the fault, they are found in the crushed and faulted country directly east of it, the hanging wall side of the fault. The faults found here are secondary and may connect with the main fault in depth. Writers describe the veins of Pachuca and Rey del Monte as analogous to Tonopah and the Comstock, in that they occupy deep fault fissures. At National, Nevada, the main fault fissure extends for several miles across the country and the bonanza gold and silver ore is found directly in it. The Nevada Hills mine at Fairview shows a great number of faults and a number of them are deep seated. As a rule it is the hanging-wall side of the fault that has moved and in moving has been crushed and fractured, thus forming a zone of easy access for the mineral-bearing solutions. The large number of successful mines in Mexico in the andesite formation are all similar in this respect, so it must be concluded that it is a necessary condition and without this extensive fault breaking a prospect in this province will not 'make good.'

The third condition, that the zone should show extensive surface alteration, silicification near the vein, and propylitic alteration farther away, is directly dependent on the second condition. Without extensive breaking and faulting the mineralizing solutions, vapors, and gases could not circulate freely and there would be put little metasomatic action. On the other hand this condition might exist without metallization. The solution might be barren of metals and the silicification and propylitic action still take place over a large broken area with the result of not producing a mine or even a surface prospect. Nevertheless it is a condition that is attendant on all the successful mines of this province and therefore a necessary surface indication linked with the preceding condition number two and the following one, number four. Becker, Spurr, Lindgren, and Ransome have discussed this condition in many of its phases in some detail in a number of their reports.

Condition four is that the zone should show some high-grade ore on the surface, not necessarily a continuous streak or in great quantity. The showing of this ore indicates that the circulating solutions, vapors, or gases carried the precious metals in such quantities as to form in favorable places commercial ore. With the three preceding conditions present it then becomes almost a certainty that ore-shoots of good size will be found. I think I can safely say that there is not a valuable mineral zone in this whole province that does not show at some place, somewhere in it, high-grade ore cropping on the surface which was either the top of an ore-shoot or an indication of an ore-shoot. One of the most important characteristics of these mines is their bonanza or high-grade ore-shoots, and it is from these bonanzas that their great production is made and not from large bodies of low-grade ore. Without the bonanzas they would be very ordinary mines, and it is this characteristic which places them in the successful list. Without possessing this high-grade ore on the surface in the favorable places (such as the intersection of the main fissure with a cross fracture) I would not hope or expect to open much of a mine in depth. In using the word mine, I do not wish to be understood as confined to claim lines on the surface, as often an ore-shoot rakes from one claim into another at depth though the latter has no surface showing and belongs to another corporation. In reality the whole vein and ore-shoot forms one mine.

It is not to be understood that the four conditions outlined are all in which a similarity exists among the successful mines, but when found on the surface in an undeveloped prospect the chances for opening a successful mine are exceedingly favorable. The work of examining and determining these features on the surface in this metallographic province is greatly relieved by the absence, in many instances, of trees, underbrush, and deep accumulations of soil—different in this respect from many parts of the Mother Lode country. With the first three conditions found, the presence of which is quite easily determined, intelligent prospecting should disclose in a short time whether or not the fourth condition exists. If it does the money and time spent in development will not be wasted.

H. C. Cutler.

Reno, Nevada, December 10.

Bureau of Mines Expenditure

Estimate of expenditure for the Bureau of Mines for the fiscal year June 30, 1913, to June 30, 1914, is as follows:

For general expenses	$70,240
For investigating mine accidents	347,900
For fuel investigation	135,000
For investigation into the treatment of ores, and other mineral substances	250,000
For inspecting mines in Alaska	6,500
For books and publications	2,500
Toward the erection of a suitable laboratory for Bureau of Mines at Pittsburg	115,000
For the collection of statistics concerning accidents in the mining industry, etc	25,000
For the purchase or lease of land for headquarters for mine safety cars	2,000
Total estimated expenditure	$954,140

The increases asked for include $4140 for general expenses, $27,900 for investigating mine accidents, $200,000 for investigation into the treatment of ores and other mineral substances, $1000 for the purchase of books and other publications, $115,000 toward a new fire-proof laboratory, and $25,000 for the collection of statistics concerning accidents in the mining industry and other interests.

Iron ore shipments from Lake ports for the year are estimated at over 47,000,000 tons. The principal shipping ports are Superior and Duluth, each of which furnishes about one-quarter of the total shipments.

Special Correspondence

FAIRBANKS, ALASKA

WORK OF THE MILLS.—HIGH GRADE ORE.—RAILROAD EXTENSION.

Only good reports come from the plant of the Chatham Mining Co., where the 4-stamp mill is in constant operation. According to late reports, it is an easy matter to supply the mill with ore. While the vein will probably average 2 ft. or less of good ore along the length of the adit, in one place on the shoot a width of 3 ft. of excellent grade is maintained for 30 ft. The owners are well satisfied with their purchase. The lack of snow and consequent impossibility of hauling wood has caused the operation of the Willis & Larson 5-stamp Hendy mill to be very intermittent. The mill has only been in operation a few weeks and no clean-up will be made till a wood supply guarantees a reasonable tonnage. Plenty of good ore awaits the mill both from the lease held by the owners of the mill, Willis, Larson, Greske, and Rodset, and from other leases in the neighborhood. Lee Green and Lysle Brown will have 100 tons to run through by the first of the year. They hold a lease on part of the Jupiter-Mars group.

The 2-stamp Hendy mill erected at the Rexall claims by Horton & Cooper has just been completed and will be crushing steadily the remainder of the winter. Plenty of ore is blocked out to now assure an adequate supply for many months. The last two lots of 10 tons each averaged $170 and $65 per ton respectively. Since the milling of these two shipments at the Fairbanks test mill, no ore has been crushed. The Rexall property should be a good producer. The Little Giant mill erected by Furstenau & McCarty is still idle, as the drifts on the 140-ft. level have not as yet cut the ore-shoot found above. While waiting for the Pennsylvania to produce ore, the mill will handle any customs ore brought in. The operation of the mill, judging from the ore already crushed, seems to be very successful and has proved a good gold saver for the local class of ores.

After finishing assessment work and the cutting of necessary timbers, Cook Bros. on Fairbanks creek, have started driving an adit on the vein found by them several weeks ago. Where opened, the ore was high-grade and it is expected that several thousand dollars will be produced this winter by shipping to customs mills. The last reports from the Crites and Fallman property are very encouraging, the same high-grade ore being found in the adit as showed in the prospect holes above. Competent judges say that for the development work done, the showing made is as good or better than that made by the Rhoads-Hall property at that stage of development. It is very probable that a mill will be put on next summer, as 100 ft. more driven on the adit in the same kind of ore will assure a fortune for each of the owners.

It has come to light that the figure $100,000 given as the option price on the claim owned by H. H. Hoover was grossly exaggerated, $30,000 being nearly the correct figures. The people holding the option are busily engaged in tracing the Crites and Fallman vein across this property and will probably take up the option later. Thirty-seven ounces of quartz gold was brought to town recently by Charles Watson, who claims to have found a pocket on lower Fairbanks creek. The gold had been pounded out without amalgamation. The position of the find is still secret.

Good news to the quartz miners is the fact that the Tanana Mines railroad will extend its line next year from Chatanika up Cleary creek. The shortage of wood will be relieved, freight rates lowered, and communication with town made shorter by this extension. The increase in volume of freight going to the quartz properties exclusively has decided the manager to make this extension. While the properties being worked are going ahead fast, it is astonishing to note the number of good prospects lying idle; prospects as encouraging on the surface as the ones being developed. That such a condition will not last very long, however, is a conservative guess. The regular heavy clean-ups from certain properties have started a quiet movement to tie up good properties and chances are that next spring and summer the movement will become a scramble.

Since moving the 5-stamp mill to its permanent position on 11 Above Cleary creek, the Newsboy company has had two clean-ups of $4600 each. While the first was produced from 225 tons of ore, the record resulted from a 100-ton run. The foreman reports plenty of ore on hand to run half time till the 3rd level is opened and more stopes opened on the 2nd level. While development work is going on at the mine, customs work will be done at the mill.

JOHANNESBURG, TRANSVAAL

IMPROVED MINING CONDITIONS.—VENTILATION OF RAND MINES

Since the passing of the recent legislation of various kinds with the object of preventing miners' phthisis in the Witwatersrand mines, there has been, as a result, a striking improvement in the underground conditions largely due, no doubt, to the onerous cost the compensation clauses of the Insurance act were likely to inflict upon the mines if the old conditions were allowed to continue. There can be no doubt that the greatest benefit has been derived from the more general use of water underground with the object of preventing the circulation of dust. In fact, instead of some of the miners complaining about the scarcity of water supplied to them for this purpose, their complaints are now mainly that not only have they now too much water forced upon them, but they are compelled by the mine officials to use water so as to comply with legislation. Generally speaking, the underground conditions have considerably improved, confirming the statement I have frequently made that unless compulsion were used at all the mines on the Rand to the same extent to get the miners to use water, there was little hope of improvement, owing to the cure being regarded as so simple that those concerned were not inclined to adopt it. It is not at all unlikely that owing to the more general use of water underground and the improved conditions brought about, that miners' phthisis may become as rare as it has recently been prevalent on the Rand.

Attention has also been called to the inadequate manner in which the deep-level mines of the Rand are ventilated. The other day the manager of the Cinderella Deep said that the highest temperature underground there was in the neighborhood of 82°F., and that it was no small task to induce the natives to work in such high temperatures. Now, 82°F. is not at all a high temperature for a South African negro to work in, and as it is well known that at this particular mine the negroes do complain about the hot workings, the temperature in some places must be nearer 90 than 80°F. Now that mining operations have attained a considerable depth on the Rand, it behooves those in charge of the mines to see that they are properly ventilated, for it is evident that at a depth of 5000 ft. from the surface something more than natural ventilation will be required. It is quite true that every mining group of importance has adopted fan ventilation for the deep mines during the past two years, but the mere fact that 200,000 cu. ft. of air may be passing through the fan chambers does not prove that the mine is well ventilated. The hanging and foot-walls on the Rand are so stable and sound, as a rule, that permanent cavities allow much of the air to escape by a short cut without passing through the stopes, many of which are quite as hot as before artificial ventilation was introduced. To ventilate a gold mine on the Rand is no easy matter; the warmed-up current of air becomes more attenuated every yard through its short circuiting to the upcast shaft, and there are so many ways in which it escapes that by the time the stopes are reached the current has practically disappeared. It must not be overlooked that fan ventilation has the effect of drying the underground atmosphere by the extraction of thousands of gallons of water in the shape of moisture, and it is here that the advantage of well spraying the underground workings will make itself felt. While there is

much room for improvement in the distribution methods on the Rand, the more general use of water for the destruction of dust has brought a welcome change for the better in underground conditions. So far as can be seen at present, there is no reason to prevent the mines on the Rand becoming the most healthy as well as the most profitable from a miner's standpoint of any in the world.

NEW YORK

FACTORS IN THE COPPER MARKET.—THE DOE RUN DISPUTE.—NOTES OF COPPER MINES.

The old-fashioned idea of the real test of strength among young men gathered together either at work or at play was designated 'pulling square hold.' Two contestants, grasping a pitch-fork handle, seated themselves facing each other upon the ground with the soles of their feet planted squarely against one another; the victor was supposed to pull his antagonist into a standing position. Something akin to this primitive tug-of-war now exists between the copper producer and the copper consumer. The rounding up of the copper situation has been frequently discussed in this column, as a typical working out of concentrated control of an industry such as has come to prevail in so many and varied lines. It is only a natural consequence therefore that the consumers and the crowd which is in control of the copper metal market should be 'pulling square hold' with the price of copper metal between them instead of the pitch-fork handle. The metal market is almost stagnant, with the sellers of copper refusing to budge from the price of 17¾c. and the consumers refusing to come into the market at this price. Discussion has again become rife as to the various phases of the copper supply and a good deal is being said about the withholding of blister copper from the refinery vats, and alleged discrepancies between refinery output and known production at the mines. For some reason the copper metal market seems always to have been a temptation to large pools with great financial strength, though the final chapter in nearly every attempt to corner copper has been one of disaster. Recent testimony before one of the congressional investigating committees was given by John D. Ryan regarding the copper manipulation of 1907 when the metal reached its record price, the slump being followed by a long and rather disastrous period for the copper producers. In the recovery from that period the present concentrated control was perfected, and the market stabilized. It is an important development that the Federal authorities are about to begin an investigation of the copper metal market, looking especially to the concerted action between the principal sellers of copper, the Phelps-Dodge Co., the United Metals Selling Co., and the American Smelting & Refining Co. It is significant that Amalgamated Copper should have had aggressive support on the day the announcement first appeared. There exists no stronger financial aggregation than that which is now in control of copper, indeed it may almost be said that it includes almost every one of the financial groups of the heaviest weight. The gross financial resources of this body of men and institutions are as nearly limitless as is possible. If the law department of the Federal Government in its endeavor to bring to book the violators of the so-called Sherman anti-trust law is looking for a test case wherein to assail the forces opposed to it, where their greatest strength is massed, a better point of attack could not be chosen.

The fight which is being waged against the officers of the Doe Run Lead Co. has been brought to New York, and the complaining stockholder, Robert Holmes of St. Louis, has petitioned the Attorney General of the state of New York to bring an action for the removal of the officers and directors. The complainant alleges that he owns, together with various members of his family, some 56,600 shares of stock, and complains of various specific acts of mismanagement in the conduct of the Doe Run Lead Company in connection with the St. Joseph Lead Co. and the Mississippi River & Bonne Terre Railway Co. in the handling of notes and bonds, the purchases of supplies, and payment of salaries. The officers of the Doe Run Lead Co. and the St. Joseph Lead Co. are practically the same.

Congress has been petitioned for an enlarged appropriation for the Bureau of Mines. The data gathered by the Bureau show some surprising conditions. The layman had rather been inclined to take it for granted that mine conditions, outside of coal mines, were not greatly in need of investigation or readjustment. From the data so far accumulated the death roll in lead, zinc, copper, and other mines seems to be unduly high, both as to those caused by accident, and those resulting from tuberculosis. It is something of a matter of surprise to learn that coal miners do not suffer as much from the last named cause as the workers in other mines. A share of the energies of the Bureau of Mines is also to be devoted to a search for metallurgical methods that will permit of the winning of a profit from ores of the various low-grade mining districts of the West. Every move in this direction is to be applauded and seconded with enthusiasm and it is no disparagement to the Bureau of Mines to say that in taking up this work its director J. A. Holmes tackled a very large problem and one which has engaged the attention and taken the capital of many individuals and organizations.

The Shattuck-Arizona Copper Co. has declared a dividend of 50c. per share. The last dividend paid was in January 1911. At present the Shattuck is shipping but 250 tons of ore per day, but this shipment is to be doubled within a short time. The trades which have been under way for the Shattuck property are evidently being held up while the value of the mine is demonstrated; undoubtedly the result will be to force the would-be buyers to pay high for the property if it is to be taken over. The company has recently come back as a dividend payer and a shipper of metal, and is to sell its product through Adolph Lewisohn & Sons. Lewisohn & Sons also handle the output of the Miami for the General Development Co., and from these two sources will have the marketing of about 4,000,000 lb. of copper per month. The Inspiration Consolidated Copper Co. has placed an order with the American Bridge Co. for some 8000 tons of steel to be used in the new plant, foundations for which are just going in.

The Alaska Gold Mines company, which has been several times compared with the so-called 'porphyries,' or low-grade milling copper properties, bids fair to carry out the comparison in a striking way. As was the case with Chino and with Braden, the orebodies are proving to be much larger than first estimated. It is said that the present development justifies the multiplication by four of the first tonnage estimate of 50,000,000. The construction of the 6000-ton mill is just about to begin, and the management is already anticipating the necessity of adding 14,000 tons daily capacity within two years, and is talking of a profit of $7,000,000 annually.

Walter L. Fisher, Secretary of the Interior, makes some interesting suggestions in his annual report in regard to the present mining law. On this point Mr. Fisher writes as follows: "It is becoming increasingly evident that the lode mining law needs changing in one respect, at least. The law at present does not provide for the creation of any rights in supposedly mineral land, except by the issuance of patents, and in that regard Congress has provided that a patent can follow only on a legal location and has said 'but no location of a mining claim shall be made until the discovery of the vein or lode within the limits of the claim located.' This law seems to be ill calculated for a district where, as is the case notably in some of the copper mining districts, the ore lies at depths of hundreds and sometimes thousands of feet. The expense of actual discovery of the vein or lode within the limits of any particular claim in such cases involves deep exploration, either by drilling or by the sinking of a shaft from the surface, or the extension of a tunnel into the claim. Either of these operations may involve great expense, and it has been repeatedly urged on the department that investors are reluctant to spend the money required without further assurance than the law as it reads at present can give them. "It seems possible by a change in the law to keep in force the policy of the gov-

ernment expressed in the mining law of rewarding the actual discoverer of valuable veins, while at the same time giving such protection during the work preliminary to actual discovery as would make it possible for capital to invest, taking no more risk than that inherent in the question whether there is or is not in fact valuable mineral in the place where it is sought." Mr. Fisher's suggestion is full of meat, but he fails to touch upon one of the most pernicious factors in deep-level mining districts; the doctrine of apex rights as now established by the courts.

At the annual meeting of the stockholders of the New York and Honduras Rosario Mining Co. this week, Ambrose G. Todd, J. Ralph Jacoby, and Sidney Abenheim were elected to the board of directors to succeed L. F. Valentine, William Kengel, and Ernest Shernikow. The board of directors immediately organized by electing Lewis L. Clark first vice-president to succeed L. F. Valentine, and Sidney Abenheim was elected the second vice-president. The other officers and directors were reëlected.

SPOKANE, WASHINGTON

North Washington Mill.—Progress in Chewelah District.

A group of claims bordering on the Spokane Falls & Northern railway, about 20 miles north of Republic, and owned by the Phoenix Gold & Copper Mining & Milling Co., is being operated by an adit, now in 230 ft. The plan is to drive it a total of 1800 ft. The portal is distant 700 ft. from the railway track, at an elevation of 140 ft. The object is to intersect six contact veins bearing gold, silver, copper, and lead, which vary in width from 6 to about 100 ft. The veins are contacts between porphyry and limestone, and of fair size. The result of the last clean-up at the North Washington Power & Reduction Co.'s mill, on November 30, was a bar of base bullion weighing 266 lb., valued at $10,740. The Ben Hur Leasing Co. is shipping 10 carloads of ore per week to the Granby smelter at Grand Forks, British Columbia. The ore is reported to be increasing in value. The Republic Mines Corporation has closed down the Surprise mine, where operations will be suspended until the termination of the suit for damages against it by the Quilp Gold Mining Co. In the meanwhile ore is being drawn from the Lone Pine mine to keep the North Washington Power & Reduction Co.'s mill running.

In the Metaline district the Lead & Zinc Mining Co. has put on 50 men, and is surveying for and building a wagon-road on a convenient grade, to be used later on for an electric railway. The company is preparing to erect a mill for which the machinery has been ordered. A power line will be built from the power-plant of the Inland Portland Cement Co. to the lead and zinc mines for the purpose of operating a compressor and power drills at the mine by electric power.

In the Chewelah district operations will be resumed next March on the Imperial mine, when a pump will be installed and the shaft will be continued down to the 300-ft. level. A pump is being installed at the Blue Star mine, now under lease to Mark Mitchell, the president of the Blue Star Mining Co. The United Copper Co. has finished a 200-ft. adit on the Widow's Mite claim, one of the United Copper group. The Widow's Mite claim adjoins the Blue Star, from which the highest grade silver ore in the district has been taken. Development work is being done on the claims of the United States Copper-Gold Mining Co. by F. A. Eickmeyer, a stockholder. The bulk of the work is the extension of an adit on the east line of the company's group of claims which is expected to tap the main vein inside of 30 ft. The Orient Gold Mining & Milling Co., Ltd., is sinking a shaft, now down 140 ft. The 100-ft. level has been opened by a drift 55 ft. and a cross-cut 85 ft., all in quartz which assays from $15 to $20 per ton in gold and silver and a little copper. Small streaks of exceedingly rich ore have assayed as high as $33,000. The company is talking of installing a concentrating plant.

RHODESIA

Shortage of Water-Supply. — Reorganization of the Mines Department

The chief topic of conversation both in mining and agricultural circles is the drought. The position daily is becoming more serious. Farmers all over Matabeleland and Mashonaland have suffered severely, and several mines have had to suspend milling operations in consequence of acute shortage of water. Unless heavy rains fall at an early date, many more properties, among them some of the leading producers of the country, will be in a parlous plight, and wholesale restriction of output will be inevitable. In Southern Rhodesia the rainy season commences usually about mid-October and continues to the end of March or early in April. During last season, however, little rain fell, and it looks as if 1912-13 will be an even more dry season than the preceding one. As an instance of the severity of the position, the Sebakwe river, from which the Globe & Phoenix obtains most of its water and which normally does not run dry until October, dried up this year in April. The management of the mine dealt promptly and energetically with the problem of securing stored water and obtained sources of temporary supply at considerable expense. It was hoped this year's rains would be early, but this was not the case and the situation is causing much anxiety.

On the Witwatersrand the mines secure large supplies through the Rand Water Board, of which all the Main Reef

MILL AT THE WANDERER MINE.

properties are members. In this country, however, there is no co-operative supply organization. Mines are dependent on adjacent rivers and streams, and in a less degree on the comparatively small quantities of mine-water pumped. The prevailing drought accordingly has put the majority of mining concerns in a very serious position, and unless there is a speedy change in climatic conditions wholesale closing down will result.

It is generally understood that the mining department of the British South Africa Co. is to be reorganized, but on what lines it will be effected is not known. A. H. Ackermann, resident mining engineer for the British South Africa or Chartered company, is in England, and it is believed the main object of his visit is to confer with the directors as to the future constitution and personnel of the Rhodesian Department of Mines. There has of late been considerable friction between the official Mines Department and the unofficial mining industry. In the first place, objection was raised to the formation of the Rhodesian Mines Development Co., and not without reason. This venture was formed by the Chartered company early this year for the purpose of prospecting and developing claims with the object of bringing properties to the flotation stage and the forming of subsidiary companies. The unofficial Chamber of Mines objected to the launching out of the Chartered company into the field of private enterprise on the ground that the Rhodesian Mines Development Co., being a subsidiary project of the government of the country, would enter the competitive arena on unduly advantageous terms. It was protested that the flotation of such an undertaking should remain in abeyance until the administrative and commercial departments were more clearly divorced than at present.

In another regard there has been considerable antagonism

between the mining industry and the Mines Department. Mr. Ackermann has lately reported on and superintended work at a number of mines in the capacity of consulting engineer. Professional and private consultants and metallurgists in Rhodesia have been up in arms against what they allege to be unfair competition from Mr. Ackermann's office. Henry Birchenough, one of the Chartered company's directors, was in Salisbury some little while ago and was waited on by a deputation of gentlemen representing the mining engineers and assayers doing business in the country. They protested against the resident Government mining engineer holding appointments as consulting engineer to private concerns, and to his staff making examinations of properties other than those of *bona fide* small workers (who are entitled to Government advice and assistance), and doing them, moreover, at prices that defied competition. The deputation was sympathetically received by Mr. Birchenough and it is probable that the whole matter will thoroughly be gone into during Mr. Ackermann's visit to London.

The syndicate of Johannesburg capitalists engaged in developing a cassiterite deposit in the neighborhood of Chishawasha valley, to the east of Salisbury, maintain a policy of secrecy. No official statements have been given, but it is understood that development continues to give highly encouraging results. It is believed that two or three of the leading Rand houses are interested in the discovery. Exploitation is to be hastened. A compressor plant should be working at an early date, and as the lode is stated to be exceptionally large, a good tonnage should quickly be blocked out and valued.

The Jumbo mine, in the Mazoe district of Mashonaland, has, unfortunately, to be added to the list of Rhodesian mines that have been tried and found wanting. At one time the company was earning substantial profits, but for months past it has been evident that the mine was on its last legs. The ore-shoot now appears to be exhausted and the consulting engineer holds out to shareholders no hope of any discovery which might redeem or save the situation. During the year the debentures have been substantially reduced, but there still is about £10,000 outstanding. The past year's work shows a loss of £27,490 as compared with £12,850 for the previous year. On June 30 the cash on hand, etc., amounted to £17,800, and at the best it would seem that the company will be able to do little more than pay off the remainder of the debentures. The property has been thoroughly tested and well managed, but the ore did not come up to expectations.

LONDON

India's Gold Absorption.—Work at Goss Moor.—Siberian Mineral Resources.

There is still no little discussion concerning India's absorption of gold. It does seem somewhat startling when it is considered that to no small degree the world's primary market for the yellow metal is at the mercy of one of the dependencies of the British Empire. The amount of gold absorbed by the Hindoos within the past fiscal year is estimated at 25% of the world's output. This taking of gold, large though it is, would not be specially important if the metal so absorbed remained liquid and moved back and forth as the exigencies of trade might demand, but of the gold which goes to India the percentage which remains in circulation is negligible. The overwhelming bulk of the metal is hoarded and lost to circulation. This Indian situation becomes particularly important at this time because it is recognized on all sides that both at home and abroad the necessity for liquidation is impending, and no inconsiderable amount of financing must be done in the industrial world within a short time, while abroad there is a huge war debt to be taken care of as soon as peace is finally restored. In the light of these factors the figures showing the imports of gold by India during the past five years, the decrease in silver importation, and the more than proportionate increase in gold imports are exceedingly interesting. The following table gives the imports of the two precious metals for the past five fiscal years, ended March 31, imports being for private account and the figures showing the equivalents in United States currency:

	Gold.	Silver.	Total.
1908	$56,270,250	$32,512,497	$88,782,747
1909	15,295,847	38,786,764	54,082,611
1910	70,279,103	30,369,395	100,648,498
1911	77,760,063	27,918,806	105,678,869
1912	122,490,684	17,167,435	139,658,119
Total, 5 yr...	$342,095,947	$146,754,897	$488,850,844

While the trade balance and metal imports are specifically a matter of concern as between London and Calcutta, how far the the drift of the yellow metal eastward is to affect the world's supply is of vital importance to America. The whole complicated structure of modern credit is, at least theoretically, based upon gold reserves, and in the maintenance of international credit gold is considered one of the prime factors in maintaining a just equilibrium.

During the past two years I have referred several times to the tin-gravel venture at Goss Moor, Cornwall, promoted by C. G. Lush, an Australian expert in gravel mining. Unfortunately, this venture is not so successful as expected. An account of the method of working was given in *The Mining Magazine* for July last, where it was shown that the alluvium is broken down by hydraulicking, and raised by a pump to a floating barge containing the sluice-boxes, this being a usual Australian practice. A new steam-plant, substituted for a suction-gas plant, commenced operations on August 15 last year, and during the 12½ months from that date to August 31 last treated 193,620 cu. yd. of gravel. The yield was 60½ tons of tin concentrate assaying 73% metal, and selling for £7561. The cost of operations and administration was £9642, so that the loss was £2081. The results are disappointing, and various suggestions as to the future have been made. One is to form a subsidiary company to treat part of the property on the northern side by a bucket-dredge. It is intended also to change the power again, this time to electricity, to be supplied by the local power company; it will thus be possible to use 5 or 6 small installations of barges, pumps, and monitors instead of a single large one as at present. The present cost per yard works out at 12d., which is double Mr. Lush's estimate, and compares with 5d., the figure quoted by him in connection with a property in Australia.

A very interesting report prepared by the Belgian minister to Russia covering the mineral resources of Siberia has just been given out. The northern part of Asia is one part of the globe which has not been explored in every quarter by the prospector, and the practically virgin character of this vast expanse of country has more than once drawn the attention of pioneers in many lines of industry. Extracts from the minister's report are as follows: Graphite exists in very large quantities in a mountainous region in the vicinity of Blagovestchensk, and these deposits are at present for sale. Gold-prospecting permits have been issued to the number of 664, and 30,000 workmen are employed in the gold-mining industry. There is little doubt that when the Amur railway is completed the output in the Amur province will be doubled. In most cases, however, the machinery is so far primitive in character. There are many deposits of silver, but the price of the metal does not encourage work upon them. Over 3000 tons of copper was extracted in 1911, the whole coming from western Siberia. Since the opening of the Trans-Siberian railroad, coal-mining has developed by leaps and bounds, and in one of the areas 20 of the collieries are state owned. Iron ore exists in many areas, and it is predicted that the Maritime province will soon become the centre of an important iron industry. Only lack of capital has prevented smelting works from being erected. The full development of the country depends primarily upon railway transportation, and until that has been improved progress must be slow, but at the same time great prizes may be secured by the adventurous in the course of development of an area so vast and known to be so rich in mineral wealth.

General Mining News

ALASKA

Cordova

On December 8 a disastrous snowslide occurred on Copper mountain, about 15 miles from Strelna, on the property of the Great Northern Development Co. The slide came with such force that the men who were in the buildings of the company were unable to escape. Four bodies were recovered, and five others were still buried at the latest advice. About a year ago a similar occurrence happened, but no lives were lost. The mines have been worked for eight years, and are well developed, and contain a large tonnage of fair-grade copper ore.

At the Dougherty property, on Shoup glacier, a drift has been driven 25 ft., and 205 sacks of ore saved. There are five distinct veins on the claims.

Fairbanks

O. P. Gaustad, from lower Cleary creek, has staked a water-right on the upper Chatanika river, and will erect a hydro-electric plant near the mouth of Pilot creek, a tributary of the Chatanika, above Cleary creek, and transmit power to the stamp-mills and mines in the Cleary and Fairbanks creeks districts. A ditch 11 miles long will be dug, and 5000 miner's inches of water required. A steam-plant will be operated in winter, when water is not procurable. Wood will be floated down the ditch in summer and stacked for winter use. It is estimated that there is over 100,000 cords of wood available near the proposed ditch.

Iditarod

The Guggenheims have acquired the Mohawk and Glen claims on Flat creek, and a small property on Otter creek, the price being $106,000. It is intended to erect two more dredges in Flat creek next season. A water right has been staked on Otter creek, and a ditch four miles long will be dug to carry water for a hydro-electric plant.

Juneau

During November the 240 and 300-stamp mills of the Alaska Treadwell company worked 27.71 and 29.05 days, respectively, crushing 29,708 and 45,108 tons of ore. From amalgamation $100,003 was saved, and from cyaniding 1539 tons of concentrate $95,504 was recovered, the total realizable value being $193,552. Operating expenses were $75,011, and construction $3983, leaving a net profit of $114,557. Development covered 651 ft., and the stock of broken ore decreased 10,593 tons.

Valdez

The Amalgamated Development Co., at Katalla, has six oil wells in operation, the newest producing 40 bbl. of high-grade oil per day. Next spring the company will continue boring operations. The Pacific Coal & Oil Co. also has large holdings near Yakataga, and along the coast between that place and Bering river, on which several thousand dollars are expended yearly in assessment work, which, it is said, is very closely inspected by Government agents.

ARIZONA

Cochise County

At the Turkey Creek mine, in the Paradise district, J. Q. Johnson and associates have opened 20 ft. of galena, and shipments will be made at once to El Paso.

Gila County

The Sleeping Beauty Copper Co., owning 20 claims, 10 miles northwest of Globe, are being worked by lessees, who are sinking an incline shaft 150 ft. Prospecting has opened promising gold, silver, and copper veins. A number of men are working at the new shaft of the Douglas Copper Co., which will be sunk 300 feet.

Excavation for the Inspiration mill has been under way for three weeks, and good progress is being made. Development at the Inspiration Consolidated during November was: Inspiration section, 3650 ft., and Live Oak section, 500 ft. Between the Scorpion and Joe Bush shafts 618 ft. remains to be driven, and 1300 ft. between the Scorpion and Colorado shafts. At the Joe Bush shaft 12,000 tons of ore is on the dump. The 80-ton waste pocket at Live Oak No. 2 is about finished.

Maricopa County

A 90-day option has been taken on the old dump of tailing of the Vulture mill, above Wickenburg, by W. H. Seamon, of the Swansea smelter. A few carloads will be used for experimental purposes. It is thought that the tailing will be used mostly for converter linings. There is about 80,000 tons in the dump.

Placer mining on an extensive scale will soon be under way in the San Domingo district, across the Hassayampa river from Wickenburg. About 500 acres, owned by Phoenix and Wickenburg people, will be worked by sluicing, and water will be secured from a pipe-line being laid to the Monarch mine, eight miles distant, the pipe passing over the placer ground. Years ago this field was extensively worked, but want of money for water-supply caused the placer to be deserted, after the coarser gold had been removed. Platinum has been found all over the district. The mill of the Monarch mine has now a full supply of water.

Pinal County

It is reported that the Guggenheims have bought the Black Diamond group of claims, in the Superior district, adjoining the Silver King mine.

CALIFORNIA

Amador County

(Special Correspondence.)—The cross-cut from the 500-ft. level of the South Jackson is expected to cut the vein within a short time. Good progress is being made. San Francisco people are interested. Jeffrey Schweitzer is manager. A heavy flow of water has been tapped by the drift from the Lincoln Consolidated shaft to the Wildman workings. Work at this point has been suspended until arrangements have been made to guard against accident. It is thought the drift has broken into the Wildman shaft workings. It is understood the parties holding a bond and option on the Doyle claims have been granted further time to make final payment. The suit to quiet title to the property was recently heard before Judge McSorley, and decree granted. Development at the Argonaut is reported to be satisfactory. This is the second deepest property on the Mother Lode, its 2800-ft. incline shaft being surpassed only by the vertical workings of the Kennedy. The Bunker Hill Consolidated Co. paid its regular monthly dividend of 5c. per share on November 15. This makes a total of $120,000 paid in 1912 and a total to date of $550,000. Good ore is being opened in the 1950-ft. workings. About 30 men are employed at the Plymouth Consolidated group, and it is reported that vigorous development with an increased force will soon commence. British capitalists are interested. The mine is situated near Plymouth. Rich ore continues to come from the Mountain King, in the Pine Grove district. The shaft is down 40 ft. and the shoot is stated to show uniform size and content; $4200 was obtained from the October clean-up. B. W. Pitts is owner. Seventeen mines are operating in the district tributary to Jackson. About 1600 men are employed. The monthly payroll approximates $112,000. The Jackson and Sutter creek districts are particularly active.

Jackson, December 14.

The 40-stamp mill of the South Spring mine, built in 1877 and not working during latter years, was burned on December 16.

Eldorado County

Work will be resumed at the Larkin mine, and 50 men will be employed. Motors are being installed in the 10-stamp mill. The Pacific mine, owned by Baring Bros., of England, is now being worked.

Lassen County

The California Gold Mining Co., which is working copper claims near Doyle, has cut a vein which carries plat-

inum worth $140 per ton, as well as gold and copper. The vein in the shaft is from 36 to 72 in. wide.

Shasta County

The Reid Mining Co. is constructing an aerial tramway one mile long to connect the mine with bins on a Southern Pacific siding on the opposite side of the Sacramento river. The cable weighs 3000 lb., and the whole will cost $20,000. During the past four years the Reid mine has shipped ore over the Mammoth Copper company's lines to ore-bins at Cuargo. The new line is really a reconstruction of the Central tramway, used for many years.

Sierra County

During November the 10-stamp mill of the Tightner mine, at Alleghany, produced bullion worth $78,000. The rich ore was stoped from the lower level, 3000 ft. from the portal of the adit, and is between the old Johnson shoot and the new Red Star claim.

Hydraulic mining is under way on an extensive scale in the western end of the county at Brandy City and Scales, the two companies operating at these points both having complied with the anti-débris regulations. The company at the former place has employed 40 men for over four years in building flumes, drains, pipe-lines, and a hydro-electric plant. San Francisco people are interested in the property. The Neocene company at Scales has been working for several years.

Yuba County

Argument in the water rights case of E. C. Horst Co. and others against the Tarr Mining Co. is concluded, and the matter is now under advisement. Plaintiffs assert that, from 1848 to 1910, the flow of water in the Bear river was always about 2000 in., but since 1910 the defendants have used so much from the upper reaches of the stream that crops raised near Wheatland are seriously threatened. The plaintiffs will be satisfied if 2000 in. is guaranteed them always.

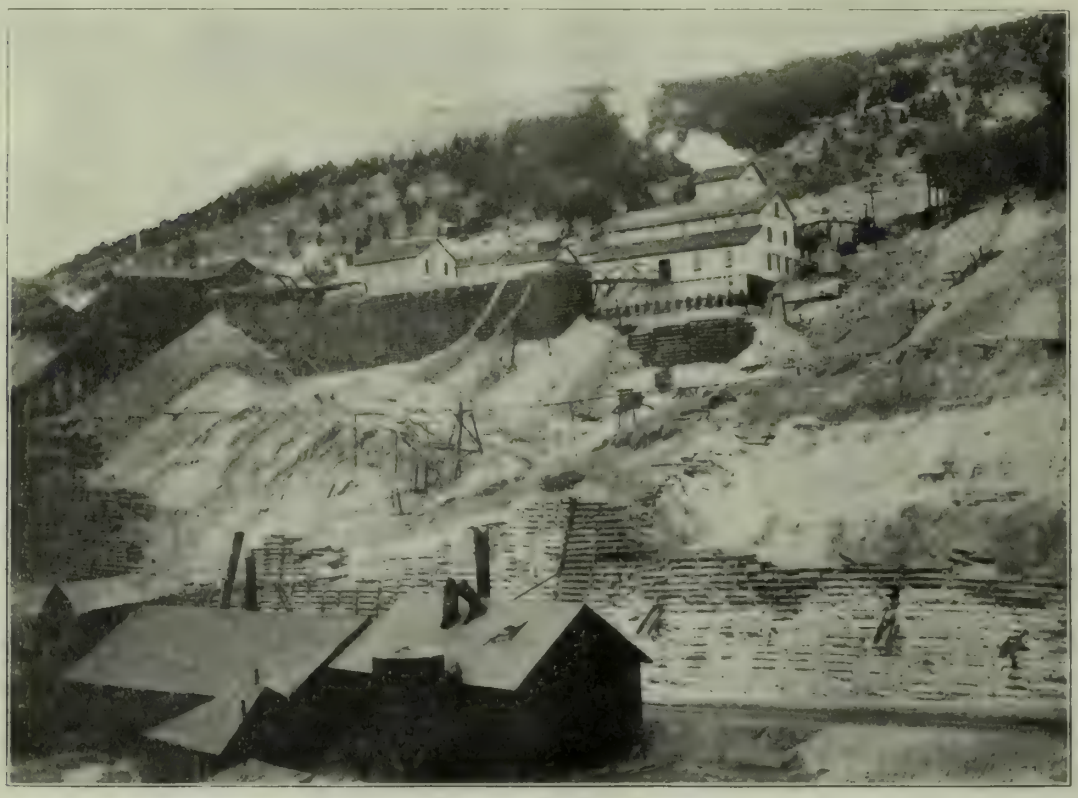
COLORADO

Clear Creek County

The Capital adit has been driven into Griffith mountain, from its base at the lower end of Georgetown, nearly one mile. At the Aetna vein, where the principal work is being done, it is over 1700 ft. below the surface. On this vein there are many lessees, and above the 300-ft. level the Capital company has a large number of men breaking ore for its mill or the smelter at Salida. Hummer & Herber's lease is the most productive, as their ore-shoot is 150 ft. long and from 8 to 60 in. wide, from which three cars per week are shipped. About 50 tons also goes to the Combination mill at Idaho Springs. An adit has been started by the Capital company to cut the Aetna vein at 500-ft. depth, and when this is done a shaft will be sunk to connect with the Capital adit workings, 1200 ft. below. This should make ventilation better also. The property should produce $200,000 this year.

Lake County (Leadville)

From the different properties of the Stars Consolidated, on Carbonate hill, shipments of different classes of ore amount to about 5000 tons per month. Lessees at the Annie have opened a large body of silicious flint on the 210-ft. level, and will make shipments. Thirty men are employed at the old Boston mine, Mayflower gulch, and a large ore-body has been opened. Mining men have recently visited the district with the object of erecting custom mills. Power has been connected to the Leadville district mill. The Iron Mask mill will be increased from 80 to 120-ton capacity, and will be equipped with new roasting furnaces, magnetic separators, and two new Wilfley tables. Lessees at the Little Giant, Dome, Rockefeller, Nevada, Little Jonny, and other properties, are busy with development and shipping ore.



A. Y. AND MINNIE MINES, LEADVILLE.

Teller County (Cripple Creek)

It is probable that, in the spring, a mill of 200 tons capacity, modeled on lines of the Portland, will be erected for the Midget-Bonanza company on Gold hill. St. Louis people are interested in the property. Encouraging results are reported from the 1600-ft. level of the Vindicator mine. The Portland company secured from the Denver Mint 800 new $5 gold pieces for Christmas distribution among its employees. This custom has been kept up by the company since its organization. Lessees working on No. 4 level of the Gold King mine are shipping four cars of ore per month, averaging nearly $40 per ton. J. C.

Clancy is leaving for New York, where he will take a place on the regular staff of the Moore Filter Company.

IDAHO

Shoshone County

Work has been started at the Tamarack & Custer Con. M. Co. The tramway, compressor, and mill are finished, and have been tried with satisfaction. Preparations are being made for erection of a mill at the Idora mine. It will consist of a crusher, rolls, elevators, concentrating tables, and jigs of the latest type, and will be of 75-ton capacity. It will be 12 miles from Wallace, and ore will be transported from the tunnel 600 ft., and then to the mill by a tramway 2000 ft. long.

The Hecla Mining Co. has paid a dividend of 5c. per share, amounting to $50,000, making $300,000 for 1912, and $2,650,000 to date. The 200-ton mill of the Interstate-Callahan Mining Co. will be ready by April 1913, and will cost about $125,000. A 450-ft. raise is being driven between the lower and intermediate levels of the mine, and high-grade silver-lead ore has been opened.

MONTANA

Lincoln County

(Special Correspondence.)—The last carload of concentrate from the Snowshoe mine, which was produced during the past season, was loaded last week for shipment to East Helena. From now on, probably the only work that will be done until spring will be to keep the property clear of water and in good condition. John J. Hibbard came in from his Wolf creek placer property last Friday and has been exhibiting a piece of quartz, thickly studded with gold, which he secured while working on his claims. The quartz has the appearance of having come from a vein at some point not far from where it was found, some of the edges being quite jagged and showing but little sign of having been water washed.

Libby, December 18.

NEVADA

Clark County

The Yellow Pine property, in the Good Springs district, is an interesting mine. Salt Lake and California people are interested in its development. Twelve miles of railroad was constructed to connect with the Salt Lake line. Down to the 550-ft. level the ore carries carbonate of lead and zinc, and Overstrom tables are used in the mill. About 1500 tons of zinc and 350 tons of lead concentrate are shipped monthly. Since April 1912 the company has earned $200,000, of which $130,000 has been paid in dividends.

Esmeralda County

The Darms Oil Co. will prospect the two seams of coal partly developed about four miles from Coaldale and six miles from Blair Junction, by core-drilling. The Okell driller will make a core 5 in. diam. from a depth of 1000 to 1500 ft. The seams were developed to 480 ft., showing one seam to be 3 ft. and the other 8 ft. wide. The new workings will be established about a half mile nearer the railroad, in level country.

A carload of ore has been delivered at the Goldfield sampler from the Vernal mine. The Bonnie Clare mill is treating over 1800 tons of Jumbo Extension ore per month. The ore is apparently too heavily mineralized to have over 2000 tons treated without increasing the plant. Two cars of concentrate were shipped in December to Tooele, and the average output of this product will be 125 tons per month.

Humboldt County

The Nenzel property in Rochester canyon has been incorporated under the name of the Rochester Mines Co., with a capital of $1,250,000 in shares of $1 each. A boom has set in at this district, and the road is crowded with teams of all kinds. Automobiles make two round trips per day from Lovelock. Two townsites have been laid out, and lots are selling fast. Twelve or fifteen lessees are busy, and others are starting work. The National Mines Co., at National, is erecting a hoisting plant.

Mineral County

Drilling for copper has been started at the Lon Stewart claim, east of Mina.

Nye County

During the week ended December 21 the mines at Tonopah treated 10,546 tons of ore worth $212,913. The Tonopah Mining Co. treated 13,953 tons in November, yielding $185,920 from 224,540 oz. of bullion, and $28,975 from 80 tons of concentrate, the net profit being $108,355. A dividend amounting to $400,000 will be paid on January 8, 1913, bringing the grand total to $10,050,000. The new Belmont mill treated 12,426 tons with a profit of $195,266 from 369,422 oz. of bullion containing $293,326 gross. On the 660-ft. level of the Extension the north vein is 10 ft. wide, of good ore. The Montana cut 2 ft. of ore on the 515-ft., 3 ft. on the 565-ft., and 3 ft. on the 615-ft. levels, all of which is profitable. At Manhattan good progress is being made with the Big Four mill. The company is treating 1000 tons of ore at the Brady mill, which should average $20 per ton. The mine is opening well, and is being sampled throughout.

Costs of sinking the Buckeye-Belmont company's shaft at Tonopah during November follows, the average hoisting distance being 1100 feet:

	Per ft. sunk.
Timber	$ 3.67
Powder	1.16
Electric power for—	
Hoisting	1.77
Ventilating	0.32
Compressed air	1.24
Miners	13.56
Smiths and timbermen	2.17
Other labor	2.56
Sundry	2.10
Total cost per foot	$28.55
Buckets of rock, water, men, etc., hoisted	1273
Number of sets placed	13
Hoisting costs per minute, cents	2

Storey County

The annual report of the Mexican Gold & Silver Mining Co. for the year ended October 31 gives the following details:

Ore treated at mill, tons	19,396
Ore shipped to smelter, tons	603
Gross value	$521,495
Net returns on ore production	453,203
Sundry receipts	11,669
Total revenue	464,872
Average extraction in mill, per cent	92
Expenditure included:	
Operating expenses (including pumping, $107,696)	$287,021
Mill construction, etc.	54,868
Legal, sundries, company notes, etc.	37,948
Supplies on hand, unsold bullion, and cash in banks	85,035

The 2300, 2400, and 2500-ft. levels supplied the bulk of the ore, and at present there is 4750 tons of broken ore, worth $99,255, in the stopes and on the surface. At present stoping is being done on the 2500-ft. level. During the year the mill and cyanide plant was completed, the total cost being $104,214, and it is now treating over 500 tons per week. The total cost of mining, milling, and treatment, exclusive of pumping, was $8.97 per ton. Since the report, the Monte Cristo and Keyes properties have been acquired, and progress has been noted in these columns from time to time.

During the year ended November 30 the Ophir company mined 8436 tons of second-class ore, and treated at the Kinkhead mill 9495 tons, yielding $28.40 per ton. Stored in ponds near the mill is 22,600 tons of tailing, valued at $6.51 per ton, which is now being treated by the cyanide plant recently erected, and described in the *Mining and Scientific Press* of November 30. Jointly with the Consoli-

dated Virginia company, the 1465-ft. station of the Ophir shaft was repaired. From the 2100 and 2200-ft. levels second-class ore was mined. Work was resumed on the 2500-ft. level in April, and the southwest drift was advanced 444 ft. and is out 651 ft. to the south boundary. Quartz veins were cut, but most of the rock passed through was porphyry. At the C. & C. pumping shaft the pumps are working well at the three stations, No. 2 Reidler being under repair during the week ended December 21. The Crown Point hoisted 696 mine-cars of ore, worth $4500, from the 1400-ft. level, the Yellow Jacket 306 cars, and Belcher 36 cars, the gross value being $6000. Shipments to the Yellow Jacket mill were 733 tons. From the raise on the lode at 2500 ft. in the Sierra Nevada, 20 cars worth $25 per ton were saved. The Mexican mill treated 581 tons of ore averaging $20.10 per ton, with 92% extraction.

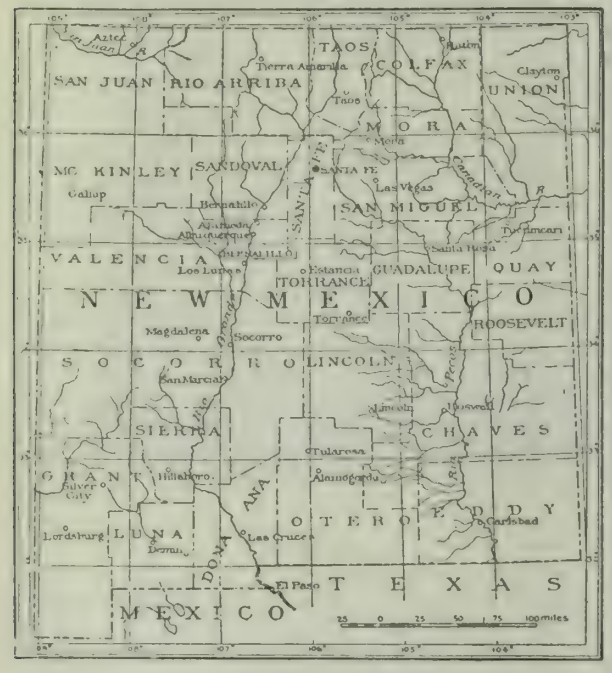
NEW MEXICO

Grant County

Work on the tunnel which is to connect the Chemung Copper mine at Tyrone with the mine at Leopold is progressing with a large number of men. When the proposed shaft is sunk midway between these two places, the number of men will be increased. Mining at Fierro is active, the Colorado Fuel & Iron Co. shipping large quantities of ore daily.

Sierra County

The new mill at the U. S. Treasury mine at Chloride, in the Black Range district, is ready for work. It consists of Morrison crushers, which grind the ore to 100-mesh size, oversize from the screen being returned to the mill



MAP OF NEW MEXICO.

for regrinding. The machine is said to be like a tube-mill, only the quartz in the ore does its own grinding instead of using flint pebbles as is usual. Daily capacity is about 50 tons. At the mine, a shaft is down 306 ft., and development has proved a fair quantity of silicious ore, with a little sulphide and carrying gold and silver.

High-grade ore is being shipped from the Silver Monument to smelters. The old workings have been opened by an adit 1500 ft. long, but the best orebodies are below this adit. A large tonnage of low-grade ore has also been opened.

Socorro County

(Special Correspondence.)—During the week ended December 13, 745 tons of ore was treated at the Ernestine mill, producing 57 sacks of high-grade concentrate. The third 10-day clean-up of November yielded 9350 oz. of bullion and 4.2 tons of concentrate. The electric hoist at the Little Charlie mine of the Mogollon company is working well and hauling 40 tons per day. From The Oaks Co. regular shipments are being made to custom mills. Development in the lower levels of the Deadwood mines is opening good ore. The Socorro mill treated 1100 tons during the week. The Trilby and Apache groups are being developed, the former's 200-ft. level being in ore.

Mogollon, December 13.

OREGON

Baker County

It is stated that the Standard mine, near Prairie City, will be again worked by the Utah Copper Co. Several years ago 100 men were employed. There is a complete mill on the property, which has not been worked for some years and recently was the subject of several lawsuits.

UTAH

Juab County

At the Victoria mine electric power is used on the hoist, and the new compressor is being installed. A recent ore shipment of 60 tons brought a settlement of $60 per ton. The Lower Mammoth is mining good zinc ore at the 1500 and 1600-ft. levels, and in the west drift of the former level 15% ore has been opened which, while not profitable, is of importance in development. From the Grand Central mine about 100 tons of ore, worth $200 per ton, was sent out, while 100 tons of copper ore will average about $65 per ton. A prospecting winze is being sunk from the 700-ft. level of the Opohongo mine. Four cars of ore are shipped each week. On December 18 the Eagle & Blue Bell company hoisted 175 tons of shipping ore from the 700 to 1350-ft. levels, and the average quantity for the week was 150 tons per day.

Salt Lake County

The Ohio Copper Mining Co. made a net profit of $32,500 in November. On one day last week the two units of the mill dealt with 2400 tons of ore. The work of removing the Wall rolls from No. 2 section is not completed yet.

Tooele County

W. Wraith, who has been with the Anaconda company for seventeen years, during the past nine years as superintendent of the Washoe reduction works, has been appointed general manager for the International Smelting & Refining Co. At present the company is not working its copper smelter owing to scarcity of ore. Two lead furnaces are working, and two new ones will be ready within six weeks.

WASHINGTON

Stevens County

The Arcade Mining Co., of Chewelah, will be reorganzide and the capital increased from 500,000 to 1,500,000 shares of $1 each. Machinery will be installed at the mine, and as soon as a depth of 200 ft. is reached ore will be stoped for shipment. The first diamond-drill exploration in this district will be started in January by the International Diamond Drill Co., which will drill several thousand feet in the claims of the United Copper and Aurora Copper Mining companies. Some high-grade copper ore has been mined from the 120-ft. level of the High Grade mine, near Chewelah. It is mainly a black oxide of copper carrying silver.

BRAZIL

From March to August, 1912, the St. John del Rey mill treated 91,958 tons of ore worth $1,070,000, a decrease of 4642 tons compared with the same period of 1911, but the yield was 38c. per ton higher. Profit amounted to $350,000. Labor has been scarce owing to railroad and municipal work in progress. The mine is showing good results, the lowest, No. 17, horizon showing a length of 1028 ft. of ore, 12.5 ft. wide. A dividend of 18c. per share was paid.

Iron and steel men on or near the Atlantic coast are much

interested in some negotiations now in progress in London, attention being focused upon the Itabira Iron Ore Co., Ltd. This company, which is an English corporation, holds certain concessions covering three properties in the district of Itabira, in the province of Minas Geraes, Brazil. It is understood that there is now being formed a corporation with a capital of $100,000,000 by financiers of the continent and of London, including the Rothschilds, the Barings, Sir Ernest Cassel, and a group of American bankers whose identity is not yet revealed.

CANADA

British Columbia

The Granby company has closed contracts worth $700,000 for equipment at its Hidden Creek mines, Granby bay. The Pelton Water Wheel Co. received a contract for water wheels; Traylor company, the furnaces, converters, settlers, crushers, and sampling machinery; Connersville Blower Co., the blowers; Nordberg company, the compressor plant; Hallidie company, the traveling cranes, etc.; Brown Hoisting Machinery Co., hoisting apparatus; and the Westinghouse Electric & Manufacturing Co., rolling stock, consisting of two 43-ton, six 12-ton, and eight 6-ton electric locomotives and twenty-five 25-ton steel ore-cars. At the Hidden Creek mines diamond-drilling has proved better than expected. The Grand Forks smelter treated 1,263,000 tons of ore from the mines at Phoenix during 1912, yielding 22,650,000 lb. of blister copper, 356,376 oz. of silver, and 52,359 oz. of gold, at a cost of $2.38 per ton for mining and treatment.

Cobalt

During the week ended December 13, nine mines shipped 533 tons of ore, and the Nipissing company sent out 49,679 oz. of bullion. The Hudson Bay Mining Co. paid $23,283 in dividends on December 20. During November the Nipissing washing plant was not working all the time, but is now treating from 250 to 300 tons per day. Hydraulic work was discontinued on November 30 owing to cold weather. The high-grade mill treated 134 tons of ore worth $168,707. In the low-grade mill 10 to 15 stamps were started during the month.

Porcupine

The Swastika main shaft is down 400 ft., and 12 ft. of ore worth $15 per ton has been cut. Enough ore has been developed on No. 1, 2, and 3 levels to keep the mill busy for two years. The final shipment of machinery for the mill has reached the mine. At the McIntyre, 25 men are working on the new mill. The old 10-stamp mill is crushing ore from the dump at No. 2 shaft. Fifty men are busy on the pipe-line from Porcupine lake to the Dome mine, which will supply water during the winter. In connection with the strike, two special cars of 50 and 60 strike-breakers arrived for the Hollinger and Dome mines, respectively. They were not molested. There seems to be no chance of the mine-owners and strikers coming to an agreement.

MEXICO

Chihuahua

The Federal army in this state numbers over 11,000 men, and the rebels number about 3000, as against 12,000 when Orozco was personally directing the campaign. The Banca de Sonora, at Alamos, Sonora, received on December 10 bullion worth ₱180,000 from the Rio Plata Mining Co., situated in the Arteaga district of western Chihuahua. This consignment was carried on burros and was not molested on the five days' journey.

Jalisco

Jose Martinez and Jose Castanos, who were in command of the rebels near Juanacatlan, in this state, have surrendered. Other rebels are said by Portillo y Rojas, the governor, to be leaving Jalisco, in view of the fact that the inhabitants in many parts of the state have taken arms against the lawless and are fighting them wherever they are found.

Sonora

In expectation of trouble among the Mexican miners employed by the Greene-Cananea Copper Co., all saloons have been closed and the garrison of Federal troops increased by 150 men. On December 18 750 Mexican miners struck work on refusal of the companies to grant an increase of 25% in wages and an eight-hour day instead of nine. Later on the Cananea Consolidated company offered to reduce the hours to eight and a half, effective January 1, 1913.

The United States Graphite Co., owner of Lapiz mine at La Colorada, is shipping three carloads of graphite per week to Saginaw, Michigan. The San Xavier mines have between 3000 and 4000 tons of ore on the dumps which cannot be moved on account of lack of freighters. The Yaqui Indians are causing so much trouble in that district that it is impossible to get men to haul this ore out. The cyanide plant of the Creston Colorado, at Torres, is treating 350 tons per day.

At El Tigre, during November, the old mill crushed 2667 tons of ore, the stamp-mill crushed 3207 tons, while the cyanide plant treated 5658 tons of current and 1649 tons of dump tailing. From ore shipped, concentrate, and cyanide plant, the total yield was $139,567. Costs, including freight, smelter, and taxes, were $81,415, leaving profits at $58,152.

Universities and Mining Schools

The University of Idaho, Moscow, will offer courses similar to those given to miners and prospectors at the University of Washington, at a winter session opening January 5. The courses include surveying, laboratory work, mining, treatment of ores, and bookkeeping.

The University of Washington, Seattle, will begin a three months' mining session on January 7. This course of instruction in mining, metallurgy, and related subjects is open to everybody without any restrictions in regard to previous training or experience. To the prospector who wishes to learn something which may be of value to him in his useful work, this opportunity to spend three months in the laboratories of the university is now offered. The work is arranged to suit the needs of the individual, and no charges are made for instruction, save that students buy their own books and supplies. Board and lodging may be secured close by at a moderate cost.

The University of Wisconsin is now giving instruction by correspondence in many engineering studies, including 16 courses in electrical engineering, 8 in mechanical drawing, 24 in mechanical engineering, and 16 in structural engineering. Instruction by correspondence is also given in many other subjects of importance to engineers, such as mathematics, chemistry, geology, and mineralogy. These courses include subjects which are usually given chiefly by lectures and recitations, and others which are largely laboratory work, such as shop sketching and topographic surveying. Recently a course has been added in microscopic petrography, given by A. N. Winchell, and in connection with work in mineralogy and economic geology as previously given, this should be of special value.

The Massachusetts Institute of Technology, in its bulletin for December, gives full details of everything in connection with the school. In the department of mining engineering and metallurgy are nine instructors, who give lectures and superintend laboratory work and the summer school. The work presupposes that the preparatory courses in mineralogy, geology, and surveying, given in preceding years, have been taken. Second year's work with lectures on mining engineering and metallurgy, is followed in the third year by lectures on mining methods generally. Ore dressing in the fourth year is taught by lectures and extended laboratory work. The student is given a wide experience in actual metallurgical work and checks his results by assays and chemical analyses at appropriate stages of the process. Applicants for admission to the Institute of Technology are, in general, required to pass the entrance examinations. Tuition fee for regular courses is $250 per year. Examinations are held each year in January and May. The second term of the year 1913-14 commences on February 9.

Personal

Professional men are invited to send news of their engagements and travels. Such news is interesting to friends.

HENRY HANSEN is in town.

L. C. TRENT is at the Palace.

F. H. DAKIN, Jr., is in town.

H. H. WEBB has gone to the Rand.

GEORGE KINGDON was in Bisbee recently.

L. I. ROWLAND is at Oakland, California.

J. G. FOLLANSBEE was at El Paso recently.

C. J. EGELSTON has gone to Salt Lake City.

EDMUND JUESSEN has returned from Colorado.

C. E. JAMISON has gone East for a brief stay.

M. FARRAGGI has returned to Europe from Peru.

C. R. CORNING has gone to Europe for six weeks.

R. P. F. PRAIN was at Buenos Aires last month.

D. W. SHANKS was in San Francisco and has gone to New York.

JACOB W. YOUNG, of Marysvale, Utah, has moved to Philadelphia.

WILLIAM A. KRIPPACHUE has gone to Seattle from Cordova, Alaska.

WILLIAM B. PHILLIPS is operating a silver-lead mine near Alpine, Texas.

M. H. KURYLA was married on December 21 and has gone to Mexico.

J. W. METZGAR is manager for the Goldfield Merger Mines Company.

W. F. DEANER, manager for the Original Amador mine, is in San Francisco.

WILLIAM R. JEWELL has returned to Bakersfield from examination work in Utah.

C. H. KREMERS is now engineer for the Mammoth smelter, at Kennet, California.

W. H. CASE has returned to El Paso from examination work at Courtland, Arizona.

R. FYFE KERR, general manager for the Guadalupe y Calvo mines, is at the property.

W. H. PAUL, formerly superintendent of the Dolores mine, in Chihuahua, is now at Denver.

L. F. S. HOLLAND will return to Telluride, Colorado, on January 1, from Arizona and Nova Scotia.

PRICE MCKUMEY and JAMES W. CORRIGAN paid a recent visit to the Concheno mine in western Chihuahua.

B. C. JACKSON, who was formerly with the Caribbean Petroleum Co., at Caracas, Venezuela, is now at Los Angeles.

RALPH B. WILLIAMS, formerly of El Paso, Texas, is now with the Minas Dolores y Anexas, Matehuala, San Luis Potosi, Mexico.

GELASIO CAETANI will deliver a course of lectures at Harvard University early in February, after which he will go to Europe for a brief stay.

WILLIAM WRAITH has been made general manager for the International Smelting & Refining Co., and will remove to Salt Lake City from Anaconda on January 1.

Obituary

ROSWELL E. SAMPSON, assistant professor of metallurgy in the State College of Washington, at Pullman, was struck and instantly killed by a Northern Pacific train on the morning of December 12. Mr. Sampson was a native of Medford, Massachusetts, and a graduate of the Massachusetts Institute of Technology, class of 1907. His first professional work was that of assayer and surveyor for the Marietta Mines Co., near Mina, Nevada, after which he was engaged in ore-testing work for the Huff Electrostatic Separator Co. of Boston. He next joined the engineering staff of the Quincy mine at Hancock, Michigan, and later became assistant to his former teacher, R. H. Richards, in adapting the Richards classifiers to Quincy mill conditions. He joined the mining faculty of the State College of Washington in the fall of 1911.

Market Reports

LOCAL METAL PRICES

San Francisco December 26.

Antimony	12—12½c	Quicksilver (flask)	$39
Electrolytic Copper	18—18½c	Tin	52—53½c
Pig Lead	4.60—5.55c	Spelter	8¼—8¾c

Zinc dust, 1400 lb. casks, per 100 lb., small lots $9.50—9.75; large $7.50—8.50

METAL PRICES

(By wire from New York.)

NEW YORK, December 24.—In the copper market there was this week more business than last with a good demand from Europe for early shipments. Lead prices were firmer, consumers buying more freely at the lower prices. Spelter remained unchanged. Average daily prices for the past week, in cents per pound, based on wholesale transactions, standard brands, are given below.

Date.	Electrolytic Copper.	Lead.	Spelter.	Silver, per oz.
Dec. 19	17.38	4.13	7.13	63¼
" 20	17.38	4.13	7.13	63
" 21	17.38	4.13	7.13	62¾
" 22	Sunday.	No market.		
" 23	17.38	4.13	7.13	62¾
" 24	17.38	4.13	7.13	62½
" 25	Holiday.	No market.		

LONDON QUOTATIONS

(By cable, through the courtesy of C. S. Burton & Co., New York.)

	December 26.
Camp Bird Ltd	$ 5½
El Oro	4½
Esperanza	9½
Oroville Dredging	1½
Santa Gertrudis	7½
Tomboy	6½

COPPER SHARES—BOSTON

(By courtesy of J. C. Wilson, Mills Building.)

	Closing prices, December 26.		Closing Prices December 26.
Adventure	$ 5	Mohawk	$ 59
Allouez	38	North Butte	32¾
Calumet & Arizona	69¾	Old Dominion	53¾
Calumet & Hecla	525	Osceola	106
Centennial	16½	Quincy	77
Copper Range	50	Shannon	13
Daly West	3½	Superior & Boston	1½
Franklin	8	Tamarack	33¼
Granby	68½	Trinity	4½
Greene Cananea, ctf.	9	Utah Con	10⅛
Isle-Royale	31¾	Victoria	1¾
La Salle	4¾	Winona	3¾
Mass Copper	5	Wolverine	69

NEVADA STOCKS

(By courtesy of San Francisco Stock Exchange.)

San Francisco, December 26.

Atlanta	$ .19	Montana-Tonopah	$1.75
Belmont	8.20	Nevada Hills	1.37
Big Four	.55	North Star	.24
Buckhorn	.85	Ophir	.22
Con. Virginia	.27	Pittsburg Silver Peak	.72
Crown Point	.25	Round Mountain	.30
Florence	.58	Sierra Nevada	.21
Goldfield Con.	2.05	Tonopah Extension	2.35
Halifax	1.25	Tonopah Merger	.83
Jim Butler	.64	Tonopah of Nevada	6.30
Jumbo Extension	.28	Union	.16
MacNamara	.18	Vernal	.10
Mexican	1.12	West End	1.25
Midway	.32	Yellow Jacket	.25

MINING STOCK QUOTATIONS—NEW YORK

(By wire from C. S. Burton & Co., New York.)

	Closing Prices. December 26.		Closing Prices. December 26.
Alaska Mexican	$ 13	McKinley-Darragh	$ 1¼
Alaska Treadwell	39½	Miami Copper	25¾
Alaska United	23¼	Mines Co. of America	3½
Amalgamated Copper	76½	Nevada Con	19¾
A. S. & R. Co.	72½	Nipissing	9¼
Braden Copper	10½	Ohio Copper	1
B. C. Copper Co.	4½	Ray Con	21½
Chino	44½	Tenn. Copper	36¾
First National	2	Tonopah Belmont	8½
Giroux	3⅛	Tonopah Ex	2¾
Goldfield Con.	2⅛	Tonopah Mining	6½
Greene-Cananea	8¾	Trinity	6¼
Hollinger	15½	Tuolumne Copper	3½
Inspiration	17½	Utah Copper	58½
Kerr Lake	2⅜	West End	1⅜
La Rose	3	Yukon Gold	3
Mason Valley	10½		

James Lewis & Son's Copper Report

During November the price of standard copper has moved in accordance with the varying prospects of an early peace being concluded between the Balkan states and Turkey, and with the fear of intervention.

From £75 7s. 6d. on November 1, cash prices advanced to £76 7s. 6d. on November 8, but declined to £76 on receipt of the American refiners' statistics on November 11, recovering to £78 10s. on November 18, from which point there was a gradual drop to £76 7s. 6d. on November 26. Changes since have been small, between £77 2s. 6d. and £76 7s. 6d., closing prices on December 2 being £76 17s. 6d. for cash and £77 12s. 6d. for three months prompt. Sales totaled about 35,000 tons. There was only a moderate demand for refined copper, and that was chiefly for early delivery, the quantity available being limited. Japanese electrolytic sold at £80 15s. per ton c.i.f. for January delivery, but for American £82 was asked, larger producers holding for 17¾c. per pound, at which price a fair quantity has been sold for home consumption, and a moderate for export. Manufactured has been in fair request.

American shipments during November were advised as only 19,146 tons. As production for that month is not likely to show any relative reduction on October, and as the large deliveries for home consumption during that month are stated to be due to pressure to ship Lake copper before the close of navigation, an increase of about 10,000 tons in refiners' stocks appears probable. European stocks have decreased 4085 tons, and the visible supply 3060 tons during November. Imports were 1844 and deliveries 9092 tons less than during the same month of 1911. Total arrivals in England and France were 13,108 and deliveries 16,717 tons fine, and from other countries 8712 and 10,127 tons respectively. Arrivals at Liverpool and Swansea from the United States were 1175 tons of bars and 260 tons of ingots, equal to about 1432 tons fine; in London, 250; and in France 2459 tons fine. Chile charters for the month were advised as 2150 tons, including 550 tons for the United States. Quotations December 2 were: Standard, £76 17s. 6d. for cash, and £77 12s. 6d. for three months prompt; English best selected ingots £82 15s. to £83 5s.; and tough cake, £82 10s. to £83 per ton, less 2½% delivered at Birmingham. Electrolytic wire bars, £81 10s. to £82 net cash c.i.f.; 13s. 9d. to 14s. for ore of 20%, and 14s. to 14s. 3d. per unit for Chile regulus, or American silver-free matte.

STOCKS OF COPPER (TONS FINE)

	1912			
	Jan. 1.	Oct. 1.	Nov. 1.	Dec. 2.
Chilean in—				
Liverpool and Swansea..	4,225	5,279	5,303	5,159
France	714	987	951	951
American in—				
Liverpool and Swansea..	12,939	1,887	1,303	819
France	4,033	5,975	5,344	3,359
Sundries in—				
Liverpool and Swansea..	786	1,065	1,111	868
London and Newcastle...	6,462	3,969	3,580	3,294
Birmingham	346	470	453	200
France	507	622	628	563
English in—				
Liverpool and S. Wales..	17,346	16,879	16,627	16,478
Total in England and France	47,358	37,133	35,300	31,691
Sundries in—				
Germany and Holland...	13,400	3,737	3,041	2,565
Total European stocks.	60,758	40,870	38,341	34,256
Afloat (as advised by mail and cable to date)—				
From Chile	1,575	1,825	2,400	2,725
From Australia	8,350	5,250	5,600	6,300
Total visible supply...	70,683	47,945	46,341	43,281

India as a Precious-Metal Market

Some interesting figures are made available in the joint report compiled by the Bureau of the Mint and the U. S. Geological Survey, covering gold and silver production in 1911 and 1910. The gold produced in the United States in 1911 was 4,687,053 oz., valued at $96,890,000. This is an increase of about 30,000 oz. over the output of 1910 and a decrease of 134,000 oz. under the output of 1909, when the production was 4,821,701 oz., valued at $99,673,400. In connection with the precious-metal production of the world, the position of India continues to attract attention. India has been for so many years looked upon as a steady absorber of silver that it is not to be wondered at that its turning into a hoarder of gold would upset the calculations of the economists. The reason why the absorption of gold by India is a particularly disturbing feature compared with its absorption by any other nation of the world, is that of the gold shipped to India 90% or more is withdrawn from circulation, nor has it any representative medium to pass from hand to hand in commerce. Instead, it is hoarded in such a way as to be almost as completely locked up as when it was in its primeval condition underground. It is pointed out that in the past five years India has absorbed 12% of the total output of gold, and that this absorption is increasing. As against a taking of 11.62% in 1907, India took to hoard away and to make into bracelets and anklets, 16⅔% of last year's output. It is difficult for the commercial nations of the world to realize that India can become to so large an extent a creditor nation. Especially is this true when the credit so held is in the form of hoarded metal instead of bills of exchange or book balances, or in any of the usual forms of international debits and credits. There is a most interesting field for speculation opened in this way in regard to the increase in commodity prices and the so-called problem of the high cost of living.

Growth of the Copper Industry

The copper industry in the United States has shown a notable growth, according to the United States Geological Survey. In 1845, when important production of copper in this country practically began, the output was but 224,000 lb., but it increased 100% the following year and gained by rapid strides until 1850, when the production was 1,456,000 lb. In 1870 it was 28,224,000 lb.; and in 1890 it was 259,763,092 lb.; in 1900 it had increased to 606,117,166 lb.; in 1909 it passed the billion mark, with 1,092,951,624 lb.; and in 1911 it exceeded all previous records with a production of 1,097,232,749 lb. The world's production in 1911 was 1,958,201,285 lb., of which 56% was the output of the United States.

It is noteworthy that, unlike areas producing most other metals, not one of the leading copper districts of the United States, several of which have been active producers for a period of 30 years or more, has been worked out or showed a marked decrease in its ability to produce copper. Twelve districts situated in eight states have each contributed over 100,000,000 lb. to the copper output of the country, or a total of 94% of the whole output of the United States since 1845. Four of these districts are in Arizona, two in California, and one each in Montana, Michigan, Nevada, New Mexico, Tennessee, and Utah. Two districts stand out prominently, the Butte district, Montana, which has contributed over one-third of the output of the country, and the Lake Superior district, Michigan, with a production of a little less than one-third of the total output.

Arizona ranks first among the United States in the mining of copper, according to the United States Geological Survey. It ranks sixth in the production of silver and seventh in the production of gold. These three metals constitute 98% of the total production of the state, which amounted to $43,483,912 in 1910 and $44,104,731 in 1911. The value of the copper product alone represents 86% of the total output.

Recent Publications

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AN INVESTIGATION OF EXPLOSION-PROOF MOTORS. By H. H. Clark. Bureau of Mines, Bulletin No. 46. 44 pp.; ill. Washington, 1912.

MECHANICAL PROPERTIES OF REDWOOD. By A. L. Heim. U. S. Department of Agriculture, Circular 193. 32 pp.; charts. Washington, 1912.

COMMERCIAL FEEDING STUFFS. Purdue University Agricultural Experiment Station Bulletin No. 161. 248 pp.; index. Lafayette, Indiana, August 1912.

COAL MINE ACCIDENTS IN THE UNITED STATES. By F. W. Horton. Bureau of Mines Monthly Statement. Technical Paper No. 27. 24 pp. Washington, 1912.

PLIOCENE AND PLEISTOCENE FORAMINIFERA FROM SOUTH CAROLINA. By Rufus Mather Bagg, Jr. U. S. Geol. Survey Bulletin 513. 153 pp.; ill., index. Washington, 1912.

CULVERTS AND SMALL BRIDGES FOR COUNTRY ROADS IN NORTH CAROLINA. By C. R. Thomas and T. F. Hickerson. State Geol. Survey Paper 28. 56 pp.; ill., plans. Raleigh, 1912.

HIGHWAY WORK IN NORTH CAROLINA. Report on road work in 1911. By J. H. Pratt and Miss H. M. Berry. State Geol. Survey Paper 27. 145 pp.; ill., maps. Raleigh, 1912.

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WATER RESOURCES OF A PART OF OWENS VALLEY, CALIFORNIA. By C. H. Lee. U. S. Geol. Survey Water-Supply Paper 294. 135 pp.; ill., maps, plans, tables, charts, index. Washington, 1912.

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THE MINING DISTRICTS OF THE WESTERN UNITED STATES. By J. M. Hill, with an introduction by Waldemar Lindgren. U. S. Geol. Survey Bulletin No. 507. 309 pp.; maps, index. Washington 1912.

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SURFACE WATER SUPPLY OF THE UNITED STATES. Part X, The Great Basin. By E. C. La Rue, F. F. Henshaw, and E. A. Porter. U. S. Geol. Survey Water-Supply Paper 290. 264 pp.; ill., map, index. Washington, 1912.

THE PRODUCTION OF EXCESSIVE HYDROGEN SULPHIDE IN SEWAGE DISPOSAL PLANTS, AND CONSEQUENT DISINTEGRATION OF THE CONCRETE. By W. M. Barr and R. E. Buchanan. Iowa State College Experiment Station Bulletin No. 26. 16 pp.; ill. Ames, Iowa, 1912.

SURFACE WATER SUPPLY OF THE UNITED STATES. Part IV, St. Lawrence River Basin. Prepared under direction of M. O. Leighton by C. C. Covert, A. H. Horton, and R. H. Bolster. U. S. Geol. Survey Water-Supply Paper 284. 125 pp.; ill., index. Washington, 1912.

THE SULPHIDES OF ZINC, CADMIUM, AND MERCURY; THEIR CRYSTALLINE FORMS AND GENETIC CONDITIONS. By E. T. Allen and J. L. Crenshaw, with microscope study by H. E. Merwin. Reprint from the *American Journal of Science*, October 1912. 56 pp.; ill. Washington, 1912.

Book Reviews

Any of the books noticed in this column are for sale by, or can be procured from, the MINING AND SCIENTIFIC PRESS.

INDEX OF MINING ENGINEERING LITERATURE. By W. R. Crane. 445 pp.; index. John Wiley & Sons, New York, 1912. For sale by the *Mining and Scientific Press*. Price $3.

A work of this description is useful to those who find it necessary to refer to important articles published in technical journals, such as in an editorial office, contributors to such journals, or others in search of information. It may be considered up to date at the time of publication, after which it must be supplemented by one of the indexes published regularly by one of the well known journals or societies. This volume is carefully prepared, well arranged, and generally represents a great deal of labor on the part of the author, though only a rather limited number of publications have been indexed.

HANDBOOK OF MINING DETAILS. Compiled from the *Engineering and Mining Journal* by the editorial staff. 372 pp.; ill. McGraw-Hill Book Co., New York, 1912. For sale by the *Mining and Scientific Press*. Price $4.

Nothing is more interesting and useful than a well made scrap-book. For some time it has been the custom of the *Engineering and Mining Journal* to devote a few pages to short notes on details of practical work, either contributed by readers or prepared by the staff. In the course of time an enormous amount of material has thus accumulated, and a judicious selection of the best of this is here gathered together in convenient form for reference. Practically the whole field of mining work is thus covered; metallurgy is not touched upon. Numerous illustrations and a good index contribute not a little to the value of this excellent book, which is likely to prove one of the most popular books of the year. The price asked is unnecessarily high, since compilations such as this can be issued at small expense, but doubtless engineers will generally feel that it is well worth the money.

HIGH SCHOOL GEOGRAPHY. By Charles R. Dryer. 535 pp.; ill. American Book Co., New York, 1912. For sale by the *Mining and Scientific Press*. Price $1.30.

The study of geography exhibits perhaps to a higher degree than any other topic the enormous progress made in the presentation of scientific knowledge. Men who are still in their first youth can remember the folio volumes illustrated by crude and often inaccurate regional maps, and replete with poorly presented material of not unimpeachable accuracy, the efforts of teacher and scholar being concentrated upon the mastery of the boundaries of states and kingdoms, political features frequently of zero significance from a geographical standpoint. Even a hasty perusal of such a volume as this is stimulating by contrast. The physical factors which condition the topographical features are logically considered first, followed by the economical factors which are their result. Topography is considered last. The up-to-date character of the book is indicated by the map of Asia, where the Chinese Republic is so designated. It is good to know that young people now have books of this character to serve as texts, and those who belong to an earlier generation will welcome the opportunity to revise their knowledge of the subject which is the basis no less of ancient history than of modern life and commerce.

Concentrates

Most of these are in reply to questions received by mail. Our readers are invited to ask questions and give information dealing with the practice of mining, milling, and smelting.

'GOAVE' is a term used to signify broken ground, or the parts of a mine from which the coal or ore has been worked.

FILLING stopes with old sand or slime from dumps has been done at a cost of only 5c. per ton in some mines in Western Australia.

AMALGAMATION is not practised in any way in the treatment of Tonopah ores, nor is acid treatment necessary in clean-up operations.

SLIME in treatment mills generally gives better results if as much valuable solution as possible is decanted or got rid of before filtering.

CHAIN driving tube-mills, pumps, or other machinery has proved successful at Tonopah, and is thoroughly reliable, with low power losses.

HOISTING ropes of 3½-in. width are used at several mines in Nevada, but they require a good deal of attention, especially after 12 months' use.

ORE fed to stamps, in many cases, is not directly sampled, but the value is calculated from tailing assays, concentrate content, and bullion actually recovered.

OXALIC ACID, in Norway, is successfully manufactured from sawdust. In Victoria, Australia, several useful compounds are being made from the distillation of wood.

MORTAR-BOXES have been set on heavy sheet lead in some districts, but this seems to get beaten out unevenly, and the usual sheet of rubber has been substituted for it.

WASTE from sorting belts is usually trammed to dumps in cars. At the new Belmont mill, at Tonopah, where about 15% is picked out, a slow-running belt-conveyor discharges it upon the dump.

BULLION produced in the Tonopah mills averages about 950 fine in silver and 12 in gold. The bars are sampled by drilling a hole about ½ in. deep at opposite corners of the top and bottom.

PIPES connected with pumps and tanks in mills situated in cold climates should be so arranged that they can be drained after use, especially where used in intermittent work, such as in vacuum filtration of slime.

MOTOR drive for the cam-shafts at the Homestake mills consists of one 25-hp. motor for each 10 stamps, set at about the level of the cam-shaft and 20 to 25 ft. distant, transmitting power by a 16-in. double leather belt.

MINTS of the United States during October coined 26,672,261 pieces, valued at $510,092.58. One cent pieces totaled 22,880,108; and 5-cent, 3,200,035; while for the Philippine Islands' Government there were 356,000 peso pieces and 520,000 10-centavo pieces coined.

LOSSES of heat by uncovered steam-pipes are not only high, but wasteful. To offset the heat from a bare 4-in. pipe-line, 300 ft. long, carrying steam at 125 lb. pressure, with the temperature of the air 90°F., it has been calculated that the consumption of 105 tons of coal per year would be necessary.

TUBE-MILLS half filled with pebbles generally give best efficiency in grinding and power consumption. It was found at the West End mill, at Tonopah, that when filled 6 in. above the centre line, motor readings were abnormally high, but on further filling the power did not rise to any extent.

ESSENTIAL factor in successful treatment of ores by flotation is the obtaining of a thick substantial or 'matted' froth, necessary to support the coarser mineral particles. If, through lack of observance of certain simple conditions, it is allowed to become thin and skin-like, it will not afford the same chance for retaining these.

VARIOUS devices have been tried in order to get better amalgamation on copper plates, the latest being a screen fixed a few inches above the plates which breaks the flow of pulp from stamps and lets it shower upon, instead of flowing over, the plates, thereby arresting the flow momentarily and giving better contact.

STAMPS, numbering 1000, crush 125,000 tons per month at the Homestake mine, South Dakota. Of this, 57% goes to the sand and 41% to the slime plant, between 1 and 2% of the slime being wasted. Of the total gold content, 94% is recovered, about 72% as amalgam and 22% by the cyanide process. From an ore carrying about 0.2 oz. gold per ton, the total monthly recovery is nearly $500,000.

GOLD varies in color according to the amount of silver alloyed with it, and may range from pale yellow to full gold color. Gold alloys are made more reddish by the presence of copper, and by varying the relative amount of silver and copper in the gold, any desired shade may be obtained from 'Roman gold' to a pale yellow. The presence of impurities may cause gold to show a variety of colors on a tarnished surface.

FINE grained precipitates such as $BaSO_4$, which tend to run through filter-paper, can be restrained in the following simple way. Take a small ashless paper, tear it into minute fragments, and shake well with a little warm water in a test-tube, until a pulp is formed. This pulp is added to $BaSO_4$ precipitation, stir well, allow to settle for a few minutes, and then filter. Do not add too much pulp, or it will be difficult to wash the precipitate thoroughly.

MANGANESE is chiefly used in the form of alloys in the steel industry, or as oxide in chemical industries. Ores to be used for the first purpose should be as low in SiO_2 as possible, while for the second they must be free from iron. Sometimes the quality of the ore can be improved by ore dressing methods. Russia is the principal producer of manganese, followed by India and Brazil. Most of the high-grade ore used in the United States is imported; imports in 1911 amounting to 177,000 tons, valued at $1,187,000, and domestic production 634,000 tons, valued at $1,386,000. The deposits of the United States are described at length in Bulletin 427 of the United States Geological Survey.

LITHIUM CARBONATE is chiefly used in the manufacture of artificial lithia waters and for medicine. Eminent physicians have claimed that it has a solvent effect upon uric acid, the deposit of which in the blood gives rise to certain diseases. Equally eminent physicians, however, have recently claimed that it does not possess such solvent power. The question is therefore an open one. Small amounts of the carbonate are used in the manufacture of fire works. The hydroxide is used mainly in storage batteries of the Edison type, in connection with alkaline electrodes, in which the depolarizing electrode consists of an oxygen compound of nickel, whereby the capacity of the battery is increased and the life of the cell prolonged. The chloride and bromide of lithium are used in photography and in medicines. Spodumene when occurring fresh and glassy with an emerald green color sells for high prices as a gem.

Decisions Relating to Mining

Specially reported for the MINING AND SCIENTIFIC PRESS.

AMENDED LOCATION NOT EVIDENCE OF ABANDONMENT

Where a locator had made a prior location of certain mining claims in Summit county, Colorado, upon which adverse locations were subsequently made, and after said adverse locations were made the original locator elected to amend his former location by sinking new discovery shafts and filing new location certificates to correct previous errors, it was held that the making of such an amended location did not constitute an abandonment of his rights under the first location such as would enable the adverse locator's rights to attach. An abandonment of a mining claim is a question of fact to be found from the intention.

King Solomon Tunnel, etc., Co. *v.* Mary Verna Mining Co., (Colorado) 127 Pacific, 129. October 14, 1912.

COAL LANDS—ACQUISITION AND PURCHASE OF

The projection of underground workings from a tract of privately owned ground into an adjoining tract of public land, with a view to extracting the coal therefrom, such being the only feasible and practical method of opening up and mining the coal from such adjoining tract, followed immediately by the execution and filing of a declaratory statement, giving notice of the extent of the coal lands claimed, constitutes the opening of the coal land laws. The expenditure of $5000 required by Section 2438, Revised Statutes, to be made by an association of four or more qualified persons seeking to acquire title to 640 acres of coal lands on condition precedent to the right to enter, but not to the right to file a declaratory statement. Where the tract in question was re-appraised after the opening and improving of a mine and the filing of the declaratory statement, but prior to the expenditure of $5000 required as above, the claimant upon seasonably making the required expenditure, is entitled to purchase at the price existent at the date of opening and improving the mine of coal.

Carthage Fuel Co., (New Mexico) 41 Land Decisions. 21. May 21, 1912.

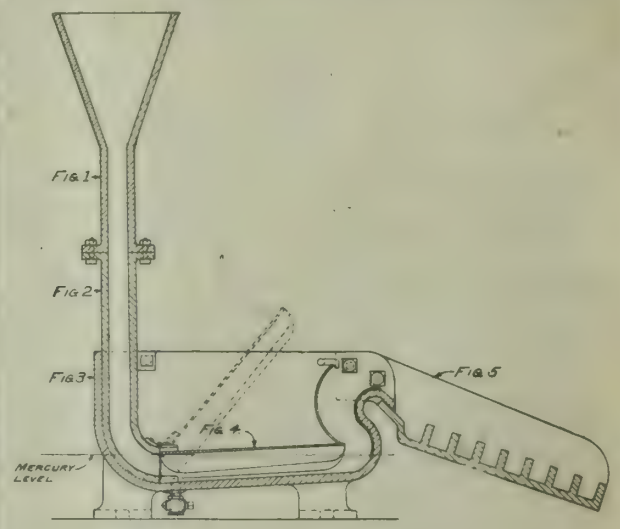
MINERAL RIGHTS DECISION—BASIS OF JUDGMENT

The State Supreme Court of Texas in a recent decision holds that the statute reserving to the state the mineral rights in its public land, which are commonly known as school lands, is constitutional. The case was that of A. A. Cox *v.* J. T. Robison, Commissioner of the General Land Office. Two members of the Board joined in the opinion, the other member, J. B. Dibrell, Associate Justice, not concurring.

In this particular case Mr. Cox sought to obtain an unconditional patent to eighty acres of land in Culberson county, which he had bought as grazing land. The Land Commissioner refused to patent it without a reservation of the mineral rights to the state under Article 3498. It was contended by Mr. Cox that the state should give an unconditional patent because the article under which the Commissioner acted is in conflict with and contrary to Section 7 of Article XIV of the Constitution, which reads: "The state of Texas hereby releases to the owner or owners of the soil all mines and minerals that be on same, subject to taxation as other property."

Nelson W. Phillips, Associate Justice, wrote the opinion for the court. He recalled that the mining industry is only in its infancy in Texas. He went back to the constitutional convention of 1866 and found the release provision there with regard to mineral rights. He investigated and found that this provision provided only for the release of rights on certain property which had already been disposed of; that the intent of the convention in 1866 in releasing certain mineral rights was not to apply the provision to all future sales, but to past disposition of real estate.

D. Phillips, Judge, says that it is recognized that in general constitutional provisions are construed as prospective, but the exception is well established that they may operate retroactively when it is apparent that such was the intention. He finds that when the provision was first read into the constitution there was no intention to make the release provision apply to all future grants from the state and that it would be illogical to assume that those who came after in writing constitutions of the state had this intention and desired to change the organic law by re-enacting an old provision. He also found that since 1863 the legislature has provided for the reservation of mineral rights to the state and it seems to be a fixed policy from the time that the constitution of 1866 was written.

Thibault Gold Amalgamator

In this device the gold is brought in contact with quicksilver by inverting an amalgamated copper plate and placing it nearly horizontally upon the surface of a shallow body of quicksilver. The gold-bearing material passes through an elongated spout (Fig. 1 and 2) under the amalgamated plate (Fig. 4), and over the surface of the quicksilver, then upward through a tortuous passage lined with amalgamated copper to the spillway. The sand or gritty material in passing creates a scouring action upon the quicksilvered surfaces, keeping them bright and clean. Ribs extending below the surface of the quicksilver and integral with the plate prevent diagonal currents and present a greater amalgamating surface to the stream by attracting the quicksilver upward along their surfaces. The stream before leaving the amalgamator takes an upward course, first coming in contact with one amalgamated lining and then with the amalgamated copper partition, which directs it toward the spillway. This partition also serves to hold down the free end of the plate when working. It is held in place by pins through the side walls; a lock can be inserted through the point of the pin, if desired, to prevent unauthorized persons from lifting the plate and removing the gold amalgam from within. A locking device is also provided on the drain cock. The plate, being hinged to the spout portion, can be raised for inspection, or if it needs dressing it can be lifted from its hinges (the hinge is so constructed as to release when the plate is in a raised position; this feature is not shown in the cut) and another or extra one can be inserted in its place, delaying operation only during the time necessary to change plates. The plate dressing can be done later in a clean-up room. The riffled portion (Fig. 5) is placed under the spillway to recover any particles of quicksilver which might accidentally pass over the spillway. This amalgamator is designed to treat fine material, and it is necessary to screen out the coarse sand and gravel before it enters the hopper. The 24-in. amalgamator is claimed to be capable of handling 1½ tons of screened sand per hour. It is made by E. E. Thibault, 1178 Union street, San Francisco.